



## Marginalized Engineering Students' Narrative Construction Through Photo Elicitation

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Manuscripts

**Table I**  
*The Images and Their Meaning*

Images	How the Research Team defined images
	A walk in the park represents enjoyment.
	Drowning; Stress
	The Leap – Willing to fall and fail
	Twists and Turns represent frustration
	The Journey (journey of 100 miles begins with one step)



An Unfair Advantage-issues of equity



Lack of inclusion-isolation



Reaching to the objectives-  
accomplishment.

Research Journal

Table II

*Participant Details*

Participants Details	Self-Reported Identity
Eileen, Computer Science, 4 <sup>th</sup> semester	White, Female, Heterosexual, Upper middle class, Dyslexia or ADHD
Charisma, General Engineering, 4 <sup>th</sup> Semester	Black, Choctaw native American and Irish, Female, Heterosexual, Lower middle class.
Josephine, General Engineering, 5 <sup>th</sup> Semester	Filipino, Irish, English, Female, Heterosexual, Lower middle class
Kathryn Hill, AS Engineering, less than 6 semester	White, English and German, Female, Lesbian, Middle class.
Maya, AS Engineering, 2 <sup>nd</sup> semester	American Indian/Alaskan, Native or Black, Female, Heterosexual, Upper middle class.
Otto, Engineering, 4 <sup>th</sup> semester	White, Male, Heterosexual, Middle class.
Maleficent, Civil Engineering Technology, less than 6 semester	White, Female, Heterosexual, Middle Income
Kiarra, Computer Science, 3 <sup>rd</sup> semester	White, Russian, Female, Heterosexual, Lower middle class
Ryan, Computer Science, 4 <sup>th</sup> semester	Opted not to answer demographic info
Selena, Civil Engineering, 2 <sup>nd</sup> semester	Black/African American, Female, Bi-sexual, Low income

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1	Shelly, Computer Science and Business Administration, 5 <sup>th</sup> semester	American Indian/ Alaskan, Irish/German/Polish, Female, Asexual, Low income, Dyslexia or ADHD.
2	Shane, Engineering, 5 <sup>th</sup> semester	White, Female, Heterosexual, Upper middle income
3	Sienna, Civil Engineering, 3 <sup>rd</sup> semester	Black/African American, Female, Bisexual, Low Income.
4	Nicole, Computer Science, 2 <sup>nd</sup> semester	White, German, Norwegian, Scottish, Icelandic, and Irish, Female, Heterosexual, Middle Income.
5	Tessa, Engineering, 4 <sup>th</sup> semester	White, Female, Cisgender, Lesbian, Upper-middle income.
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1 Running head: MARGINALIZED ENGINEERING STUDENTS' NARRATIVE  
2 CONSTRUCTION

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4 Purpose - The goal of this study was to explore an immediate step in understanding the lived  
5 experiences of Under-represented students through metaphor construction and possibly collect  
6 more in-depth data through photograph-based interviews.  
7

8 Design/methodology/approach – This article introduced photo-elicitation based narrative  
9 interviews as a qualitative methodology while interviewing fourteen undergraduate community  
10 college students mostly from underrepresented groups (URGs). At the beginning of each  
11 interview, we probed the participants with 8 photographs chosen by the research team to  
12 represent a diverse set of experiences in engineering. We conducted a thematic analysis of the  
13 interview data.  
14

15 Findings – Our findings suggested that the inclusion of photo-elicitation often catalyzed  
16 consumption of representations, images, metaphors and voice to stories passed unnoticed; and  
17 finally produces more detailed descriptions and complements semi-structured narrative  
18 interviews.  
19

20 Research limitations/implications – This study advances the scholarship that extends photograph  
21 driven interviews/photo elicitation methodology while interviewing marginalized population and  
22 offers a roadmap for what a multi-modal, arts-based analysis process might look like. depth  
23 interviews.  
24

25 Originality/Value – The study presented in this paper serves as an example of qualitative  
26 research that expands methodological boundaries and centers the role of power, marginalization  
27 and creativity in research. This work serves as a unique and important contribution to the photo-  
28 elicitation literature, offering a critical roadmap for researchers who are drawn to photo  
29 elicitation/photograph driven interviews as an appropriate methodology to explore their inquiry.  
30

31 Research Implication-Our interview data based on PEI cannot provide an immediate solution for  
32 improving the two-year college experience of URGs but certainly helps uncover new  
33 perspectives on their marginalized experiences and serve as a catalyst to start dialogues on  
34 changes.  
35

36 Practical Implication- The use of photo-elicitation in our research enabled a deeper, more  
37 poignant exploration of the URG students' experience of navigating engineering. The  
38 participants were able to relate to the photographs and shared their life narratives through them,  
39 hence use of photographs can be adapted in future research.  
40

41 Social Implication-Our research revealed that PEI has excellent potential to capture marginalized  
42 narratives of URGs, which is not well explored in educational research, specially, in higher  
43 education. In our research PEI promoted a more culturally inclusive approaches positioning the  
44 participants as experts of their own narratives.  
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46 Research Paper  
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## 1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION

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3 *Keywords:* photo elicitation, narrative interviews, rapport building, marginalized experiences in  
4 engineering, underrepresented students, broadening participation in STEM, photograph driven  
5 interviews, community college students  
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Qualitative Research Journal

**Marginalized Engineering Students' Narrative Construction through Photo Elicitation**

In this article, our goal is to explore the marginalized Under-Represented Groups' (URG) engineering journey through narrative-based photograph driven interviews. Storytelling, or narrative inquiry, is about retrospective meaning-making and the shaping of past experience as a way of understanding one's own and others' actions and consequences (Chase, 2005). With time, qualitative researchers defined and expanded narrative inquiry through diverse methods to connect events and objects into a meaningful whole. The introduction of visual media in narrative research challenges the assumption that narratives are primarily formed orally and textually. We wanted to add the visual element through photographs to stimulate the sharing in interviews through resonance to the marginalized experiences represented in photos.

Researchers who study images treat them as socially situated narrative texts. Creation of narratives through pictures has remained our focus (Riessman, 2008). Adapting the amalgamation of semi-structured photograph-based narrative interviews meant considering the participants' understanding of meaning of their experiences, reflexive knowledge, voice, construction and re-construction of their identity in shaping their own experience as STEM students during their formative years.

Honoring the voice of the socially and culturally marginalized is the pivotal idea of including photographs. Garcia-Pastor (2020) stated that "the concept of voice is related to the acknowledgment of the right to express oneself and to be taken into account, each person as he or she is, without the condition of having to adopt a strange, imposed language or way of representation". Listening to the students' representations manifested one's own subjectivity, their career trajectory, and acknowledgment of the reality of those turbulent experiences.

## 1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION

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3 Our research team asked each participant to choose one or more images from the set that  
4 resonated most with them in their academic journey at the onset of the interviews immediately  
5 following instructions. We had a limited time frame to build rapport with each participant yet we  
6 wanted to maximize our efforts in capturing the lived experiences of our participants, resulting in  
7 our Principal Investigator using a set of photos at the beginning of the interviews.  
8

9 There is a national urgency for diversifying engineering talent, particularly from women  
10 and underrepresented groups (Adams, Perez, & Ballard, 2007; Lord, Layton, & Ohland, 2011).  
11 Despite progress in some areas, the diversity of undergraduate engineering student bodies has  
12 primarily been stagnant. Contrary to that data, there is a growing diversity where students  
13 traditionally underrepresented in engineering are overrepresented at Community Colleges, which  
14 have become the chosen pathway for many students to pursue higher education. URGs imply the  
15 intersections of multiple components of underrepresented identity; for example; first-generation  
16 status, gender, race, ethnicity, socioeconomic status, Veteran, a person with a disability, LGBTQ,  
17 etc. However, community colleges continue to be under-researched as a means of increasing  
18 diversity in the engineering workforce. This study aims to capture the students' rich lived  
19 experience through PEI so that their struggles and challenges can be better understood beyond  
20 numbers. This research article is part of our broader study funded by the National Science  
21 Foundation.  
22

23 This work was guided by the following RQs:  
24

25 RQ1: How does photo-elicitation as an opening prompt stimulate sharing and rapport during a  
26 narrative interview?  
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28 RQ2: How does the use of photo-elicitation as a qualitative tool support marginalized students'  
29 narration of their own experiences?  
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### Previous Research

Photo Elicitation was first introduced by Collier (1967) in a paper that examined mental health in changing communities in the maritime provinces in Canada. He suggested photo interviews for investigating the quality of housing. PEI revealed that the interviews reduced the power dynamics and the areas of misunderstanding during the interviews. There are different methods of doing PEIs. For example, Harper (2002) used aerial views of farmland and historical photographs to interview farmers about their identity and community and took detailed, close-up photographs in a rural workshop (Harper, 1997).

Many researchers adapted PEI methods in educational research. For example, Copes, Tchoula, Brookman, and Ragland (2018) mentioned that researchers and participants could join forces to capture more participants' stories meaningfully. Stewart (2020) adapted PEI to understand the various ways that students find belonging in university-sponsored digital spaces and on college campuses. Clark-IbáÑez (2003) study in the context of educational studies revealed that photographs could generate data that illuminate a subject invisible to the researcher but apparent to the interviewee, which we might miss easily as an individual researcher unless it is pointed out. This research also stressed that photographs are a powerful tool to ease the relationship between interviewee and interviewer. In-depth visual research methods provide a student-centric, holistic approach to the data. Using photographs as a catalyst in an interview, can "elicit implicit knowledge and self-identities in a way that other methods cannot" (Edgar, 1999: 198).

Our literature review revealed that PEI methods are underutilized as an approach to study marginalized population. In context to our work studying underrepresented students, Romasanta (2016) researched on photo-elicitation on minority low-income *first-generation college students*

1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 6  
23 (FGCS) to identify their sources of protective factors to increase their academic resilience.  
45 Witcomb, Brophy, and McDermott (2019) studied the increasing prevalence of transgender and  
6 gender diverse (TGD) people and discrimination and poor mental wellbeing experienced by  
7 them. PEI added another dimension to understand the lived experience of them. These to date are  
8 the only studies explored the possibility of using photographs while studying URGs. Also,  
9 Lenette and Body (2013) highlighted that use of visual ethnography and photo elicitation was  
10 cathartic for a small group of marginalized refugee women. This study also took an intersectional  
11 approach like ours to explore socio-cultural resilience and mental health. However, our research  
12 is still on the marginalized students, we centered our research on the marginalized narratives.  
1314 **Purpose of Using Photographs**  
1516 The methodology that we incorporated was our adaptation of an approach commonly  
17 referred to photo-elicitation (Harper, 2002). Approaching our research questions from a social  
18 constructionist perspective helped us to emphasize the meaning-making process of our  
19 participants' experiences in the conversations (La Jevic & Springgay, 2008).  
2021 A metaphor is a way of making an abstract idea or experience easily understandable by  
22 framing it with a concrete concept (Kövecses, 2017). Our thinking process is fundamentally  
23 metaphorical and thus, metaphors form an essential part of the narratives and shape our social  
24 world.  
2526 Thus, our methodology of incorporating photographs enabled participants to explore their lived  
27 experiences. Through conversations, they could share the significance of those experiences. In  
28 the past, there have been multiple studies investigating marginalized incidents of the students in  
29 higher academia. However, using metaphor-based narratives in studies and analyzing them could  
30 shed new lights on the experiences, which was a rationale of including a set of photographs.  
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## 1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION

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3 Even though our research team selected the photographs, participants led the discussion of their  
4 struggles. Thus, the photographs our participants chose to discuss directed the research interview  
5 and the subsequent learning.  
67 **The Amalgamation of Photo Elicitation with Semi-structured Interviews: Methodology**  
89 In this study, we did not use PEI as our primary data collection method; rather use of  
10 photos were adapted as an add-on to influence the regular semi-structured interviews.  
1112 We incorporated photos at the beginning of the interviews to ease the power dynamics  
13 between the interviewer and the interviewee, to capture the reflection of the marginalized  
14 undergraduate journey; and finally, to capture the “thick description” as suggested by Lincoln  
15 and Guba (1985). Schwartz (1989) noted that what we try to convey through the photos or  
16 evaluation of the images’ aesthetics is more effective than verbal communication. We adapted a  
17 similar approach to unpack students’ narratives. We thought the photos represented turbulence of  
18 life and they might particularly be instigating for URGs to share their extraordinary stories.  
1920 We approached this research epistemologically from a social constructionist perspective  
21 as participants constructed their own metaphor through the set of photographs. We collected data  
22 through narrative based interviews since the goal was to collect life stories of our participants  
23 and using PE as a catalyst for URGs.  
2425 **Photo Selection**26 Then, the research design started with development of the interview protocol. The  
27 Principal Investigator had familiarity with the method of photo-elicitation. However, in the given  
28 study, the researchers desired to create a range of pictorial representations anchored in the  
29 literature of undergraduate student experiences in engineering; that the participants might be able  
30 to resonate with their own experiences. It then became the first task to find images representing 8  
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1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 8  
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3 themes selected to represent common descriptions of undergraduate experiences in engineering.  
4 Additionally, as one of the main emphasis of the larger study that this work derived from was to  
5 learn of the experiences of students from groups that are traditionally underrepresented in  
6 engineering, specifically, there was intent to include themes that were inclusive of a range of  
7 experiences, i.e., not feeling like a part of a group for having an “outsider” identity; being on a  
8 roller coaster indicating a journey of ups and downs ,long hike representing an arduous path to  
9 explore; a baby and sumo wrestler representing lack of equity or cumbersome amount of hurdles  
10 to overcome; two swimmers , one being rescued by other indicating stress . The chosen 8 images  
11 and possible representation of them are shown in Table 1. Table 1 contains each image and its  
12 description as defined by our research team. Internet searches were conducted using text  
13 descriptions of what the pictures were to represent. The researchers encountered a myriad of  
14 images in attempts to select those that would best represent the associated theme. Ultimately, the  
15 researchers chose eight associated images and are presented in the findings in context with the  
16 description of participant selections. Then the research team reflected on the photographs  
17 individually and defined what it meant for us collectively as mentioned in table 1. Also, some of  
18 us reflected on each image and each represented our own metaphor to make sense of the  
19 interview process.

42 INSERT TABLE I  
4344 **Student Recruitment**  
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46 With IRB approval of the study, then participants were contacted through email by the  
47 program director since all were part of a STEM pathway program at a community college.  
48 Connecting with the participants and recruiting them was our step 2. A targeted recruitment  
49 strategy was employed. All potential participants were enrolled in engineering at the same  
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3 community college at the time of the interview. The program director sent an email to all the  
4 participants informing them about the opportunity to participate in the study. Then, the students  
5 volunteered to be interviewed, and they reached out to the research team. All the interviews were  
6 conducted in person, pre-Covid -19, during the spring semester of 2020. With the exception of  
7 two participants, everyone else consented to be audio-recorded. Each student was compensated  
8 with a \$50 gift card for their time and participation.  
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## 17 Profile of Our Participants 18

19 The participant details are presented in table II. The table entails the self-reported  
20 identification details of participants, and they are protected by pseudonyms. All of the  
21 participants reported at least one or more marginalized identity.  
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26 INSERT TABLE II  
27

## 28 Interview Details 29

30 Then the step 3 was to conduct the actual interviews. Our purpose was to conduct a  
31 collaborative qualitative research study using a set of photos driven narrative inquiry approach.  
32  
33 At the beginning of the interview, our research team collected the written consent form and  
34 verbal consent from the participants. They read the consent form to the participants, explained  
35 the research process and their role to the participants. In preparing for regular semi-structured  
36 verbal interviews, our research team designed an interview guide, carefully reflecting on the  
37 content, the order of the questions, probe, and the form of the questions. However, we did not  
38 prepare all the questions, and many times the participants were probed spontaneously. At the  
39 beginning of each interview participants were informed that they would first be presented a  
40 series of images, and they were asked to pick the images that resonated most with them in terms  
41 of their academic trajectories in STEM. All the images were printed and laminated as 8\*11  
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1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 10  
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3 colored images. The research team laid out all the images in front of the participants. Participants  
4 were free to choose more than one image. Following the prompts students shared their narratives.  
5  
6 For example, here is an excerpt of a conversation.  
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10 PI: So you can see it's just another audio recording. So, with that, the pictures that are in  
11 front of you are symbolic or descriptive of different things. And so just from looking,  
12 visual inspection, we'd like you to consider them in perspective to your own journey here  
13 at PCC or in computer science in general. And if you had to identify with one resonating  
14 with you and your experiences, what would it be?  
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17 Ryan: Probably the hiker. Because ... I guess generally what I'm, my experience at PCC  
18 and working on getting a job and starting a career and developing experience is, I feel  
19 like, especially compared to high school or living with my parents or anything like that,  
20 it's a lot of figuring out things on my own and going and doing things on my own.  
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23 There was no time assigned to this exercise but the participants were usually able to  
24 select an image or more in less than a minute and often went into explanation of how their  
25 experiences influenced to make meaning of their chosen images  
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### 28 Thematic Analyses 29

30 Then we conducted a thematic analysis of the data. All the 14 interviews were transcribed  
31 and managed in Dedoose 12. The first author looked for the emerging themes from the  
32 description of the photographs by the participants. The recurrent themes were identified as the  
33 main themes. We selected them based on participants' own words. We wanted to capture their  
34 lived experiences in their own words: in-vivo coding, or short phrases from the participant's  
35 language in the data were recorded as codes. In vivo codes are more prevalent in studies that  
36 prioritize and honor the participant's voice. I, as the first author, paid particular attention to both  
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1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 11  
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3 the linguistic and conceptual metaphors of students to make sense of their experiences. For  
4 example, arduous path, doing it by myself, unknown kind of vibe, jumping from one cliff to  
5 another, exploring, ups and downs were some of the in-vivo codes that I identified from the data.  
6  
7 Then I categorized them based on similarities and finally reported them for this article based on  
8 my best judgment. I built an inductive frame-work based on the transcripts, it was bottom to top  
9 approach since social-constructionist approach was the epistemological foundation of this study.  
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11 The analyses were similarly diverse, and each provided a fascinating thematization of a complex  
12 data set. Overall, the analyses and preliminary interpretations provided a deep look into the  
13 identity and self of each student.  
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16 However, different students chose different images to represent the same ideas. Then, similar  
17 sentiments were grouped together. Or pattern coded to find the themes as represented by the  
18 participants.  
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## Results

### Photo Elicitation as an Opening Prompt for Sharing

Our research revealed that PEI not only encouraged participants to share their narratives faster, PEI also created a reduced power differential even when identity was not shared across researcher and researched. Here are a couple of narratives that were stimulated as opening prompts by PEI.

**"That Seems a Lot Like Me"** A powerful example of how photographs altered the interview dynamics and produced more in-depth, detailed interview content was evident in

1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 12  
23 interview with Otto. Otto explained her first -year community college experience to our graduate  
4 student researcher, K while referring to the hiker photo  
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7 I thought it'd be like climbing a mountain, which I got one time to climb a mountain and  
8 get experience. It's not as easy as it looks on TV. It's fun, and that's actually kind, in a  
9 way, because it actually is kind of like once you got kind of experiencing some of the  
10 stuff you learned, it is kind of fun to learn it. And it's now some, it's a little difficult and  
11 stuff; it's a little hard.  
1213 Then he shared in more details;  
1415 maybe this one, because last semester was more like I feel like you're trying to leap  
16 across a cliff trying to get through it and sometimes when you don't have enough force or  
17 if your velocity is not good enough so you fall down that cliff and don't make it across.  
1819 Fortunately, I made it. This semester is definitely feeling like this one. Well, this is  
20 definitely me on this side. This is all my work and my deadlines are literally at the same  
21 time. So this is literally every... because it really fits because this is definitely me trying  
22 to push through that, but I'm now I'm probably being pushed back a lot.  
2324 **“But It Looks Arduous”** Another participant also echoed the thought; Kathryn a white  
25 female identified herself as LGBTQIA complimented that “the person staring out at a bunch of  
26 mountains in front of them. I feel like the backpacker in the mountains, it's more of a, there's  
27 this obstacle ahead of me. It's like I could see it, I know the path, but it looks arduous”  
2829 Even though Charisma, a Black female student from lower middle class. chose a different image,  
30 the roller coaster, conversation with her revealed a journey of lots of ups and downs.  
3132 PI: Okay, you chose the roller coaster and by choosing the roller coaster, what does,  
33 what does that symbolize to you?  
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## 1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION

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Charisma: That there are ups and downs. There're a lot of ups.

PI: Okay. More ups than downs?

Charisma: Yes.

PI: Okay, great.

Charisma: But the downs are real low.

This theme explained us the uncertainty and the ups and downs each student went through. They recognized it's not an easy journey to embark on.

**"It is Extremely Hard"** Another example where students shared her experience of taking computer science class followed by her passion. Shelly chose the roller coaster image and reflected on it;

So this journey me and it represents the computer classes...I started right at college, so I'm learning all this new language, and it's kind of hard. Just me, it is extremely hard. It's fun, and I like the idea of it. The reason why I chose computer science was because I like the innovation of it, creating machines, creating software to do particular things. That was the main... and particularly I was interested in medical, like bioinformatics, nanotechnology, stuff like that, and using computer science to solve that, because I also am interested in medical and helping people with their health.

#### **Photo Elicitation Stimulates Rapport Building**

As Research team we did not have a lot of time for rapport building with the participants, our method of using a set of photographs with interviews stimulated participants to share their stories more in-depth and often they already described topics that we planned to ask them later during the interviews.

1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 14  
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3           **"I could definitely be relating to that right now"** Otto, a white middle class young man  
4 and our only participant without one or more shared marginalized identities stated as our  
5  
6 interview progressed "that definitely is a cool way to kind of use that picture".  
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10 PI:    Oh, thanks. Yeah, we're trying something new, so we'll see. Sometimes things  
11 are harder to describe, or when stimulated it's easier to describe if we have something to  
12 reference, so-  
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15 Otto: Yeah, like you said, anybody could see a different thing in that. I'll be honest, I  
16 saw the drawing the first time [pointing to the drowning photo], I was like, well, I could  
17 definitely be relating to that right now.  
18

19 This example also revealed the effectiveness of the chosen images in terms of resonance with the  
20 participants' academic journey.  
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23           **"Jumping from one cliff to another."** Selena had very specific things that she wanted to  
24 say about the chosen photographs in terms of her undergraduate engineering experience at PCC.  
25 She identified herself as a Black bi-sexual female from low-income family. In response to the  
26 cliff jumping image; she mentioned;  
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29           The leap of faith because this is a leap of faith. When I got to PCC I did the placement  
30 test and they were like, "Well you did well, we can actually place you into Calculus One  
31 but do you want to go through the pre-requisites for getting there?" Cause I was like, you  
32 know it's been years since I've been in school. Cause by then it would have been three  
33 years since I graduated high school.  
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36 Then she goes back to her academic journey and her early career decision to make meaning of  
37 cliff jumping. She narrated to our PI  
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1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 15  
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3 So that's how it felt. And then it was just, it became a leap of faith because I was actually  
4 going to join the military.  
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7 And then she reflected more on her career choices and finally her path to PCC,  
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9  
10 And it was just a lot. And so I just focused on school. And then one day there was this  
11 post, it was called CN. It's a local architecture company. And I was like, "Ooh, that looks  
12 cool. Maybe I should go there." So I signed up for it, didn't know it was going to happen.  
13

14 I made a few weeks before that. Oh a few weeks after that, after I signed up, I went to  
15 this career fair cause, I was part of the coding club and they were like, "Hey a bunch of  
16 graduates from PDU are going to come by and you know we can ask them questions  
17 about programming about STEM." There was a booth for my program, Promise Program.  
18  
19 Her explanation of how she found promise program metaphorically related to the phrase  
20 of "cliff jumping".  
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22 **Photo Elicitation Facilitates Marginalized Narratives**  
23

24 **"I got to do it by myself."** With Josephine our conversation started with the image of  
25 journey with the backpack. Josephine a female student from lower middle-class background  
26 identified herself as Filipino, eventually extended the dialogue to her experience of trying to find  
27 study groups and later accepting it as her individual journey. It was a fascinating description of  
28 how she tried to find a study group for her classes and then everyone in the program was focused  
29 to their own academic goals, her metaphor was expanded beyond the literal meaning making of  
30 metaphor.  
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32 But, it can also resonate with the ... It means they're standing in groups, they're working  
33 on a team but it also ... Some journeys you kind of need to take alone. I have people  
34 around me that are supporting me. But this one, I of got to do it by myself. You can see in  
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1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 16  
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3 the classes starting to get smaller and smaller and I had friends who I had study groups  
4 with in my math classes and I was really good but it's hard to find a good study group in  
5 those engineering classes. You know what I'm saying?  
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8 K: Mm-hmm (affirmative).  
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11 Josephine: But yeah, that one resonates with me, plus it's so pretty. Plus, I want to go  
12 to the mountain.  
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15 K: Do you think it's hard to find the or I guess I should say, when you say it's hard to  
16 find the groups, what makes it hard?  
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19 Then Josephine replied;  
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22 what I say is finding someone you click with. Or that wants to study with you. Because  
23 I've had experiences where I'll go up to somebody and be like, hey would you want to go  
24 study with me a library? They just said, "No, I don't study in groups." And it's like, "Oh,  
25 okay no worry. Okay no worries." That's fine. That's how I always started study groups.  
26 With my math group, I waited behind to see who also ask for questions from the teacher.  
27 And I was like, all right, hey guys, you want to be in a study group with me? And they  
28 were like, "Yeah, cool." But I don't know, it was just that one experience in the  
29 engineering class. I was like, Oh that's weird. But I do have a group that I'll bounce  
30 questions off of. But what I've noticed is a lot of engineering students they're super  
31 focused on their one thing and you have to be.  
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33

34 Josephine made an active effort to start a study group, which represents her way of seeking for  
35 academic support groups, however other students seemed reluctant or busy. Josephine's story  
36 tells us there is a lack of peer-to-peer support available at her two-year degree program.  
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39 Josephine's story depicted the loneliness in STEM that URGs navigate often.  
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## MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION

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3       **"I left the university because it was like too masculine there."** We interviewed Kiarra,  
4  
5       she is from Russia. She identified herself from lower middleclass background. Interestingly, her  
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7       previous experience of gendered- marginalization in Russia was revealed through the interview.  
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17       Kiarra: I just feel like maybe I started this too late. I mean, most of the students, they go  
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to college after school and I went to college in Russia, in a university, too, and I started  
engineering there, but I quit because I left the university because it was like too  
masculine there.

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Then she went on to reflect more on her experience from Russia as only female in STEM class.

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Yeah. So from like 20 students, I was the only one girl.20 in my group, I mean. Like And  
also they were more like ... I didn't know, a little bit older than me. I was after school and  
some of them, they were 25 and 30 years old. Some of them were my age, but still, I  
don't know, it felt like I was out of group, so I left it there. And when I moved here, I  
know that Americans like more friendly and most of my friends, they told me that it's  
okay to go to college when you 30 and 40 and 50. So, I decided to try it because I always  
wanted to, like computers or engineering. But in Russia it was almost impossible,  
because it was too much pressure. Because you study with all men and if you're doing  
any mistake or if you don't get anything during the class and you are ask questions, they  
will make fun of you. Yeah.

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From their our PI moved to the actual interview and it was a smooth transition.

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PI : I mean, that's an excellent start to what we're trying to get into for our studies. So,  
thank you for opening us up like that. One of the things that you said that it was just  
interesting was when you started there you felt pressure. One, because you're a woman as

1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 18  
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3 well as you were younger, and then now here you're saying it's a little different, because  
4 you feel like you started because you're older. So, can you go into that a little bit?  
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7 The transition to the semi-structured interview was easy as Kiarra prepared the ground for the  
8 actual interview through her gendered marginalized narrative in Russia and her determination to  
9 start STEM program in the United States. This is a great example of effectiveness of PEI blended  
10 methods as rapport building qualitative tool.  
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### 13 **Significance**

  
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15 All the metaphors of academic challenges, marginalized experiences, identities and  
16 intersectionality formed by our participants eased the rapport, they also served as opening  
17 prompt to more in-depth interviews. Most of the participants reported feeling lonely, dealing  
18 with lot of uncertainties, ups and downs, financial barrier, academic challenges through their  
19 metaphor. They told us many complex issues of their academic life effortlessly through the  
20 photographs. Other than incorporating a novel methodological approach, participants' narratives  
21 also revealed that the students needed more support and services at institutional level. Even  
22 though our PEI approach is more methodologically driven, the stories have great potential for  
23 policy makers, and administrators.  
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26 To ignore issues of inclusion permeates on all aspects of institutional contexts previously  
27 tailored for a more homogenous population and privileged the dominant more. However,  
28 embracing critical approaches in studying marginalized population invite us to challenge the  
29 dominant discourses. Our research is one of the first-ever studies to an adaptation of PEI as a  
30 prompt for semi-structured narrative-based interviews. This study has shown that creating a safe  
31 space can be transformative for students where they can share their life experiences, and this is  
32 supported by growing literature on the importance of allowing students to have these dialogic  
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1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 19  
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3 experiences (Romasanta, 2016). Creating dialogic spaces based on PEI can be implemented in  
4 multicultural learning communities (Jehangir, 2010), first- generation- low income students  
5 (Romasanta, 2016).

6  
7 Many of the participants revealed during the interview that it was their first-time experience of  
8 being interviewed. They expressed the excitement of being interviewed. Our research provided a  
9 platform and empowered them to share their life stories. Visual artists and academics need to ask  
10 more about the presentation of the vignette or the individual narratives in visual arts and how  
11 these can be empowering experiences not just in creative presentations, but also in disadvantaged  
12 communities as noted by Lord (2015), we feel our research was able to empower the URG  
13 students and provide them a voice.

14  
15 The PEI methods provided them an opportunity to reflect on their STEM experiences  
16 intensely. Binance (2010) also, mentioned that once meanings attributed to the images, the  
17 emotions invoked, and information elicited through them provide insights to different from and  
18 beyond verbal inquiry.

19 We also argue that interviews were able to reach a greater depth in the 60-90 minute than  
20 those conducted similarly without the PEI. Figure 1 depicts the effectiveness of using  
21 photograph-based interviews based on our research findings.

22 The use of images helped the research team to explicate some of the aspects that we were  
23 interested in exploring deeply with our participants: meaning making and identity construction in  
24 context to their academic challenges. The photographs helped the students to recall, reflect, and  
25 reclaim their experience while enriching the interview process and constructing the self.

1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 20  
23 Conclusion  
45 The photos helped the participants give richer answers about their educational journeys,  
6 eased the interviewer-interviewee dynamics, and provided a platform for the students to share  
7 their stories. However, photo-elicitation was not our primary data collection method, and we  
8 collected limited data at the beginning of each interview. Our interview data based on PEI cannot  
9 provide an immediate solution for improving the two-year college experience of URGs but  
10 certainly helps uncover new perspectives on their marginalized experiences and serve as a  
11 catalyst to start dialogues on changes. Also, our research revealed that PEI has excellent potential  
12 to capture marginalized narratives of URGs, which is not well explored in educational research,  
13 specially, in higher education. In our research PEI promoted a more culturally inclusive  
14 approaches positioning the participants as experts of their own narratives. Also, data from our  
15 research revealed that PEI can serve as a great qualitative tool for rapport building with the  
16 participants and stimulates sharing of richer narratives. We also noted that the photos and the  
17 narratives both added different types of meanings to a story. Photos visually represented the  
18 content of the narratives, and often provided added information not mentioned in the narratives  
19 and symbolically represented the content of the narratives. (Covert and Koro-Ljungberg, 2015)  
2021 Pursuing higher education is a complex learning experience that demands navigating intricate  
22 information. It requires navigational and informational support from the institution, friendly  
23 policies, adequate infrastructure, and psychosocial skills in order to be successful for the  
24 students. The process becomes more complex and extremely hard for the underrepresented  
25 students due to color-blind hostile policies to the minority students. Therefore, it's critical for  
26 their success that their narratives are told and written. Also, previous research noted that PEI  
27 promotes critical visual thinking (Bowen, 2017) and deep learning. Therefore, PEI can be  
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1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 21  
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3 utilized in various ways, not only as a tool for capturing lived experiences of the participants or  
4 building rapport with the participants; PEI also can promote critical thinking and visual literacy  
5 skills (Choon-Lee Chai,2019) as a pedagogy for marginalized students in future.  
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8 Also, we hope our PEI research inspires more scholars to study the narrative construction  
9 of marginalization.  
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12 References  
13  
14

15 Adams. S. Perez. L. and Ballard. J. (2007) *Work in Progress—Increasing transfer student*  
16 *enrollment, retention and graduation through the strengthening transitions into engineering*  
17 *programs*. Faculty publications from the Department of Electrical Engineering, paper 155.  
18  
19

20 Allen. L. (2009) 'Snapped': Researching the sexual cultures of schools using visual methods.  
21 *International Journal of Qualitative Studies in Education*. Vol 22. pp. 549–561.  
22  
23

24 Barbour. R. (2014) *Introducing qualitative research* (2nd edn.). SAGE Publications, Inc.  
25  
26

27 Chai. Choon-Lee. (2019) Enhancing Visual Literacy of Students through Photo  
28 Elicitation. *Journal of Visual Literacy*. Vol 38 no.1-2. pp113-122.  
29  
30

31 Chase. S. E. (2005) Narrative inquiry: Multiple lenses, approaches, voices. In N. K. Denzin.  
32 and Y. S. Lincoln (Eds.) *The SAGE handbook of qualitative research* (3rd ed) London: Sage,  
33 pp. 651–679).  
34  
35

36 Clark-Ibáñez. M. (2004) 'Framing the Social World With Photo-Elicitation  
37 Interviews', *American Behavioral Scientist*, 47(12), pp. 1507–1527.  
38  
39

40 doi: [10.1177/0002764204266236](https://doi.org/10.1177/0002764204266236).  
41  
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1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 22  
23 Collier, J. (1967). *Visual anthropology: photography as a research method*. New York, Holt,  
4 Rinehart and Winston.  
56 Copes, H., Tchoula, W., Brookman, F., & Ragland, J. (2018). Photo-elicitation interviews with  
7 vulnerable populations: Practical and ethical considerations. *Deviant Behavior*. Vol 39. pp. 475–  
8 494. doi:[10.1080/01639625.2017.1407109](https://doi.org/10.1080/01639625.2017.1407109)  
910 Covert, H. & Koro-Ljungberg, M. 2015, "Layers of narratives, images, and analysis", *Qualitative*  
11 *Research Journal*, vol. 15, no. 3, pp. 23  
1213 Edgar, I. R. (1999) 'The Imagework Method in Health and Social Science Research', *Qualitative*  
14 *Health Research*, Vol 9 no 2. pp. 198–211. doi: [10.1177/104973299129121785](https://doi.org/10.1177/104973299129121785).  
1516 García-Pastor, M. D. (2020). Digital storytelling and learners' dialogical construction of identity  
17 in EFL. In F. Nami (Ed.), *Digital storytelling in second and foreign language teaching*. Bern,  
18 Switzerland: Peter Lang.  
1920 Kenneth J. Gergen, (2015). *An Invitation to Social Construction*. Third Edition ed. 55 City  
21 Road, London: SAGE Publications Ltd.  
2223 Gibbons. M. Limoges, C. Nowotny, H. Schwartzman, S. Scott, P. and Trow, M. (2010). *The*  
24 *New Production of Knowledge: The Dynamics of Science and Research in Contemporary*  
25 *Societies*. London: SAGE Publications Ltd.  
2627 Harper, D. (1997). Visualizing structures: Reading surfaces of social life. *Qualitative Sociology*,  
28 vol 20. pp 57–77. doi:[10.1023/A:1024764214854](https://doi.org/10.1023/A:1024764214854)  
2930 Harper, D. (2002). Talking about pictures: A case for photo elicitation. *Visual Studies*, vol 17, pp  
31 13–26. doi:[10.1080/14725860220137345](https://doi.org/10.1080/14725860220137345)  
3233 1  
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1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 23  
2

3 Jehangir, R. (2010). Stories as knowledge: Bringing the lived experience of first-generation  
4 college students into the academy. *Urban Education*. Vol 45, pp. 533–553.  
5

6 doi:[10.1177/0042085910372352](https://doi.org/10.1177/0042085910372352)  
7

8 Kovecses, Z. (2017). Levels of metaphor. *Cognitive Linguistics*. Vol 28 no 2. pp 321–347.  
9  
10 <https://doi.org/10.1515/cog-2016-0052>  
11

12 La Jevic, L. and Springgay, S. (2008) A/r/tography as an ethics of embodiment: Visual journals  
13 in preservice education. *Qualitative Inquiry*, Vol 14. pp 67–89. doi:[10.1177/1077800407304509](https://doi.org/10.1177/1077800407304509)  
14

15 Lincoln. Y. & Guba, E. G. (1985). *Naturalistic inquiry*. Newbury Park, CA: SAGE.  
16

17 Lord, A.M. (2015),"Empowering with image: arts based practice", Qualitative Research Journal,  
18 Vol. 15 Iss 3 pp.  
19

20 Lord, S. M., Layton, R. A., & Ohland, M. W. (2011). Trajectories of electrical engineering and  
21 computer engineering students by race and gender. *IEEE Transactions on Education*. Vol 54, pp.  
22 610–618. doi:[10.1109/TE.2010.2100398](https://doi.org/10.1109/TE.2010.2100398)  
23

24 Meyers, K. L. Silliman, S. E. Gedde, N. L. and Ohland, M. W. (2010). A comparison of  
25 engineering students' reflections on their first-year experiences. *Journal of Engineering  
26 Education*. vol 99. pp-169–178. doi:[10.1002/j.2168-9830.2010.tb01053.x](https://doi.org/10.1002/j.2168-9830.2010.tb01053.x)  
27

28 Orellana, M. F. (1999). Space and place in an urban landscape: Learning from children's views  
29 of their social worlds. *Visual Sociology*. Vol 14. pp 73–89. doi:[10.1080/14725869908583803](https://doi.org/10.1080/14725869908583803)  
30

31 Riessman, C. J. (2008). *Narrative methods for the human sciences*. Thousand Oaks, CA: Sage  
32 Publications.  
33

34  
35  
36  
37  
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1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 24  
2

3 Romasanta, L. R. (2016). *Students as experts: Using photo-elicitation facilitation groups to*  
4 *understand the resiliency of Latina low-income first-generation college students*. Retrieved from  
5 ProQuest. ([1793406588](https://search.proquest.com/docview/1793406588))  
6

7  
8 Schwartz, D. (1989). Visual ethnography: Using photography in qualitative research. *Qualitative*  
9 *Sociology*. Vol 12. pp 119–154. doi:[10.1007/BF00988995](https://doi.org/10.1007/BF00988995)  
10

11  
12 Stewart, A. J. (2020). *Sense of belonging in digital spaces* [Doctoral dissertation, California  
13 State University, Fresno]. ProQuest Dissertations Publishing.  
14

15  
16 Stewart. W. P. and Floyd. M. F. (2004). Visualizing leisure. *Journal of Leisure Research*, 36,  
17 445–460. doi:[10.1080/00222216.2004.11950031](https://doi.org/10.1080/00222216.2004.11950031)  
18

19  
20 Werts. A. B. Brewer. C. A. and Mathews, S. A. (2012). Representing embodiment and the policy  
21 implementing principal using photovoice. *Journal of Educational Administration*. Vol 50. pp  
22 817–844. doi:[10.1108/09578231211264702](https://doi.org/10.1108/09578231211264702)  
23

24  
25 Witcomb. G. L. Brophy, H. and McDermott, H. (2019). More than meets the eye: A photo-  
26 elicitation study of gender (dis)affirmation in seven gender non-conforming university students.  
27  
28 *Psychology*, 10, 1599–1614. doi:[10.4236/psych.2019.1012105](https://doi.org/10.4236/psych.2019.1012105)  
29

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Running head: MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION

**Word Count: 6979 including reference and abstract.**

Purpose - The goal of this study ~~is was~~ to explore an immediate step in understanding the lived experiences of Under-represented students through metaphor construction and possibly collect more in-depth data through photograph-based interviews.

Design/methodology/approach – This article introduced photo-elicitation based narrative interviews as a qualitative methodology while interviewing fourteen undergraduate community college students mostly from underrepresented groups (URGs). At the beginning of each interview, we probed the participants with 8 photographs chosen by the research team to represent a diverse set of experiences in engineering. We conducted a thematic analysis of the interview data.

Findings – Our findings suggested that the inclusion of photo-elicitation often catalyzed consumption of representations, images, metaphors, and voice to stories passed unnoticed; and finally produces more detailed descriptions and complements semi-structured narrative interviews.

Research limitations/implications – This study advances the scholarship that extends photograph driven interviews/photo elicitation methodology while interviewing marginalized population and offers a roadmap for what a multi-modal, arts-based analysis process might look like for in-depth interviews.– depth interviews.

Originality/Value – The study presented in this paper serves as an example of qualitative research that expands methodological boundaries and centers the role of power, marginalization, and creativity in research. This work serves as a unique and important contribution to the photo-elicitation literature, offering a critical roadmap for researchers who are drawn to photo elicitation/photograph driven interviews as an appropriate methodology to explore their inquiry.

Research Implication-Our interview data based on photo elicitation PEI cannot provide an immediate solution for improving the two-year college experience of URGs -but certainly helps uncover new perspectives on their marginalized experiences and serve as a catalyst to start dialogues on changes.

**Practical Implication-** The use of photo-elicitation in our research enabled a deeper, more poignant exploration of the URG students' experience of navigating engineering. The participants were able to relate to the photographs and shared their life narratives through them, hence use of photographs can be adapted in future research.

## 1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION

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3 Social Implication-Our research revealed that PEI has excellent potential to capture marginalized  
4 narratives of URGs, which is not well explored in educational research, specially, in higher  
5 education. In our research PEI promoted a more culturally inclusive approaches positioning the  
6 participants as experts of their own narratives.  
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8 Research Paper  
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12 *Keywords:* photo elicitation, **narrative interviews**, rapport building, marginalized experiences in  
13 engineering, underrepresented students, broadening participation in STEM, photograph driven  
14 interviews, community college students  
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Qualitative Research Journal

### Marginalized Engineering Students' Narrative Construction through Photo Elicitation

In this article, our goal is to explore the marginalized Under-Represented Groups' (URG) engineering journey through narrative-based photograph driven interviews. ~~Storytelling, or narrative inquiry, is about retrospective meaning-making and the shaping of past experience as a way of understanding one's own and others' actions and consequences (Chase, 2005).~~ With time, qualitative researchers defined and expanded narrative inquiry through diverse methods to connect events and objects into a meaningful whole. The introduction of visual media in narrative research challenges the assumption that narratives are primarily formed orally and textually. We wanted to add the visual element through photographs to stimulate the sharing in interviews through resonance to the marginalized experiences represented in photos.

Researchers who study images treat them as socially situated narrative texts. Creation of narratives through pictures has remained our focus (Riessman, 2008). Adapting the amalgamation of semi-structured photograph-based narrative interviews meant considering the participants' understanding of meaning of their experiences, reflexive knowledge, voice, construction and re-construction of their identity in shaping their own experience as STEM students during their formative years.

Honoring the voice of the socially and culturally marginalized and listening to the students' representations manifested one's own subjectivity, their career trajectory, and acknowledgment of the reality of those turbulent experiences are the pivotal idea of including photographs.

#### In context to

~~Our study the research research team asked asked each participant to choose one or more images from the set of images set that resonated most with them in their academic journey at the onset of the interviews immediately following the interview consent instructions.~~ We had a

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3 limited time frame to build rapport with each participant yet we wanted to maximize our efforts  
4 in capturing the lived experiences of our participants, resulting in our Principal Investigator using  
5 a set of photos at the beginning of the interviews based on her own marginalized engineering  
6 experience as she shares more than one intersectional marginalized identity; for example, she is a  
7 Black woman engineering professor and she identifies herself as LGBTQIA.  
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9 There is a national urgency for diversifying engineering talent, particularly from women  
10 and underrepresented groups (Adams, Perez, & Ballard, 2007; Lord, Layton, & Ohland, 2011).  
11

12 Despite progress in some areas, the diversity of undergraduate engineering student bodies has  
13 primarily been stagnant. Contrary to that data, there is a growing diversity where students  
14 traditionally underrepresented in engineering are overrepresented at Community Colleges, which  
15 have become the chosen pathway for many students to pursue higher education. URGs in STEM  
16 imply the intersections of multiple components of underrepresented identity; for example; first-  
17 generation status, gender, race, ethnicity, socioeconomic status, veteran, a person with a  
18 disability, LGBTQ- etc e(Atkins et al, 2020; Romasanta, 2016). However, community colleges  
19 continue to be under-researched as a means of increasing diversity in the engineering workforce.  
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21 This study aims to capture the students' rich lived experience through PEI so that their struggles  
22 and challenges can be better understood beyond numbers. This research article is part of our  
23 broader study funded by the National Science Foundation. The goal of our original study was to

24 explore the engineering experiences of the URG students in their pathway program. A greater  
25 understanding of students' experiences could elucidate early interventions and strategic  
26 opportunities to foster an awareness and desire among URG students to transfer to four-year  
27 institutions in pursuit of higher education.

28 This paperwork was guided by the following RQs:  
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## MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION

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3 **RQ1:** How does photo-elicitation as an opening prompt stimulate sharing and rapport during a  
4 narrative interview? And  
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7 **RQ2:** hHow does the use of photo-elicitation as a qualitative tool support marginalized students'  
8 narration of their own experiences?  
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### 15 Previous Research

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Photo Elicitation Interviews (PEI) was first introduced by Collier (19657) in a paper that examined mental health in changing communities in the maritime provinces in Canada. He suggested photo interviews for investigating the quality of housing. PEI revealed that the interviews reduced the power dynamics and the areas of misunderstanding during the interviews. There are different methods of doing PEIs. For example, Harper (2002) use ofd aerial views of farmland and historical photographs to interview farmers about their identity and community and took detailed, close-up photographs in a rural workshop (Harper, 1997).

Many researchers adapted PEI methods in educational research. For example, Copes, Tchoula, Brookman, and Ragland (2018) mentioned that researchers and participants could join forces to capture more participants' stories meaningfully. Stewart (2020) adapted PEI to understand the various ways that students find belonging in university-sponsored digital spaces and on college campuses. In-depth visual research methods provide a student-centric, holistic approach to the data. Using photographs as a catalyst in an interview, can "elicit implicit knowledge and self-identities in a way that other methods cannot" (Edgar, 1999: 198).

Our literature review revealed that PEI methods are underutilized as an approach to study marginalized population. In context to our work studying underrepresented students, Romasanta (2016) researched adapting on photo-elicitation on minority low-income *first-generation college*

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3 *students* (FGCS) to identify their sources of protective factors to increase their academic  
4 resilience. Witcomb, Brophy, and McDermott (2019) studied the increasing prevalence of  
5 transgender and gender diverse (TGD) people and discrimination and poor mental wellbeing  
6 experienced by them at college setting. PEI added another dimension to understand the lived  
7 experience of them. These to date are the only studies explored the possibility of using  
8 photographs while studying URGs. Also, Lenette and Body (2013) highlighted that use of visual  
9 ethnography and photo elicitation was cathartic for a small group of marginalized refugee  
10 women to study their resilience. This study also took an intersectional approach like ours to  
11 explore socio-cultural resilience and mental health. These to date are the only studies that  
12 explored the possibility of using photographs while studying URGs. Our research becomes  
13 significant as However, our research is on the marginalized students, we centered our research  
14 on the marginalized narratives of engineering students and we used PEI as a complimentary  
15 method to the original semi-structured interviews. -

34 **Purpose of Using Photographs**

35 The methodology that we incorporated was our adaptation of an approach commonly  
36 referred to as photo-elicitation (Harper, 2002). Approaching our research questions from a social  
37 constructionist perspective helped us to emphasize the meaning-making process of our  
38 participants' experiences in the conversations (La Jevic & Springgay, 2008).

39 A metaphor is a way of making an abstract idea or experience easily understandable by framing  
40 it with a concrete concept (Kövees, 2017). Our thinking process is fundamentally metaphorical  
41 and thus, metaphors form an essential part of the narratives and shape our social world.

42 From the previous research it is evident that there are two primary variants of photo-elicitation.  
43 The first is externally driven like our method; participants are asked to evaluate images that

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3 researchers have selected and we adapted that approach. The second alternative is participant-  
4 driven where participants choose the images that are the foundation of the interview.<sup>17</sup>  
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7 Through this method, participants get more control of the situation (Harper, 1997). Collier  
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10 Collier (1957) mentioned using photographs chosen by him to interview participants. In his words  
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13 I gathered the pictures for the first interview, a rapid file on all the town's industries-  
14 lumber milling, clam packing, and fish processing plants. . . . It was our goal to find out  
15 how our informants felt about their work and whom they could recognize in the various  
16 plants; this last information was valuable to our study, for if large numbers of people  
17 could be recognized we would have evidence on where Acadians worked and where they  
18 came from. (p. 847)

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30 Therefore, in photo elicitation-based studies Researcher chosen photographs have been  
31 used widely in different contexts and it was first introduced by Collier (1967). A similar  
32 approach of researcher chosen photo elicitation was used recently by Kahu and Picton (2020) to  
33 explore the college experience of the first-year students. Thus, Our methodology of  
34 incorporating photographs enabled participants to explore their lived experiences. Through  
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36 conversations, our participants could share the significance of those experiences.

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44 In the past, there have been multiple studies investigating marginalized experiences of the  
45 students in higher academia (Romasanta, 2016; Witcomb et al 2019). For example, Romasanta  
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47 (2016) explored academic resilience and navigation of hidden curriculum of first generation  
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49 Latina college students through photo elicitation. Romasanta (2016) noted that use of  
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51 photographs were used because it facilitated a reflective dialogue as students identified hidden  
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53 curricula that was the most challenging in their educational journeys and identified the sources of  
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## 1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION

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3 strength to overcome those challenges. Witcomb et al (2019) study adapted visual elements to  
4 unpack -more about what objects, experiences or events affirm or disaffirm gender for college  
5 students that goes beyond verbal narratives. Use of visuals enables participants to powerfully  
6 self-illustrate.

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8 However, unlike the research studies mentioned above our research is focused specifically on the  
9 experiences of marginalized students studying engineering at a community college, therefore our  
10 study uses photo elicitation to garner rich narratives of underrepresented students experience.

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12 Photo elicitation allowed for the extension of ideas and thoughts into a richer narrative  
13 discussion by triggering memories with visual stimulation. This is something that has not been  
14 previously done in academic space.

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16 Also, However, using metaphor-based narratives ([Palmer and Furler, 2018](#)) in studies and  
17 analyzing them could shed new lights on the experiences ([Johnson, 2020](#)), which was a rationale  
18 of including a set of photographs. Even though our research team selected the photographs,  
19 participants led the discussion of their struggles. ~~All the researchers in our team share more than  
20 one marginalized identities and those photographs resonated with them based on their own  
21 lonely STEM journey.~~

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28 **The Amalgamation of Photo Elicitation with Semi-structured Interviews: Methodology**

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30 ~~In this study, we did not use PEI as our primary data collection method; rather use of~~  
31 ~~photos were adapted as a tool for in-depth regular semi-structured interviews.~~ We incorporated  
32 photos at the beginning of the interviews to ease the power dynamics between the interviewer  
33 and the interviewee, to capture the reflection of the marginalized undergraduate journey; and  
34 finally, to capture the “thick description” as suggested by Lincoln and Guba (1985). Schwartz

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(1989) noted that what we try to convey through the photos or evaluation of the images' aesthetics is more effective than verbal communication. We adapted a similar approach to unpack students' narratives. We thought the photos represented turbulence of life and they might particularly be instigating for URGs to share their extraordinary stories.

We approached this research epistemologically from a social constructionist perspective as participants constructed their own metaphor through the set of photographs. We collected data through narrative-based interviews since the goal was to collect life stories of our participants and using PEI as a catalyst for URGs.

### Photo Selection

Once the research team decided that we wanted to adapt photographs during the semi-structured interviews to explore engineering experiences of the underrepresented students, Then, the research design started with development of the interview protocol. The Principal Investigator of the project had familiarity with the method of photo-elicitation. However, in the given study, the researchers desired to create a range of pictorial representations anchored in the literature of undergraduate student experiences in engineering; that the participants might be able to resonate with their own experiences. It then became the first task to find images representing themes selected to represent common descriptions of undergraduate experiences in engineering. Additionally, as one of the main emphasis of the larger study that this work derived from was to learn of the experiences of students from groups that are traditionally underrepresented in engineering, specifically, there was intent to include themes that were inclusive of a range of experiences, i.e., not feeling like a part of a group for having an "outsider" identity; being on a roller coaster indicating a journey of ups and downs, long hike representing an arduous path to explore; a baby and sumo wrestler representing lack of equity or cumbersome amount of hurdles

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3 to overcome; two swimmers-, one being rescued by other indicating stress. Our research team  
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5 decided those were the themes commonly experienced by them during their engineering studies-.  
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7 The chosen 8 images and possible representation of them identified by research team are shown  
8 in Table 1. Table 1 contains each image and its description as defined by our research team.  
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10 Internet searches were conducted using text descriptions of what the pictures were to represent  
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12 possibly. However, when we asked our participants to choose one or more images we did not  
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14 instruct or restrict their responses, we ascribed themes to the images based on team discussion  
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16 and internet searches we for the purpose of choosing meaningful photographs for the  
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18 participants.

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24 ~~The researchers encountered a myriad of images in attempts to select those that would~~  
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26 ~~best represent the associated theme. Ultimately, the researchers chose eight associated images~~  
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28 ~~and are presented in the findings in context with the description of participant selections. Then~~  
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30 ~~the research team reflected on the photographs individually and defined what it meant for us~~  
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32 ~~collectively as mentioned in table 1. Also, some of us reflected on each image and each~~  
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34 ~~represented our own metaphor to make sense of the interview process.~~

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INSERT TABLE I

**Table I: The Images and Their Meaning**

**Positionality Of Research Team**

Trustworthiness in qualitative research is extremely crucial. Merriam (1998) stated that "there  
are interpretations of reality, in a sense the researcher offers his or her interpretation of someone  
else's interpretation of reality". (p,54) Then she suggested ways to achieve internal validity.  
"Statement of researchers' experience, assumptions, biases presenting the orientation, biases and  
so on, of the researcher at the outset of the study. This enables the reader to better understand

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3 ~~how the data might have been interpreted in the manner in which they were". (p,55). Therefore,~~  
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5 ~~it is an integral part of qualitative research to declare who we are and what were our interests to~~  
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7 ~~pursue this study. Our team consisted of two women, one Black woman engineering faculty and~~  
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9 ~~one postdoctoral researcher with an international background (India). Principal Investigator of~~  
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11 ~~the project (Black woman faculty) chose those images based on her intersectional racial,~~  
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13 ~~gendered and low-SES marginalized experiences during her engineering journey as a student of~~  
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15 ~~color and later as a Black woman faculty in higher academia.~~

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19 ~~The first author of this article is the postdoctoral researcher involved in diversity, equity, and~~  
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21 ~~inclusion driven academic research. She comes to this work with first-hand experience of facing~~  
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23 ~~invisibility and difficulties in navigating higher education in the US. Also, she is not in an~~  
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25 ~~engineering discipline, being a social science major, she did not experience gendered oppression~~  
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27 ~~in her classes or program. However, coming from a patriarchal society means dealing with~~  
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29 ~~inappropriate comments based on gender and facing discrimination is everyday reality. Also, she~~  
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31 ~~started working on this project once the data collection was already done.~~

### 35 **Participant Student Recruitment**

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38 ~~With Institutional Review Board (IRB) -approval of the study, then participants were contacted~~  
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40 ~~through email by the program director since all were part of a STEM pathway program at a~~  
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42 ~~community college. Connecting with the participants and recruiting them was our step 2. A~~  
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44 ~~targeted recruitment strategy was employed. All potential participants were enrolled in~~  
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46 ~~engineering at the same community college at the time of the interview. The program director~~  
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48 ~~sent an email to all the participants informing them about the opportunity to participate in the~~  
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50 ~~study. Then, the students volunteered to be interviewed, and they reached out to the research~~  
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1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 12  
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3 team. Participants were recruited using a snowball sampling approach (Woodley & Lockard,  
4 2016)

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6 All the interviews were conducted in person, pre-COVID-19, during the spring  
7 semester of 2020. With the exception of two participants, everyone else consented to be audio-  
8 recorded. Each student was compensated with a \$50 gift card for their time and participation.  
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11 **Profile of Our Participants**  
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13 The participant details are presented in table II. The table entails the self-reported  
14 identification details of participants, and they are protected by pseudonyms. All of the  
15 participants reported at least one or more marginalized identity in STEM as defined by NSF  
16 (2019). Also, researchers like Bahr et al 2017 defined racial, ethnic identity and gendered  
17 identity-based marginalization and White and Mitchell (2013) classified minorities in STEM  
18 based on gender (women), gender identity and ability status), we took help from those sources to  
19 define who are the URGs in engineering. -  
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INSERT TABLE II

**Table II: Participant Details**

**Interview Details**

Then the Step 3 was to conduct the actual interviews. Our purpose was to conduct a  
collaborative qualitative research study using a set of photos driven narrative inquiry approach.  
At the beginning of the interview, our research team collected the written consent form and  
verbal consent from the participants. They read the consent form to the participants, explained  
the research process and their role to the participants. In preparing for regular semi-structured

verbal interviews, our research team designed an interview guide, carefully reflecting on the content, the order of the questions, probe, and the form of the questions. However, We did not prepare all the questions for PEI, and many times the participants were probed spontaneously. At the beginning of each interview participants were informed that they would first be presented a series of images, and they were asked to pick the images that resonated most with them in terms of their academic trajectories in STEM. All the images were printed and laminated as 8 inches by 11 inches\*11 colored images. The research team laid out all the images in front of the participants. Participants were free to choose more than one image. Following the prompts students shared their narratives.

There was no time assigned to this exercise but the participants were usually able to select an image or more in less than a minute and often went into explanation of how their experiences influenced to make meaning of their chosen images.

### Thematic Analyses

. The data—the chosen photographs and the students' explanations of their choices —were thematically analyzed. All the 14 interviews were transcribed and managed in Dedoose 12. The first author looked for the emerging themes from the description of the photographs by the participants. The recurrent themes were identified as the main themes (Saldana, 2021). We selected them based on participants' own words. We wanted to capture their lived experiences in their own words: in-vivo coding (Saldana, 2014), or short phrases from the participant's language in the data were recorded as codes. In vivo codes are more prevalent in studies that prioritize and honor the participant's voice. I—as the first author, paid particular attention to both the linguistic and conceptual metaphors of students to make sense of their experiences. For example, arduous path, doing it by myself, unknown kind of vibe, jumping from one cliff to

1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 14  
23 another, exploring, ups and downs were some of the in-vivo codes that I identified from the data.  
45 Then I categorized them based on similarities in their experiences and finally reported them for  
6 this article based on my best judgment. I built an inductive frame-work based on the transcripts,  
7 it was a bottom to top approach assinee social-constructionist approach was the epistemological  
8 foundation of this study. The phrases to represent the concept of the codes were mentioned by  
9 participants and chosen by the first author to depict their experiences. The analyses were  
10 similarly diverse, and each provided a fascinating thematization of a complex data set. Overall,  
11 the analyses and preliminary interpretations provided a deep look into the identity and self of  
12 each student.  
1314  
15 However, At times different students chose different images to represent the same ideas. Then  
16 and, similar sentiments were grouped together, known as pattern coding. Or pattern coded to  
17 find the themes as represented by the participants. The coding process was developed by the first  
18 author and principal investigator and first author frequently checked in to make sure the  
19 consistency of the themes.20  
21 **Positionality Statement of Research Team**22  
23 Trustworthiness in qualitative research is extremely crucial. Merriam (1998) stated that “there  
24 are interpretations of reality, in a sense the researcher offers his or her interpretation of someone  
25 else's interpretation of reality”. (p,54). She also suggested ways to achieve internal validity,  
26 “statement of researchers' experience, assumptions, biases-presenting the orientation, biases and  
27 so on, of the researcher at the outset of the study. This enables the reader to better understand  
28 how the data might have been interpreted in the manner in which they were”. (p,55). Therefore,  
29 it is an integral part of qualitative research to declare who we are and what were our interests to  
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3 pursue this study. Our team consisted of two women, one Black woman engineering faculty and  
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5 one postdoctoral researcher with an international background (India). Principal Investigator of  
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7 the project (Black woman faculty) chose those images based on her intersectional racial,  
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9 gendered and low SES marginalized experiences during her engineering journey as a student of  
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11 color and later as a Black woman faculty in higher academia. Choosing photographs were a  
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13 collaborative process and two graduate students (one Black female and one Black male who  
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15 successfully navigated their engineering during undergraduate) took part in this process of  
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17 selecting photographs.  
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21 The first author of this article is post-doctoral researcher involved in diversity, equity, and  
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23 inclusion driven academic research. She comes to this work with first-hand experience of facing  
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25 invisibility and difficulties in navigating higher education in the US ad gendered micro-  
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27 aggression in her home country. However, navigating microaggression based on gender  
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29 and facing discrimination was integral to her academic experience in India. Also, she started  
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31 working on this project once the interviews were already conducted, that means she did not  
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33 choose photographs and experience facilitating those PEI,  
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40 **Figure 1- Representing the step-by- step methodology**  
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## Results

### Photo Elicitation as an Opening Prompt for Sharing

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47 Our research revealed that PEI not only encouraged participants to share their narratives  
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49 faster, PEI -also created a reduced power differential even when the exact identity was not shared  
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51 across researcher and researched. Here are a couple of narratives that were stimulated as opening  
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3 prompts by PEI where students described the challenges in their engineering journey as Lincoln  
4 and Guba (1985) suggested. -

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7 “That Seems a Lot Like Me” This phrase represents a A powerful example of how  
8 photographs altered the interview dynamics and produced more in-depth, detailed interview  
9 content at the beginning was evident in interview with Otto. Otto explained his first -year  
10 community college experience to our graduate student researcher, K while referring to the hiker  
11 photo.  
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19 *I thought it'd be like climbing a mountain, which I got one time to climb a mountain and  
20 get experience. It's not as easy as it looks on TV. It's fun, and that's actually kind, in a  
21 way, because it actually is kind of like once you got kind of experiencing some of the stuff  
22 you learned, it is kind of fun to learn it. And it's now some, it's a little difficult and stuff;  
23 it's a little hard.*  
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25 Then he shared in more details;

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27 *maybe this one, because last semester was more like I feel like you're trying to leap  
28 across a cliff trying to get through it and sometimes when you don't have enough force or  
29 if your velocity is not good enough so you fall down that cliff and don't make it across.  
30 Fortunately, I made it. This semester is definitely feeling like this one. Well, this is  
31 definitely me on this side. This is all my work and my deadlines are literally at the same  
32 time. So this is literally every... because it really fits because this is definitely me trying to  
33 push through that, but I'm now I'm probably being pushed back a lot.*  
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36 Otto's quotes highlighted the components of difficulty during his engineering journey. His  
37 metaphor represents if students are not well prepared for their engineering pursuit, they might  
38 not make it and often students have lots of responsibilities to meet. He also explained pushing  
39 himself a lot to make it through.

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44 “But It Looks Arduous” Students often found their academic journey complex and full  
45 of obstacles. For example, Another participant also echoed the thought; Kathryn a white female  
46 identified herself as LGBTQIA echoed complimented that “the person staring out at a bunch of  
47 mountains in front of them. I feel like the backpacker in the mountains, it's more of a, there's  
48 this obstacle ahead of me. It's like I could see it, I know the path, but it looks arduous”  
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3 Kathryn's comment highlighted her awareness around challenges in her engineering  
4 journey and her willingness to overcome that.

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7 Even though Charisma, a Black female student from lower middle class, chose a different  
8 image, the roller coaster, conversation with her revealed a journey of lots of ups and downs  
9  
10 which represent challenges.

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13 PI: Okay, you chose the roller coaster and by choosing the roller coaster, what does,  
14 what does that symbolize to you?

15 Charisma: That there are ups and downs. There're a lot of ups.

16 PI: Okay. More ups than downs?

17 Charisma: Yes.

18 PI: Okay, great.

19 Charisma: But the downs are real low.

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21 This theme explained us the uncertainty and the ups and downs each student went through. They  
22  
23 recognized it's not an easy journey to embark on. As participants were able to explicate those  
24 challenges at the beginning of the interviews, it became easy for researchers and participants  
25 both to move to more in-depth conversations which might have been difficult if we only relied  
26 on semi-structured verbal interviews.

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30  
31 "It is Extremely Hard" This phrase represents the struggle Shelley navigated during her  
32 engineering studiesAnother example where students shared her experience of taking computer  
33 science class followed by her passion. For example, -Shelly chose the roller coaster image and  
34  
35 reflected on it;

36  
37  
38 So this journey is me and it represents the computer classes...I started right at college, so  
39 I'm learning all this new language, and it's kind of hard. Just me, it is extremely hard.  
40 It's fun, and I like the idea of it. The reason why I chose computer science was because I  
41 like the innovation of it, creating machines, creating software to do particular things.

3 *That was the main... and particularly I was interested in medical, like bioinformatics,*  
4 *nanotechnology, stuff like that, and using computer science to solve that, because I also*  
5 *am interested in medical and helping people with their health.*

6  
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8  
9 Even though Shelly described her struggles, she also mentioned her passion for Computer  
10 science and her future career plans and her desire to help people.

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12  
13 We argue that use of visual stimulus made our participants more comfortable to open up at the  
14 beginning of the interviews, use of the metaphors helped us to quickly move to the more in-depth  
15  
16 conversation.

## 25 Photo Elicitation Stimulates Rapport Building

26

27 As Research team we did not have a lot of time for rapport building with the participants,  
28 our method of using a set of photographs with interviews stimulated participants to share their  
29 stories more in-depth and often they already described topics that we planned to ask them later  
30 during the interviews. Here are some of the codes and their excerpts that highlighted how easy it  
31  
32 was for us to know the participants without much effort.

33  
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37  
38 “I could definitely be relating to that right now” Otto, a White middle class young  
39 man and our only participant without one or more shared marginalized identities stated as our  
40 interview progressed “that definitely is a cool way to kind of use that picture”.

41  
42  
43  
44  
45  
46 Then he explained, PI: Oh, thanks. Yeah, we’re trying something new, so we’ll see.

47  
48 Sometimes things are harder to describe, or when stimulated it’s easier to describe if we  
49  
50 have something to reference, so-

## MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION

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3     **Otto:**—Yeah, like you said, anybody could see a different thing in that. I'll be honest, I  
4     saw the drawing the first time [pointing to the drowning photo], I was like, well, I could  
5     definitely be relating to that right now.  
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9

10     Otto's comment highlighted the cumbersome amount of pressure engineering students often  
11     experience to meet their academic requirements. This example also revealed the effectiveness of  
12     the chosen images in terms of resonance with the participants' academic journey.  
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19     **"Jumping from one cliff to another."** Selena had very specific things that she wanted to  
20     say about the chosen photographs in terms of her undergraduate engineering experience at PCC.  
21  
22     She identified herself as a Black bi-sexual female from low-income family. In response to the  
23     cliff jumping image; she mentioned;  
24  
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27

28     *The leap of faith because this is a leap of faith. When I got to PCC I did the placement*  
29     *test and they were like, "Well you did well, we can actually place you into Calculus One*  
30     *but do you want to go through the pre-requisites for getting there?" Cause I was like, you*  
31     *know it's been years since I've been in school. Cause by then it would have been three*  
32     *years since I graduated high school.*

33  
34     Then, she goes back to her academic journey and her early career decision to make meaning of  
35     cliff jumping and. She narrated to our PI

36  
37  
38     So that's how it felt. And then it was just, it became a leap of faith because I was actually going  
39     to join the military.

40  
41  
42     And then she reflected more on her career choices and finally her path to PCC,

43  
44     And it was just a lot. And so I just focused on school. And then one day there was this  
45     post, it was called CN. It's a local architecture company. And I was like, "Ooh, that  
46     looks cool. Maybe I should go there." So I signed up for it, didn't know it was going to  
47     happen. I made a few weeks before that. Oh a few weeks after that, after I signed up, I  
48     went to this career fair cause, I was part of the coding club and they were like, "Hey a  
49     bunch of graduates from PDU are going to come by and you know we can ask them  
50     questions about programming about STEM." There was a booth for my program,  
51     pPromise pProgram.

1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 20  
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3 Her explanation of how she found promise program metaphorically related to the phrase of "cliff  
4 jumping". Her explanation of the decision to enroll at PCC was an organic process through the  
5 photographs even before we asked that specific question to her.  
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15 **Photo Elicitation Facilitates Marginalized Narratives**  
16

17 Since we studied URGs and their engineering pursuit, we found a lot of marginalized  
18 narratives emerged from the data. Here are a few themes and their examples.  
19  
20

21 **"I got to do it by myself."** With Josephine our conversation started with the image of  
22 journey with the backpack. Josephine, a female student from lower middle-class background  
23 identified herself as Filipino, eventually extended the dialogue to her experience of trying to find  
24 study groups and later accepting it as her individual journey. It was a fascinating description of  
25 how she tried to find a study group for her classes and then everyone in the program was focused  
26 to their own academic goals, her metaphor was expanded beyond the literal meaning making of  
27 metaphor.  
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37 *But, it can also resonate with the ... It means they're standing in groups, they're working*  
38 *on a team but it also ... Some journeys you kind of need to take alone. I have people*  
39 *around me that are supporting me. But this one, I of got to do it by myself. You can see in*  
40 *the classes starting to get smaller and smaller and I had friends who I had study groups*  
41 *with in my math classes and I was really good but it's hard to find a good study group in*  
42 *those engineering classes. You know what I'm saying?*  
43  
44

45 ~~what I say is finding someone you click with. Or that wants to study with you. Because I've had~~  
46 ~~experiences where I'll go up to somebody and be like, hey would you want to go study with me a~~  
47 ~~library? They just said, "No, I don't study in groups."~~ And it's like, "Oh, okay no worry. Okay  
48 ~~no worries."~~ That's fine. That's how I always started study groups. With my math group, I  
49 ~~waited behind to see who also ask for questions from the teacher. And I was like, all right, hey~~  
50 ~~guys, you want to be in a study group with me? And they were like, "Yeah, cool."~~ But I don't  
51 ~~know, it was just that one experience in the engineering class. I was like, Oh that's weird. But I~~  
52 ~~do have a group that I'll bounce questions off of.~~ But what I've noticed is a lot of engineering  
53 students they're super focused on their one thing and you have to be.  
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4 Josephine made an active effort to find an affinity space~~start a study group~~, which represents her  
5 way of seeking for academic support groups, however other students seemed reluctant or busy.  
6  
7

8 Josephine's story tells us there is a lack of peer-to-peer support available at her two-year degree  
9 program. Josephine's story depicted the loneliness in STEM that URGs navigate often are posed  
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with. -

17 "I left the university because it was like too masculine there." We interviewed Kiarra,  
18 a Russian student~~she is from~~ Russia. She identified herself from lower middleclass background.  
19 Interestingly, her previous experience of gendered- marginalization in Russia was revealed  
20 through the interview.

25 Kiarra quoted thatrra:  
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— *I just feel like maybe I started this too late. I mean, most of the students, they go to college after school and I went to college in Russia, in a university, too, and I started engineering there, but I quit because I left the university because it was like too masculine there.*

Then she went on to reflect more on her experience from Russia as only female in STEM class.

*Yeah. So from like 20 students, I was the only one girl. 20 in my group, I mean. Like And also they were more like ... I didn't know, a little bit older than me. I was after school and some of them, they were 25 and 30 years old. Some of them were my age, but still, I don't know, it felt like I was out of group, so I left it there. And when I moved here, I know that Americans like more friendly and most of my friends, they told me that it's okay to go to college when you 30 and 40 and 50. So, I decided to try it because I always wanted to, like computers or engineering. But in Russia it was almost impossible, because it was too much pressure. Because you study with all men and if you're doing any mistake or if you don't get anything during the class and you are ask questions, they will make fun of you. Yeah.*

From this point From their our PI moved to the actual semi-structured interview and it  
was a smooth transition to ask her more questions on the gendered marginalization in  
engineering. -

1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 22  
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3 PI : I mean, that's an excellent start to what we're trying to get into for our studies. So,  
4  
5 thank you for opening us up like that. One of the things that you said that it was just  
6  
7 interesting was when you started there you felt pressure. One, because you're a woman as  
8  
9 well as you were younger, and then now here you're saying it's a little different, because  
10  
11 you feel like you started because you're older. So, can you go into that a little bit?  
12  
13

14  
15 The transition to the semi-structured interview was easy as Kiarra prepared the ground for the  
16  
17 actual interview through her gendered marginalized narrative in Russia and her determination to  
18  
19 start STEM program in the United States. This is a great example of effectiveness of PEI blended  
20  
21 methods as rapport building qualitative tool and helping participants reflect on their marginalized  
22  
23 experiences. -

24 **Limitation of the Study**  
25

26 Photo-elicitation was not our primary data collection method, that means we collected limited  
27  
28 data at the beginning of each interview. We asked each participant to only identify the images  
29  
30 that resonated most with them and then asked for their explanation. Our interview protocol was  
31  
32 not entirely photographs driven, instead we asked them a few questions at the beginning based  
33  
34 on the photographs our participants chose.  
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36

37 **Discussion and Implication**  
3840 **Significance**  
41

42 All the metaphors of academic challenges, marginalized experiences, identities and  
43  
44 intersectionality formed by our participants eased the rapport, they also served as opening  
45  
46 prompt to more in-depth interviews. Most of the participants reported feeling lonely, dealing  
47  
48 with lot of uncertainties, ups and downs, financial barrier, academic challenges through their  
49  
50 metaphor. They told us many complex issues of their academic life effortlessly through the  
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## MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 23

photographs. Other than incorporating a combinednovel methodological approach, participants' narratives also revealed that the students needed more support and services at institutional level. Even though our PEI approach is more methodologically driven, the stories have great potential for policy makers, and administrators. We recognize that our interview data based on PEI cannot provide an immediate solution for improving the two-year college experience of URGs but certainly helps uncover new perspectives on their marginalized experiences and serve as a catalyst to start dialogues on changes.

~~To ignore issues of inclusion permeates on all aspects of institutional contexts previously tailored for a more homogenous population and privileged the dominant more. However, Embracing critical visual approaches in studying marginalized population invite us to challenge the dominant discourses. Our research is one of the first ever studies to an adaptation of PEI as a prompt for semi-structured narrative-based interviews. This study has shown that creating a safe space through PEI can be transformative for students where they can share their life experiences, and this is supported by growing literature on the importance of allowing students to have these dialogic experiences (Romasanta, 2016). Creating dialogic spaces based on PEI can be implemented in multicultural learning communities (Jehangir, 2010), first- generation- low income students (Romasanta, 2016). Pursuing higher education is a complex learning experience that requires navigational and informational support from the institution, friendly policies, adequate infrastructure, and psychosocial skills in order to be successful for the students. The process becomes more complex and extremely hard for the underrepresented students due to color-blind hostile policies to the minority students. Therefore, it's critical for their success that their narratives are told and written.~~

1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 24  
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3 Many of the participants revealed during the interview that it was their first-time experience of  
4 being interviewed. ~~They expressed the excitement of being interviewed.~~ Our research provided a  
5 platform and empowered them to share their life stories. ~~Visual artists and Academics using~~  
6  
7 ~~visual methods to study URGs~~ need to ask more about the presentation of the vignette or the  
8 individual narratives in visual arts and how these can be empowering experiences ~~for the~~  
9  
10 ~~participants, not just be portrayed in~~ creative presentations ~~, but also in disadvantaged~~  
11  
12 ~~communities~~ as noted by Lord (2015). ~~Following that, we argue that~~ feel our research was able to  
13  
14 empower the URG students and ~~amplified provide their them a~~ voices.  
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17 The PEI methods provided them an opportunity to reflect on their STEM experiences  
18  
19 intensely. ~~Binance (2010) also, mentioned that once meanings attributed to the images, the~~  
20  
21 ~~emotions invoked, and information elicited through them provide insights to different from and~~  
22  
23 ~~beyond verbal inquiry.~~

24 We also argue that interviews were able to reach a greater depth in the 60-90 minute than  
25 those conducted similarly without the PEI.

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32 INSERT FIGURE 2

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37 Figure 2: PEI as a Qualitative Tool

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43 Figure 24 depicts the effectiveness of using photograph-based interviews based on our research  
44 findings.

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46  
47  
48 The use of images helped the research team to explicate some of the aspects that we were  
49 interested in exploring deeply with our participants: meaning making and identity construction in  
50 context to their academic challenges. The photographs helped the students to recall, reflect, and  
51  
52 reclaim their experience while enriching the interview process and constructing the self.  
53  
54

## Conclusion

The photos helped the participants give richer answers about their educational journeys, eased the interviewer-interviewee dynamics, and provided a platform for the students to share their stories. ~~However, photo-elicitation was not our primary data collection method, and we collected limited data at the beginning of each interview. Our interview data based on PEI cannot provide an immediate solution for improving the two-year college experience of URGs but certainly helps uncover new perspectives on their marginalized experiences and serve as a catalyst to start dialogues on changes.~~ Also, our research revealed that PEI has excellent potential to capture marginalized narratives of URGs, which is not well explored in educational research, specially, in higher education. In our research PEI promoted a more culturally inclusive approaches positioning the participants as experts of their own narratives. Also, data from our research revealed that PEI can serve as a great qualitative tool for rapport building with the participants and stimulates sharing of richer narratives. We also noted that the photos and the narratives both added different types of meanings to a story. Photos visually represented the content of the narratives, and often provided added information not mentioned in the narratives and symbolically represented the content of the narratives. (Covert and Koro-Ljungberg, 2015)

~~Pursuing higher education is a complex learning experience that demands navigating intricate information. It requires navigational and informational support from the institution, friendly policies, adequate infrastructure, and psychosocial skills in order to be successful for the students. The process becomes more complex and extremely hard for the underrepresented~~

1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 26  
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3 ~~students due to color blind hostile policies to the minority students. Therefore, it's critical for~~  
4 ~~their success that their narratives are told and written~~Prior. Also, previous  
5 research noted that  
6 PEI promotes critical visual thinking (Bowen, 2017) and deep learning. Therefore, PEI can be  
7 utilized in various ways, not only as a tool for capturing lived experiences of the participants or  
8 building rapport with the participants; PEI also can promote critical thinking and visual literacy  
9 skills (Choon-Lee Chai,2019) as a pedagogy for marginalized students in future.  
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12 Also, we hope our PEI research inspires more scholars to study the narrative construction  
13 of marginalization.  
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16 References  
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19  
20  
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22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32

33 Adams. S. Perez. L. and Ballard. J. (2007) *Work in Progress—Increasing transfer student*  
34 *enrollment, retention and graduation through the strengthening transitions into engineering*  
35 *programs*. Faculty publications from the Department of Electrical Engineering, paper 155.  
36  
37

38 Allen. L. (2009) 'Snapped': Researching the sexual cultures of schools using visual methods.  
39 *International Journal of Qualitative Studies in Education*. Vol 22. pp. 549–561.  
40  
41

42 Atkins, K., Dougan, B.M., Dromgold-Sermen, M.S., Potter, H., Sathy, V. and Panter, A.T., 2020.  
43 "Looking at Myself in the Future": how mentoring shapes scientific identity for STEM students  
44 from underrepresented groups. *International Journal of STEM Education*, 7(1), pp.1-15.  
45  
46  
47  
48  
49  
50  
51  
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53  
54  
55  
56  
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1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 27  
2

3 Bahr, P.R., Jackson, G., McNaughtan, J., Oster, M. and Gross, J., 2017. Unrealized potential:  
4  
5 Community college pathways to STEM baccalaureate degrees. *The Journal of Higher*  
6  
7 *Education, 88*(3), pp.430-478.

8  
9  
10  
11 Barbour. R. (2014) *Introducing qualitative research* (2nd edn.). SAGE Publications, Inc.

12  
13  
14 Bowen, T. and Drysdale, M., 2017. *Work-integrated learning in the 21st century: Global*  
15  
16 *perspectives on the future*. Emerald Group Publishing.

17  
18  
19 Chai. Choon-Lee. (2019) Enhancing Visual Literacy of Students through Photo  
20  
21 Elicitation. *Journal of Visual Literacy*. Vol 38 no.1-2. pp113-122.

22  
23  
24 Chase. S. E. (2005) Narrative inquiry: Multiple lenses, approaches, voices. In N. K. Denzin.  
25  
26 and Y. S. Lincoln (Eds.) *The SAGE handbook of qualitative research* (3rd ed) London: Sage,  
27  
28 pp. 651–679).

29  
30 Clark-Ibáñez. M. (2004) 'Framing the Social World With Photo-Elicitation  
31  
32 Interviews', *American Behavioral Scientist*, 47(12), pp. 1507–1527.  
33  
34 doi: [10.1177/0002764204266236](https://doi.org/10.1177/0002764204266236).

35  
36 Collier, J. (1967). *Visual anthropology: photography as a research method*. New York, Holt,  
37  
38 Rinehart and Winston.

39  
40 Copes, H., Tchoula, W., Brookman, F., & Ragland, J. (2018). Photo-elicitation interviews with  
41  
42 vulnerable populations: Practical and ethical considerations. *Deviant Behavior*. Vol 39. pp. 475–  
43  
44 494. doi: [10.1080/01639625.2017.1407109](https://doi.org/10.1080/01639625.2017.1407109)

45  
46 Covert, H. & Koro-Ljungberg, M. 2015, "Layers of narratives, images, and analysis", *Qualitative*  
47  
48 *Research Journal*, vol. 15, no. 3, pp. 23  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 28  
2

3 Edgar, I. R. (1999) 'The Imagework Method in Health and Social Science Research', *Qualitative*  
4 *Health Research*, Vol 9 no 2. pp. 198–211. doi: [10.1177/104973299129121785](https://doi.org/10.1177/104973299129121785).

5  
6 García-Pastor, M. D. (2020). Digital storytelling and learners' dialogical construction of identity  
7 in EFL. In F. Nami (Ed.), *Digital storytelling in second and foreign language teaching*. Bern,  
8 Switzerland: Peter Lang.

9  
10 Kenneth J. Gergen, (2015). *An Invitation to Social Construction*. Third Edition ed. 55 City  
11 Road, London: SAGE Publications Ltd.

12  
13 Gibbons. M. Limoges, C. Nowotny, H. Schwartzman, S. Scott, P. and Trow, M. (2010). *The*  
14 *New Production of Knowledge: The Dynamics of Science and Research in Contemporary*  
15 *Societies*. London: SAGE Publications Ltd.

16  
17 Harper, D. (1997). Visualizing structures: Reading surfaces of social life. *Qualitative Sociology*,  
18 vol 20. pp 57–77. doi:[10.1023/A:1024764214854](https://doi.org/10.1023/A:1024764214854)

19  
20 Harper, D. (2002). Talking about pictures: A case for photo elicitation. *Visual Studies*, vol 17, pp  
21 13–26. doi:[10.1080/14725860220137345](https://doi.org/10.1080/14725860220137345)

22  
23 Jehangir, R. (2010). Stories as knowledge: Bringing the lived experience of first-generation  
24 college students into the academy. *Urban Education*. Vol 45, pp. 533–553.  
25  
26 doi:[10.1177/0042085910372352](https://doi.org/10.1177/0042085910372352)

27  
28 Johnson, K. M. (2020) 'Hotdog as Metaphor: (Co)Developing Stories of Learning through  
29 Photo-Cued Interviewing', *Teachers College Record*, 122(9), pp. 1–38.  
30  
31 doi: [10.1177/016146812012200905](https://doi.org/10.1177/016146812012200905).

32  
33 Kahu, E. R. and Picton, C. (2022) 'Using photo elicitation to understand first-year student  
34 experiences: Student metaphors of life, university and learning', *Active Learning in Higher*  
35 *Education*, 23(1), pp. 35–47.

1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 29  
23 Kovecses, Z. (2017). Levels of metaphor. *Cognitive Linguistics*. Vol 28 no 2. pp 321–347.  
45 <https://doi.org/10.1515/cog-2016-0052>  
67 La Jevic, L. and Springgay, S. (2008) A/r/tography as an ethics of embodiment: Visual journals  
8 in preservice education. *Qualitative Inquiry*, Vol 14. pp 67–89. doi:[10.1177/1077800407304509](https://doi.org/10.1177/1077800407304509)  
910  
11  
12  
13  
14  
15 Lenette, C. and Boddy, J., 2013. Visual ethnography and refugee women: nuanced  
16  
17 understandings of lived experiences. Qualitative Research Journal.  
1819 Lincoln. Y. & Guba, E. G. (1985). *Naturalistic inquiry*. Newbury Park, CA: SAGE.  
2021  
22 Lord, A.M. (2015), "Empowering with image: arts based practice", Qualitative Research Journal,  
23 Vol. 15 Iss 3 pp.  
2425  
26 Lord, S. M., Layton, R. A., & Ohland, M. W. (2011). Trajectories of electrical engineering and  
27 computer engineering students by race and gender. *IEEE Transactions on Education*. Vol 54, pp.  
28 610–618. doi:[10.1109/TE.2010.2100398](https://doi.org/10.1109/TE.2010.2100398)  
2930  
31 Merriam, S. B. (1998). *Qualitative research and case study applications in education*.  
3233 Meyers, K. L. Silliman, S. E. Gedde, N. L. and Ohland, M. W. (2010). A comparison of  
34 engineering students' reflections on their first-year experiences. *Journal of Engineering*  
35  
36 *Education*. vol 99. pp-169–178. doi:[10.1002/j.2168-9830.2010.tb01053.x](https://doi.org/10.1002/j.2168-9830.2010.tb01053.x)  
3738 [NSF] National Science Foundation. 2019. Women, Minorities, and Persons with Disabilities in  
39 Science and Engineering: 2019. Special report no. NSF 19–304 .  
4041  
42 <https://ncses.nsf.gov/pubs/nsf19304>  
4344  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 30  
23 Orellana, M. F. (1999). Space and place in an urban landscape: Learning from children's views  
4 of their social worlds. *Visual Sociology*. Vol 14. pp 73–89. doi:[10.1080/14725869908583803](https://doi.org/10.1080/14725869908583803)  
5  
6  
7  
8  
910 Palmer, V.J. and Furler, J., 2018. A room with a view: a metaphor analysis of Vietnamese  
11 women's representations of living with depression using photo elicitation. Visual Studies, 33(3),  
12 pp.251-263.  
13  
14  
15  
1617 Riessman, C. J. (2008). *Narrative methods for the human sciences*. Thousand Oaks, CA: Sage  
18 Publications.  
19  
2021 Romasanta, L. R. (2016). *Students as experts: Using photo-elicitation facilitation groups to*  
22 *understand the resiliency of Latina low-income first-generation college students*. Retrieved from  
23 ProQuest. ([1793406588](https://search.proquest.com/docview/1793406588))  
24  
2526 Saldana, J., 2011. *Fundamentals of qualitative research*. Oxford university press.  
27  
2829 Saldana, J., 2014. Coding and analysis strategies. In *The Oxford handbook of qualitative*  
30 *research*.  
31  
3233 Schwartz, D. (1989). Visual ethnography: Using photography in qualitative research. *Qualitative*  
34 *Sociology*. Vol 12. pp 119–154. doi:[10.1007/BF00988995](https://doi.org/10.1007/BF00988995)  
35  
3637 Stewart, A. J. (2020). *Sense of belonging in digital spaces* [Doctoral dissertation, California  
38 State University, Fresno]. ProQuest Dissertations Publishing.  
39  
4041 Stewart, W. P. and Floyd, M. F. (2004). Visualizing leisure. *Journal of Leisure Research*, 36,  
42 445–460. doi:[10.1080/0022216.2004.11950031](https://doi.org/10.1080/0022216.2004.11950031)  
43  
4445 Werts, A. B. Brewer, C. A. and Mathews, S. A. (2012). Representing embodiment and the policy  
46 implementing principal using photovoice. *Journal of Educational Administration*. Vol 50. pp  
47 817–844. doi:[10.1108/09578231211264702](https://doi.org/10.1108/09578231211264702)  
48  
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1 MARGINALIZED ENGINEERING STUDENTS' NARRATIVE CONSTRUCTION 31  
2

3 White, J.L. and Mitchell, S.K., 2013. Career certainty and persisting interest in STEM: An  
4 analysis of underrepresented groups. *Journal of Women and Minorities in Science and*  
5 *Engineering, 19*(1).

6  
7  
8  
9  
10  
11  
12 Witcomb, G. L. Brophy, H. and McDermott, H. (2019). More than meets the eye: A photo-  
13 elicitation study of gender (dis)affirmation in seven gender non-conforming university students.  
14  
15  
16  
17 *Psychology, 10*, 1599–1614. doi:[10.4236/psych.2019.1012105](https://doi.org/10.4236/psych.2019.1012105)

18  
19 Woodley, X.M. and Lockard, M., 2016. Womanism and snowball sampling: Engaging  
20  
21 marginalized populations in holistic research. *The Qualitative Report, 21*(2), pp.321-329.

22  
23  
24  
25  
26  
27  
28  
29  
30 **Word Count: 6969 including reference and abstract.**

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CONSTRUCTION

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Figure 1: Research process

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Figure 2:  
*PEI as a Qualitative Tool*

