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A Process for Matching Science of Health Care Delivery Students to Quality Improvement Capstone Projects and Implications for Experiential Learning

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A Process for Matching Science of Health Care Delivery Students to Quality Improvement Capstone Projects and Implications for Experiential Learning

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Abstract

Purpose: Quality and patient safety deficiencies have increased demand for quality improvement (QI) specialists in health care. Capstone projects and other practicum experiences provide opportunities for hands-on application of classroom learning, expose students to interprofessional work in a team-based environment, and help bridge quality gaps. A systematic process for matching health care delivery students to QI projects was developed and implemented to replace a first-come, first-served student sign-up process. The goal was to improve the quality of the match and the overall capstone experience.

Methods: Twenty-six graduate students enrolled in a capstone research course and assigned to health care QI capstone projects reflected on their site experiences in 6 journal entries. A total of 156 journal entries were analyzed using standard open coding procedures to understand the factors influencing student perceptions of the quality of the capstone project match and the implications of a systematic approach for matching student to site.

Results: Three key themes emerged in the journals: (1) A "successful" QI capstone match, as defined by the student, is multidimensional and includes both technical and emotional factors; (2) "If you are not visible, they will forget about you; " and (3) Students want meaningful capstone projects with potential for broad impact.

Discussion: Our findings suggest that emotional factors, such as feeling supported and accepted at the site, influence student perception of the capstone match and should be considered when orchestrating quality improvement experiential learning. Further, a systematic matching process that utilizes behavioral interviewing, student input regarding project preferences, strong community partnerships, and academic program support contributes to rich learning opportunities and high-quality work that benefits student and capstone site. These findings may be of value to administrators, educators, and practitioners who orchestrate experiential learning for students.

Keywords: Health care internships, Health care practicum matching, Health care quality improvement, Health care workplace training, Interprofessional education

1. Introduction

Landmark reports about the prevalence of quality and patient safety issues [1–5] have raised public awareness and prompted many health care organizations to prioritize quality improvement (QI) initiatives [6]. Teaching health care workers how to improve health care at the point of delivery is considered a 'bridge to quality' and a core competency of professional practice [7]. Health care educators can help bridge quality gaps through effective applied learning opportunities, such as practicums, internships, clinical rotations and capstone projects.

This focus on quality has increased demand for QI specialists, who are educated and trained to identify problems and optimize system performance. The science of health care delivery, also known as improvement science, provides a multidisciplinary framework for researching and implementing strategies to enhance health care quality, safety, service, and costs. It is a new field of science that provides a

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framework for multidisciplinary research to investigate improvement strategies in healthcare, systems, safety, and policy. Arizona State University's Science of Health Care Delivery (SHCD) program curriculum includes the concepts and tools of data-driven quality improvement (e.g. statistical process control, root cause analysis, and plan-do-study-act (PDSA) cycles), as well as systems-thinking and team-based health care innovation. This two-semester specialty master's degree attracts U.S. and international students with varied health care experience and career goals, including medical school, physician assistant programs, health care administration, and employment as QI specialists. A capstone project in the second semester gives students experience conducting fieldwork to improve real-world health care problems.

Several major Phoenix-metro health care systems partner with ASU and serve as capstone sites for experiential learning. SHCD students with a quality improvement focus are placed at these 'client' sites and assigned to system optimization projects, such as streamlining the hospital discharge process and reducing operating room turnover times. These team-based QI projects expose students to inter-professional practice and help them examine health care delivery problems from others' perspectives. Students' final capstone project deliverables to the client include a formal presentation of their methods, results, and recommendations; an action plan; and a copy of the final thesis.

Internal program research for improvement purposes identified several factors that negatively affect the capstone project experience. These include the student's communication skills, motivation, and resiliency; the capstone site's culture; the level of engagement of the site mentor; and the quality of the match of student to project.

2. Background

Pragmatic, experiential learning figures prominently in the learning process. Dewey asserted that knowledge is constructed with each experience and recognized the strong influence of the environment on learning [8]. Lewin claimed that learning occurs when groups with similar interests collaborate to solve problems [9]. Kolb argued that effective learning occurs through hands-on activity and application [10]. These theories have been applied to health care capstones and practicums [11—18]. The health care workplace is a powerful learning environment, so the process for matching student to practicum site and student perception of the match deserve careful consideration [19].

Processes for placing health care students in applied learning experiences vary by profession. In their second year, student nurses begin standard clinical rotations through acute and long-term care. The final year is a clinical internship with opportunities to explore specialties such as mental health, pediatrics and obstetrics [20—22]. Medical students also complete standard clinical rotations, followed by electives in their desired areas of clinical specialization to match them to a residency program [23]. Medical students rank their preferred residency placements, and the residency programs rank their top students. A software application then matches the student's most preferred location to the residency program's most preferred applicant [24,25]. Physician assistants (PA) also complete standard clinical rotations through emergency and internal medicine and an elective rotation of the student's choice [26]. PA programs also consider students' preferred practicum sites in the matching process.

Health care practicum placements traditionally have focused on training future clinicians. Quality improvement (QI) specialists, as members of the health care team, also need a matching process to prepare them for professional practice. This article describes the development of a systematic process for matching graduate SHCD students to QI capstone projects and the implications for experiential learning. Our study contributes to the literature on health care practicum placements and could be of value to administrators, educators, and practitioners who orchestrate experiential learning for students. Specific research questions were:

1. What factors influence student perceptions of the quality improvement capstone project match?
2. What are the elements of a systematic process for matching health care students to quality improvement projects and the implications?

2.1. ASU's capstone matching process

Prior to implementation of this new process, students independently signed up for a capstone project on a first-come, first-served basis. Students were dissatisfied with this process when, for example, several students signed up for the same project at a well-known academic medical center of excellence and capstone staff could not explain how or why the assignment was made. Also, many students needed more information to understand the project before signing up. Finally, students choosing

hospital-based projects were not aware of the costs for mandatory onboarding tests, such as background checks and drug screens.

The new process for matching students to health care QI capstone projects is depicted in Fig. 1. Requests for project proposals (RFPs) are emailed to all current and prospective capstone clients in the database in mid-May, after the end of the academic year. Proposals typically are completed by physician leaders, nurse managers, QI department directors, and administrators. The proposal form was updated to obtain from the client a detailed project description to ensure a robust, data-driven improvement opportunity for students. Final project proposals are uploaded to ASU's learning management system for student review prior to new student orientation in mid-August.

A Student Ranking Form was developed with information, such as travel requirements, onboarding expenses, and required skills (e.g. SPSS analysis, bilingual), to help students prioritize their top three project choices. At orientation, the Capstone Director distributes the ranking form and explains and situates each project in the greater health care context to help students select projects that are aligned with their career goals. Students return these forms to the Capstone Director and sign up for a behavioral-based interview with a multidisciplinary faculty panel that includes a physician, a clinical/business process improvement specialist, and a health policy expert. The interviews are conducted methodically, with each student being asked about prior health care experience, career goals, and reasons for their top three project rankings. In the behavioral interview, students are asked to describe a time when they experienced teamwork challenges and how they resolved them. Communication and other 'soft' skills are considered when matching student to capstone site and mentor.

Immediately following each student's interview, the faculty panel discusses objective criteria (e.g. student's career goals, project rankings, and specific needs) and subjective impressions (e.g. 'soft' skills) to determine placement. Students applying to medical school typically prioritize projects that improve clinical operations and quality of care. Those wanting to learn more about health care business operations typically prioritize projects with strategic planning or financial foci. Interviewing students and understanding their and clients' needs elicits more granular information that helps faculty determine project placements. For example, several students ranked a neuroscience project at a well-known academic medical center of excellence in their top three choices; however, the client needed only two students. During the interview, the panel learned that one student wanted the project as a stepping stone for admission to the capstone site's medical school; another hoped to be hired by the site after graduation. Two more students with neuroscience undergraduate degrees and relevant research experience wanted the project to further their neuroscience careers. This level of detail, not obtained with a first come, first served sign-up process, helps optimize the match to benefit student and client and provides rationale for placement decisions.

The students' project rankings are compiled in an Excel spreadsheet for quickly sorting, analyzing, and comparing against panel interview notes. If necessary, the Capstone Director will reconnect with a student for clarification before making final project assignments. All students typically are placed at one of their three preferred projects. Capstone site matches are emailed to students, faculty, and clients by mid-September to begin enculturation to the sites. A final project assignment grid containing students' and mentors' email addresses, IRB requirements, and the site's IRB contact, is distributed to all who have a role (e.g. Capstone Director, onboarding specialists, administrative assistants) in orchestrating the student experience.

3. Methods

3.1. Study participants

Participants for this qualitative study were purposefully selected from the Spring 2020 Capstone Research course, taught at ASU's downtown Phoenix campus. Of the 37 total enrolled students, 26 who were assigned to health care quality improvement projects consented to participate. Of the remaining 11 enrolled students, 8 were assigned to health policy projects (not the experience under investigation) and 3 declined to participate. The study sample included 7 males (27%) and 19 females (73%), as well as one international student who planned to return home after graduation to work as a pharmacy QI specialist. The average age of the sample was 23 years. All students had matriculated at the start of the Fall 2019 semester, and all but one had attended new student orientation and received information about the capstone program. Table 1 summarizes participant demographics.

3.2. Materials and procedure

Data were collected from 6 weekly journal assignments completed by participants [27]. Students

A Process for Matching Graduate Students to Health Care Quality Improvement Projects
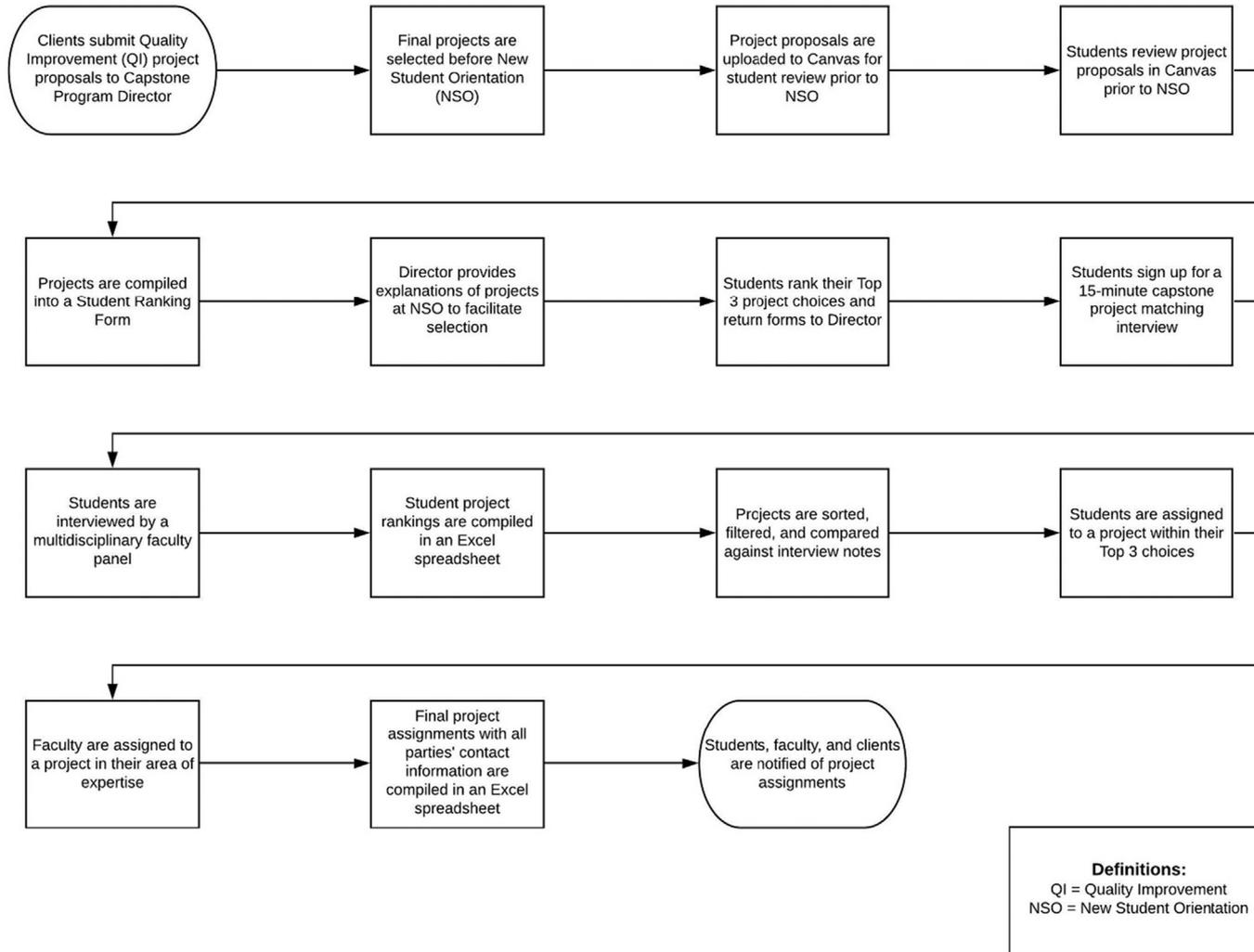

Fig. 1. A systematic process for matching Science of Health Care Delivery students to quality improvement capstone projects.

Table 1. Demographics of study participants.

Participant Number	Gender	Minority Description	Age	Health Care Volunteer or Previous Work Experience	Career Goal
1	Female	Black or African American	22	No	QI Professional
2	Female	White	21	Yes	Medical School
3	Female	Two or More Races	22	Yes	Medical Devices
4	Female	Black or African American	23	Yes	Medical School
5	Female	White	22	No	Health Care Administration
6	Female	Hispanic/Latino	21	Yes	Health Care Administration
7	Female	Two or More Races	22	Yes	Health Care Administration
8	Female	Asian	21	No	Health Care Administration
9	Female	White	22	Yes	Health Care Administration
10	Male	White	23	Yes	Medical School
11	Female	White	23	Yes	Medical School
12	Female	Black or African American	22	Yes	Medical School
13	Female	White	21	No	Medical School
14	Male	Two or More Races	22	No	Medical School
15	Male	White	22	Yes	Medical School
16	Female	Hispanic/Latino	31	Yes	QI Professional
17	Female	Asian	23	No	Medical School
18	Female	Two or More Races	21	Yes	Medical School
19	Female	Black or African American	22	Yes	Health Care Administration
20	Male	White	21	No	Health Care Administration
21	Male	White	23	Yes	Medical School
22	Female	Asian	22	Yes	Medical School
23	Male	White	23	Yes	Medical School
24	Female	Hispanic/Latino	26	Yes	QI Professional
25	Male	White	39	Yes	QI Professional
26	Female	Non Resident Alien	23	No	QI Professional

were asked to journal their capstone experiences in detail and reflect upon what they learned. They were assured that no identifying information would be included in the analysis or publication of results. The study was exempted by ASU's Institutional Review Board.

3.3. Data analysis

A total of 156 (6 entries/student) journal entries were analyzed, using standard open-coding procedures [28]. All entries were read first in their entirety to gain a broad sense of students' perceptions

of the capstone project match and overall experience. Then, the first week's entries were analyzed line by line to identify attributes of a 'successful' capstone match, as defined by the student. Codes were applied to these attributes, and a master code list was created with these initial open codes, along with definitions for applying them. Then, each week's journal entries were analyzed, compared to the first week's entries and initial codes, and codes were applied as appropriate. Using an iterative process with constant comparison, codes were created for new concepts detected in the textual data, similar codes were collapsed, and some codes were eliminated [28]. Saturation was achieved when no new codes were detected. Two weeks after the initial coding, the master code list was re-evaluated and the journal entries were recoded for reliability [29]. The final code listing was then reviewed, and similar codes were categorized into themes.

4. Results

Three main recurring themes that provided insight into student perceptions of the match and the overall QI capstone experience were detected in the journals.

Theme 1: A 'Successful' QI Capstone Match is Multidimensional

Students frequently used the words "succeed" and "success" in their journal reflections. The capstone was seen as a path to success because it provided work experience. Students described their application of run charts, process maps, and other quality improvement (QI) tools as reinforcing what they had learned in the classroom. On a deeper level, however, students saw the capstone as a space in which mentors wanted to help them succeed. In their journals, students defined a "successful" QI capstone match as providing more than applied technical learning. They also defined it with emotional factors related to feeling accepted and supported at the site, learning to trust their mentors, gaining new insights about themselves, and being able to visualize their futures in health care.

"Throughout this capstone, I have [been] elated, excited, fascinated, and inspired. I want to be a neurosurgeon, so this project has me excited to see real patient outcomes from neurosurgical interventions to treat epilepsy. I have learned so much about myself [and] am positive this is what I want to do for my future."

"I feel like I am very fortunate to have this experience with people who want to see me succeed and people who are willing to help. Thank you for choosing advisors and sites that make it easy for us students."

"From this experience, I learned it is essential to have a passion for what you are trying to do and how [passion] is crucial when having to navigate unforeseen obstacles. I also learned that part of being a successful professional is having hard, direct conversations with people to overcome obstacles."

"One of the most important things I learned during this week was [that] the health care field is unpredictable and working within it will require flexibility and willingness to adapt. This was a great way to learn about the proper ways to respond to barriers in a professional setting and how you can successfully overcome them."

Related to flexing and adapting to unpredictability was an underlying tension between the student's responsibility for completing the capstone work and the site's barriers that impeded progress. A few resilient students seemed to be able to see alternatives, redirect themselves, and take action to successfully overcome challenges.

"We do feel like there has been some changes to the project design and … the research plan has evolved into something different than we had originally anticipated. Although this is unexpected, we are attempting to provide [the client] with anything that can be seen as useful."

"I have been anxious because my project was delayed [and] I experienced days where I wanted to give up. However, … I took a step back and forced myself to remember why … I am so passionate about health care. By doing this, I was able to put everything back into perspective and take action to get my project back on track."

Theme 2: "If You Are Not Visible, They Will Forget about You."

Students typically have some latitude for experiential learning at the capstone sites. Some students described taking the initiative to increase their visibility on site as a way of communicating their desire to learn as much as they could from the capstone experience. By setting and adhering to predictable fieldwork schedules, these highly visible students were provided rich, learning opportunities.

"I think if you don't actually go there [capstone site] very often, you could have a harder time …

We made it evident that we wanted to be there. We sat in on many executive meetings … where our piece was 2 minutes. We were soaking in and learning. It was cool … being exposed to more than just your project, making yourself available to those opportunities. The capstone is what you make of it. If you are not visible, they will forget about you."

"Dr. [X] once again mentioned the idea of attending a conference in Sedona and San Diego for the American Academy of Pediatrics in order to share our capstone findings."

"This week, [we] spent a lot of time [on site]. We made a lot of progress with going through patient logs … We had the unique experience of shadowing a surgery, which ended up being really eye-opening for me about potential career paths."

Theme 3: Students Want Meaningful Capstone Projects with Potential for Broad Impact

In general, students valued the learning gained from the site, and many felt "responsible" for giving back to the site by producing "high-quality work" that "helps the organization." They valued site mentors who clearly communicated expectations so they could "honor" their obligations.

"Our current tasks have been made clear and we are aware of what we are responsible for. I am excited for the project launch date and for the responsibilities we will uphold."

Some students chose QI projects with potential to more broadly impact populations beyond the capstone site.

"[Working] with underserved communities drove my choosing this project … [It] will teach patients and their families about tobacco smoke exposure, provide health literacy material for them to promote cessation … and educate [providers] and nurses about the importance of standardized screening."

"I am excited to be a part of this project as it will greatly benefit our society. We hope that other health care systems will adopt this same pathway and surgical site infections will be reduced."

5. Discussion

We sought to identify the factors influencing student perceptions of the quality improvement capstone project match. We also wanted to understand the elements of a systematic matching process and the implications for experiential learning. Our findings indicate that many factors influence student perceptions of the match. Students seeking QI specialist jobs after graduation were influenced by technical factors, such as applying QI concepts and tools at the site, because these job skills are in demand. More nuanced data, however, suggest that student perception of the match also is influenced by emotional factors. As defined by the student, the match is successful when mentors care and make time; when students feel supported; when the capstone confirms their career choices; when they experience and successfully navigate new facets of the health care system, such as its unpredictability; and when students feel accepted by the site. Acceptance was mentioned frequently and perceived in small gestures. Being offered warm-up jackets in the operating room, food at the morning meeting, and a seat at the table, instead of a visitor chair against the conference room wall, signified acceptance of the student by the capstone project team.

A successful capstone match also helps students learn to navigate the barriers and challenges of the health care system [30]. One student described stepping back to gain perspective and asserting herself with newly developed interprofessional communication skills to keep her capstone project on track. Completing the capstone requires the right amount of assertiveness, tempered with respect for site mentors and staff. These interpersonal skills are likely better learned by experience in the field than in the classroom.

Students at practicum sites learn by observing others [12]. Some students perceived that their learning experiences were dependent, in part, on *their* being observed − i.e., by being "visible" to site mentors and staff. Their journals described a continuum of capstone learning opportunities, ranging from passively observing processes to actively participating in executive team meetings. The difference in these experiences could be due to students' maintaining visibility at the capstone site with a regular schedule that communicated their receptivity to learning [31]. These data suggest that QI students consciously planned to be visible and create their own rich learning opportunities. This differs from medical or nursing students who, while learning to care for patients under the tutelage of experienced clinicians, are regularly exposed to rich learning opportunities. QI students who were able to read the culture and behave in a way that communicated their desire to learn opened their own doors to impactful learning experiences within and beyond their capstone projects.

Our findings also suggest that a successful capstone match has both local and broad impact. Students felt a strong obligation to produce high-quality work that helped the site, which may be due to being interviewed for a capstone placement. When a student qualifies for a capstone placement and is contacted directly by the site mentor, they feel a duty to perform. Depending on their career goals, some students preferred meaningful capstone projects that broadly impacted the health of disadvantaged populations. Such projects enabled them to apply their QI learning to health care issues about which they were passionate, such as pediatric tobacco smoke exposure. Most students journaled "frustrations" and "unexpected changes" that are typical of most health care organizations. However, students who were matched to projects with potential for broad impact often ended their journal entries eagerly anticipating what the next day at the capstone site would bring. Giving students input into their capstone placement may impart a sense of ownership or control, positively altering their perception of challenges and maximizing their experiential learning.

5.1. Recommendations and implications

These findings have several implications for educators and site mentors who orchestrate experiential learning. QI students are trained in health care organizations, and our findings suggest that matching them to practicums with a systematic process similar to that of students pursuing patient care careers has benefit. For this study, we define a systematic matching process as (1) requiring a standardized, behavioral-based student interview; (2) soliciting student input regarding their career goals and project preferences; (3) having sound knowledge of the capstone environment and the site's mentoring style, which are gained through strong community partnerships; and (4) being facilitated by the academic program. This new process is mostly standardized, yet allows for flexibility and career-specific interventions to accommodate the professional diversity of SHCD students. For example, a student who wanted to learn health care business operations was matched to an accountable care organization by leveraging an established capstone client relationship. The student likely could not have secured this career-specific match without academic program facilitation.

Optimal capstone project matches can ignite passion and motivate students to produce high-quality work for the client. This feedback from a physician mentor — "We will miss him. He helped me complete work to improve patient care that would not have been possible this year" (Personal Communication,

2020) — suggests that community health care providers also benefit from increased labor resources provided by capstone students. This perceived value of student work enhances the academic program's reputation and strengthens community partnerships. Conversely, telling students to find their own capstone projects could result in a poor match between the student's and the site's goals, "devaluing the experience for both parties" [32].

Our findings indicate that emotional factors, such as students feeling accepted on site, are relevant to the learning experience. These findings seem to confirm Armstrong et al.'s [11] assertion that experiential learning for QI students should include attention to the "soft" skills, in addition to the technical skills. Understanding the technical *and* emotional factors that influence student perception of the capstone match and learning experience could be of value to site mentors. Orchestrating student acceptance at the site, reinforcing the value of the students' work, and actively monitoring and removing project barriers can minimize anxiety and optimize the learning experience for the student.

5.2. Limitations and future research

This study is limited to students enrolled in one health care program and assigned to quality improvement capstone projects in one metropolitan area. These results are best utilized for program development or improvement purposes. The journal entries were assigned to promote reflective learning; however, some entries could have been positively skewed due to the hierarchy in the student-professor relationship. To mitigate this risk, signed letters of consent were held by a third party until after graduation, so the professor did not know participants' identities.

The themes generated in this exploratory qualitative study give health care educators insights into factors influencing the capstone match and how these factors affect experiential learning. These findings will inform the development of pre-capstone learning materials to prepare students for the experience. They also will inform the development of survey instruments to measure student and client satisfaction with the program.

6. Conclusions

Patient safety and quality of care are global concerns that have increased the need for QI specialists who are educated and trained for systems improvement and interprofessional practice [33]. Health care educators can help reduce quality gaps

in the system with applied learning opportunities that teach students how to identify and improve problems at the point of care. Most health care programs incorporate applied learning; however, no single best practice exists for matching students to practicum sites. Traditional methods for teaching improvement science can be adapted for non-clinical health care students [34]. Approaching QI practicum placements with the same deliberation as students pursuing caregiving professions is one example of a necessary adaptation. Further, we propose a systematic process for optimizing the match of students to quality improvement projects. Our key findings, as well as this systematic process, may help other programs in the U.S. and abroad orchestrate more efficient and effective practicum placements that better prepare health care students and help bridge the quality gap.

Ethical approval

IRB exemption was granted from the Arizona State University Institutional Review Board for research involving human subjects (8 January 2020, STUDY00011235).

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Conflict of interest

None.

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