



## Entrepreneurially-Minded Program Assessment During Emergency Situations: Using Photovoice to Understand Customer (Engineering Student) Needs

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### STRUCTURED ABSTRACT

**CONTEXT:** Innovation, design, and entrepreneurship are economic drivers promoting competition and growth throughout the world, many of which would not exist without well-established continuous improvement and new product development processes. Continuous improvement and new product development processes, such as the lean start-up methodology and design thinking, are well known and thriving in the business world due to the vast amount of empirically-grounded research. Unfortunately, educational institutions and researchers, alike, are lagging when it comes to these processes. Although the quantity of new and transformative degree offerings has increased substantially over the past several decades, limited research has been conducted to document key procedures associated with continuous improvement and the creation of new programs. This problem is only exacerbated when considering the role of innovation during emergency situations.

**PURPOSE OR GOAL:** The purpose of this study is to show one approach (using photovoice) to understand how student voices can be incorporated into the continuous improvement and new program development process, specifically during emergency situations. In contrast to traditional passive data collection methods, such as a survey or focus groups, photovoice is an active data collection method where students engage in the information sharing and interpretation process at a deeper level. Using photovoice, researchers and practitioners, alike, can gain greater insights into the who, what, and how of educational effectiveness. The guiding research question is as follows: *What are the factors which can influence the discovery, evaluation, and exploitation of continuous improvement and new program development during emergency situations?*

**APPROACH OR METHODOLOGY/METHODS:** This approach uses participatory research, wherein students act as researchers and actively participate in the data collection and analysis process. Under the umbrella of participatory research, the study uses photovoice for collecting qualitative data. The study was implemented in a software engineering course at a university located in the United Kingdom. Students responded to the photovoice prompts by supplying both picture and narrative. The prompts target student perceptions (positive and negative) with respect to blended learning perceptions, technology integration, and career preparedness. The qualitative data was analyzed for themes using NVivo.

**ACTUAL OR ANTICIPATED OUTCOMES:** Analysis of the qualitative data led the researchers to identify three core themes related to the blended learning approach implemented as a result of the COVID-19 pandemic: (1) Institution – macro level, (2) Instruction – mezzo level, and (3) Student – micro level.

**CONCLUSIONS:** The study concludes with recommendations for various higher education benefactors of the user generated data including administration, faculty, marketing, recruitment, advisors, and the students, themselves. It is intended for the overall recommendations to have a direct impact on improving the student experience.

**KEYWORDS:** Entrepreneurial mindset, program assessment, emergency situations

## 1. Introduction

Innovation and entrepreneurship are economic drivers promoting quality of life and sustainability throughout the world (Usai, Orlando, & Mazzoleni, 2020), much of which would not exist without well-established continuous improvement and new product development frameworks. Some of these frameworks include design thinking (Brown, 2009), business model and value proposition canvas (Osterwalder & Pigneur, 2010; Osterwalder, Pigneur, Bernarda, & Smith, 2014), and lean startup methodology (Nirwan & Dhewanto, 2015). Moreover, these frameworks have proven successful in the business world as evidenced through a vast amount of empirically-grounded research (Di Russo, 2016; Roth, Globocnik, Rau, & Neyer, 2020). Unfortunately, educational institutions and researchers, alike, are lagging when it comes to the effective implementation of these frameworks. Although the quantity of updated and new degree offerings has increased substantially over the past several decades (Jacob, 2015), limited research has been conducted to document key procedures and models associated with continuous improvement and the creation of new programs. This problem is only exacerbated when considering the role of innovation during emergency situations.

The purpose of this study is to show one approach (using photovoice) to how students can be incorporated into the continuous improvement and new program development process, in particular during emergency situations. In contrast to traditional passive data collection methods, such as a survey or focus groups, photovoice is an active data collection method where students engage in the information sharing and interpretation process at a deeper level (Wang & Burris, 1997). Using photovoice, researchers and practitioners, alike, can gain greater insights into the who, what, and how of educational effectiveness. This approach is considered entrepreneurially-minded as it relates to the definition of entrepreneurial mindset - "*inclination to discover, evaluate, and exploit opportunities*" (Bosman & Fernhaber, 2018). As such, the intention is to take action via participatory action research (as an entrepreneurially-minded assessment approach). The guiding research question is: *What are the factors which can influence the discovery, evaluation, and exploitation of continuous improvement and new program development during emergency situations?*

## 2. Literature Review

COVID-19 was declared a pandemic by the World Health Organization (WHO) on 11<sup>th</sup> March 2020 (Spinelli & Pellino, 2020) and dubbed the greatest challenge that education systems have ever faced (Daniel, 2020), as institutions around the world (Senel & Senel, 2021) had to stop face-to-face learning and adapt to online/virtual learning. This led to a paradigm shift within the higher education landscape, as it provided institutions with an opportunity (some might say forced) to rethink their pedagogic approaches to deliver and assess online learning. One example of assessment can be through applying entrepreneurially-minded participatory action research and photovoice assessments.

Photovoice is a *participatory action research* strategy, which is an ethnographic and experiential technique which brings together photography and images, narrative and critical dialogue, and reflection to uncover social issues and promote change (Sutton-Brown, 2014). According to Wang and Burris (1997), photovoice has three core goals: (1) empower participants to reflect upon and document strengths and weaknesses, (2) promote discourse through narrative, and (3) inform decision makers for the purpose of taking action. Photovoice has been applied in a variety of environments and social settings including veteran experiences in higher education (Tomar & Stoffel, 2014), healthcare (Ahari, Habibzadeh, Yousefi, Amani, & Abdi, 2012), food insecurity (Shannon, Borron, Kurtz, & Weaver, 2021), and refugee camps (Green & Kloos, 2009) as a form of needs assessment to promote problem identification and social transformation.

In summary, photovoice has been applied within education settings and emergency situations, separately. Yet, limited research shows the effective use of photovoice applied with education and during emergency situations together. The purpose of this study aims to shed light on this

phenomenon by conducting an entrepreneurially-minded program assessment during the COVID-19 pandemic using photovoice to better understand customer (i.e. software engineering students) needs.

### 3. Methods

#### 3.1 Participants

The study focuses on the learning experience of Degree Apprenticeship software engineering students (participants) enrolled in an industry-based degree program offered in the United Kingdom. The participants are classified as part time students as they spend only two days with the university and the remaining three days they are with their respective employers during term time. The questionnaire was shared with a group of 23 participants which returned a response rate of 39%. Demographic data on the study participants indicated that the views were more skewed towards female learner perspective (66.6%) with male learner perspective (33.3%) underrepresented.

#### 3.2 Study Design and Data Collection Protocol

The study design for this research follows a similar approach to previous photovoice research (Kotla, Bosman, & Keller, 2021), which is a qualitative approach that explores the data as it gives a unique depth of understanding to the research questions explored. The participants were required to provide three pictures that best describes their response to each question. In addition, each picture was supplemented by a short narrative (3-5 sentences) to explain the choice of image. The questions are as follows:

1. Blended Learning Experience: What are three things you liked **least** about the blended learning mode? What are three things you liked **most** about the blended learning mode?
2. Learning Management System: What were the three biggest factors **negatively** impacting your use of the learning management system? What were the three biggest factors **positively** impacting your use of the learning management system?
3. Work-Based Module: What were the three most **memorable** aspects of the module assessment that helped you in developing skills that would be transferrable within your workplace context.

#### 3.3 Data Analysis

Thematic analysis was used to analyze the photovoice data. According to Braun and Clark (2006), a thematic analysis is a foundational qualitative method for discovering patterns within the data, which should be conducted using a step-by-step process. All three researchers first individually became thoroughly familiar with the data to generate initial codes, where the NVivo 12 qualitative analysis software was used to code the data. Then all three researchers came together to review their findings and come to agreement. Upon completion of coding, themes were generated. As a final step, the lead author revised the themes and wrote the report. Quotes were drawn from the data to allow readers to judge credibility, accuracy, and fairness (Corden & Sainsbury, 2006).

### 4. Results and Discussion

Analysis of the qualitative data led the researchers to identify three core themes related to the blended learning approach implemented as a result of the COVID-19 pandemic: (1) Institution – macro level, (2) Instruction – mezzo level, and (3) Student – micro level.

## 4.1 Macro Level (Institution): Technology

The institutional macro level theme primarily addressed the use of technology, viewed somewhat outside the control of the individual student and instructor. Here, three subthemes emerged.

Learning Management System (LMS) Access: Participants acknowledged challenges with LMS access, speed, and reliability. Example quotes are provided here:

- *I felt as though the [Learning Management System] was slow and crashed more frequently due to the number of users on the system. This meant that it took longer to do work than necessary.*
- *When using [Learning Management System] and studying the site will always timeout and say that the session has expired and the user must log in again, it would be nice if the time before the session expires was longer, because it should be expected that those studying might not interact with the [Learning Management System] page for a while.*

LMS User Experience (UX) Design: Participants recognized both negatives and positives associated with the LMS UX design. From a negative perspective, participants perceived difficulties in finding resources. Example quotes are provided here:

- *Each model was structured into layers, and whilst this was a good way to separate content, it made each page long and it took a long time to find what I was looking for. If I then clicked on a link (for example to see my quiz results) and wanted to go back, I would need to scroll down the long page again to find where I was.*
- *I don't like how the [Learning Management System] has the date in red, even if you have already submitted something, because it gives me the impression that I have missed the deadline/ not submitted something.*

From a positive perspective, once the resources were found and identified, participants agreed that having resources to look back on was a good thing. Example quotes are provided here:

- *There are student forums where I could ask questions, as well as if I encountered any issues.*
- *The fact that a lot of lectures are recorded so I can rewatch them in my own time is a positive factor as it allows me to be flexible with my revision and note taking.*

Internet Access: Participants established that their home or personal internet access had the potential to be troublesome, which in some cases only exacerbated issues associated with the other two sub-themes. Example quotes are provided here:

- *Sometimes my Wi-Fi is not always the best, seeing as everyone in my household uses it at one time it can be quite difficult to work with, especially when I am completing quiz's in a time frame, I can concur in technicality difficulties.*
- *The [Learning Management System] crashes a lot sometimes and with slow internet it doesn't help. Sometimes it acts up when you need it the most so I downloaded what I needed and rarely accessed it after.*

## 4.2 Mezzo Level (Instructor): Curriculum Design

The instructional mezzo level theme mainly addressed the curriculum design and pedagogical structure of the course, viewed as the principal area where instructors can make direct and immediate changes to improve the course content and delivery. Here, two subthemes emerged.

Delivery and Pedagogical Approach: Participants recognized beneficial outcomes associated with the course delivery and pedagogical approach. Example quotes are provided here:

- *One of the lecturers did a whiteboard exercise, where all students can put their ideas on one page. This made the lectures much more interactive and interesting.*
- *The Tutorial sessions made up for the blended learning approach because any questions to do with the content for that week can be discussed in the Tutorial. I like the way the Tutorials are formatted as they support the independent learning done before the lesson.*

Authentic Learning and Transferable Skills: Participants identified constructive outcomes related to authentic learning (e.g., real-world domain-related skill development) and transferable skills (e.g., skills perceived to be beneficial across domains and learning environments). Example authentic learning quotes are provided here:

- *The lecture's where we had to create diagrams really helped to improve my skills, which is beneficial at work as I am a BA.*
- *Design patterns are mentioned often at work so useful to have an understanding of what they are.*

Example transferable skills quotes are provided here:

- *I'm glad we were able to present as we rarely get to practice this work skill at university, and this skill is so vital for work environments.*
- *This module has allowed me to work in a group and learn skills, such as delegation. Going forward, this will definitely allow me to understand how to work and handle colleagues in projects where collaboration is vital.*

### 4.3 Micro Level (Individual): Student Adaptability

The individual student micro level theme largely highlighted student adaptability, within the control of the participants. Here, four subthemes emerged.

Health and Wellbeing: Participants recognized both pros and cons connected to personal healthy and wellbeing (including both physical and mental health considerations). From a pro viewpoint, participants discovered the silver lining and new habit development implemented as a result of blended learning. Example quotes are provided here:

- *Blended learning helped counteract the negatives health effects of travelling I had previously experienced (such as fainting and panic attacks due to the trains).*
- *Due to having more time on my hands by not having to travel into university, I have found more time to cook and bake, here you can see a picture of a cheesecake I made in the first lockdown and since then I have enjoyed making my meals at home, so in my lunch breaks for university I can spend time cooking which I also find therapeutic.*

From a con viewpoint, participants revealed the challenges with implementing new personal habits as a result of blended learning. Example quotes are provided here:

- *Blended learning made me feel isolated and lonely as I wasn't experiencing the social aspect of university.*
- *My desk space is very limited which makes it hard to make written notes and feel comfortable. I do not have a proper chair either, I sit on a stool which makes it very uncomfortable.*

Efficiency: Participants detected efficiency related consequences with respect to time saving and money savings. Example time saving quotes are provided here:

- *Due to not having to waste time travelling to the campus, I found I had extra time to complete my work.*

- *I enjoy that because I am home all the time, I can spend time with my cat and my dog. During my breaks or in the mornings before work, I enjoy taking my dog for a walk to get some exercise as well as running which I now have more time to do.*

Example money savings quotes are provided here:

- *Saving time also leads to saving money as less travel and food costs.*
- *Once blended learning was introduced, I saved money on travelling to and from university. In addition to this, I saved on spending money for lunch during university days.*

Procrastination and Time Management: Participants admitted challenges with procrastination and time management as a result of working from home during the COVID-19 pandemic.

Example quotes are provided here:

- *Staring at the laptop all the time isn't so good, especially when having weird timetables (starting at 9am and then finishing at 6pm). I can get lazy as well sitting in bed all day.*
- *When I come onto campus I feel like I have routine and structure in my day, whereas when I am at home I could be more inclined to work from my bed, which is not very practical.*

Acknowledged Implementation of Best Practices for Moving Forward: Participants acknowledged ownership, empowerment, and recommendations for overcoming many of the previously mentioned challenges. Example quotes are provided here:

- *To influence my behavior going forward I attend morning meetings with my teams at work and this gives more of a collaborative structure to my mornings.*
- *I have been recently using the do not disturb mode which has helped massively and I will put my phone in another room resist the temptation to go on it.*
- *I have now started to write out my day plan and a to do list and get satisfaction when things are ticked off therefore applying some sort of routine to my day.*

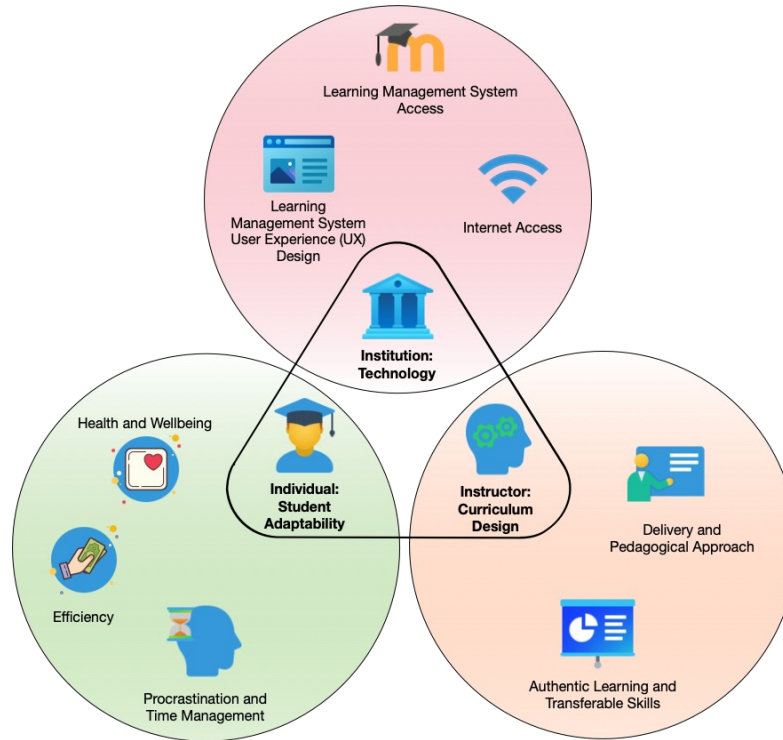
## 4.5 Summary and Discussion

In summary, the qualitative analysis of photovoice data resulted in three core themes (Figure 1) related to the blended learning approach implemented in response to the COVID-19 pandemic: (1) Institution – macro level, (2) Instruction – mezzo level, and (3) Student – micro level.

The institutional macro level theme primarily addressed the use of technology. Although this theme and subthemes are commonly considered outside the control of instructors, instructors have the opportunity and responsibility to at least share the LMS issues and UX challenges with the computer (IT) help desk department (in this case, the Information Technology Services and future students (so they can be prepared and respond accordingly). The subthemes identified are not uncommon within the higher education setting and can be categorized under “system factors” which account for infrastructure system quality and organization service quality (Radwan, Senousy, & Din, 2014). However, although Radwan, Senousy, and Din (2014) suggest the evaluation of LMSs in general to be “costly, time consuming, and needs an effort”, the current student showcases how the use of photovoice can obtain relatively quick feedback with limited costs, time, and effort.

The instructional mezzo level theme mainly addressed the curriculum design and pedagogical structure of the course. This theme and subthemes are considered within the direct and immediate control of instructors, and thus, are “low hanging fruit” for instructors to make course improvements. Moreover, these subthemes align well with instructional best practices identified in the literature which suggests content skill development is just as important as transferable skill development (Chase, S. Rao, Lakmala, & Varma-Nelson, 2020). As a result of this study, the instructors intend to make the following changes: (1) implement more active learning via tutorials, (2) consider creating content using media (e.g., audio- or video-based)

so participants can download if internet or LMS is a barrier to access, (3) provide opportunities to reinforce learning through instructor-led group discussions, (4) be more explicit about labeling and calling out transferable skills, and (5) offer additional opportunities for group work, especially online.



**Figure 1: Summary of Themes**

The individual student micro level theme largely highlighted student adaptability. This theme and subthemes are considered within the primary control of the students, yet can be influenced by the institution and instructor. For example, the literature on metacognition and self-regulated learning suggests instructors can encourage students to gain self-regulated learning skills through reflective metacognitive assignments (Cunningham, Matusovich, Hunter, McCord, & leee, 2015). As a result of this study, the instructors intend to make the following changes to encourage and promote student adaptability and resilience: (1) share printout of student recommended best practices from previous semester with students entering the new semester, (2) setup the place and time for students to connect with each other informally to ask questions, get answers, and build their networks, and (3) implement a rotating student advocate role whereby a designated student will provide anonymous feedback throughout the semester on behalf of their peers.

Since the COVID-19 pandemic started, some other publications have come out to document best practices and lessons learned within the engineering classroom (Asgari et al., 2021; Jamalpur, Chythanya, & Kumar, 2021; Kapilan, Vidhya, & Gao, 2021; Liu, Vijay, Tommasini, & Wiznia, 2021; Piyatamrong, Derrick, & Nyamapfene, 2021). Piyatamrong, Derrick, and Nyamapfene (2021) found students were frustrated with the lack of socializing, perceived low accountability, and were disappointed with the limited opportunities to practice hands-on skills. Liu, Vijay, Tommasini, and Wiznia (2021) founded the discussion sessions promoted instructor-student interactions and the perception of support; yet, commented on the increase in course budget to accommodate the greater integration of technologies (e.g., simulation, computer-aided design, and finite element analysis) and shipping out prototype kits to promote a virtual classroom. Asgari, Trajkovic, Rahmani, Zhang, Lo, and Sciortino (2021) recognized

the benefit of Zoom break-out rooms and students downloading/using phone scanning apps to share work. The authors went on to recommend the use of syllabus templates for online teaching and the development of a university-wide repository for sharing best practices.

## 5. Conclusion

The purpose of this study was to demonstrate how an approach using photovoice was incorporated into the continuous improvement and new program development process during emergency situations, namely the COVID-19 pandemic. In contrast to traditional quantitative data collection methods, such as an end-of-semester survey, photovoice is an active data collection method where students engage in the information sharing and interpretation process at a deeper level. Although the primary purpose of this study was for instructors to assess and evaluate course delivery during an emergency situation (e.g., the COVID-19 pandemic), the debrief aspect of the photovoice assignments also allowed student participants to reflect on what went well and what didn't go so well. In this way, students received an immediate effect and potential for making changes going forward simply by reflecting and writing down future intentions. In response to the guiding research question, *What are the factors which can influence the discovery, evaluation, and exploitation of continuous improvement and new program development during emergency situations?*, three core themes and eight subthemes emerged from the qualitative data collection and analysis process, as visually summarized in Figure 1. From a practical perspective, photovoice-based course evaluations have the potential to provide instructors with rich student feedback which can be enhanced by focusing on the institutional macro level, instructional mezzo level, and individual student micro level.

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