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RESEARCH ARTICLE

The Facilitator Model: Investigating a Novel Dual Credit Experience for Open-Ended Design Coursework

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Abstract

This study explored the implementation of a novel approach to dual credit referred to as the facilitator model that can be suited for STEM-focused coursework such as courses focused on engineering, design, technology, and innovation. Unlike other models, high school teachers facilitate the implementation of a college course for both high school and college credit in *collaboration* with a university instructor who evaluates student learning. This novel approach was specifically implemented for an open-ended undergraduate design course within an engineering technology college, similar to many first-year engineering course experiences that emphasize project-based learning, from a large research-intensive public university. For this study, the facilitator model was piloted with five high school teachers as facilitators of an undergraduate design course for dual credit at two innovative, STEM-focused public charter schools. The qualitative research design focused on examining (1) teacher needs while implementing, and perceptions of, the dual credit facilitator model for an undergraduate design course in urban public charter schools and (2) the impact of this model on student learning. This study included the collection and analysis of over 90 h of interviews, focus groups, surveys, and observations. Results provide a promising outlook for the use of the facilitator model when delivering dual credit content that is open ended and within the context of design, technology, and engineering by (1) navigating multiple institutional policies and processes related to dual-credit implementation, (2) providing ongoing support and fostering collaboration between high schools and university, (3) enabling students to earn directly transcripted college credits that count as a required course toward degree completion, and (4) increasing affordability and access to dual credit coursework. These potential advantages over other dual credit models can help address barriers that may limit access to dual credit coursework, specifically for underserved high schools.

Keywords Design thinking · Dual credit · High school · Facilitator model · Project based · Engineering technology

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Introduction

Participation in dual credit coursework often fulfills requirements toward high school graduation and can enable students to earn a diploma with academic honors (Indiana Department of Education, 2016; Kelley & Rowland Woods, 2019). Additionally, these advanced diplomas are a strong indicator for student success in college (Indiana Commission for Higher Education, 2019). In fact, one study states that "exposure to any college course has a positive impact on student retention and graduation," and that students who completed dual credit courses were twice as likely to complete their first 2 years of college than those who did not participate in dual enrollment coursework (Troutman et al., 2018, p. 33).

While many secondary schools offer dual credit opportunities, they are not all equal. Some courses are taught by high school teachers with special certifications on high school campuses, others on community college campuses, and a wide variety of courses are offered online. There are even college preparatory high schools and charter schools that tailor their curriculum around credit earning opportunities (Cowan & Goldhaber, 2015). As delivery methods of dual enrollment vary, so do eligibility requirements, such as a student's grade level, GPA, and funding for tuition costs (Burns & Leu, 2019). A 2019 report titled, *Unlocking Potential: Jobs for the Future,* was published from a collaboration between the *College in High School Alliance* and *Level Up*—two coalitions made of national and state organizations that focus to increase representation of students of color, low-income, and first-generation college students in post-secondary institutions. The report highlights six categories to consider to advance equity and remove barriers toward dual credit programs: (1) statewide goals for engaging underrepresented minorities, (2) ensuring credit transfer and articulation, (3) affordability, (4) accessibility, (5) collaboration of high school and college instructors, and (6) student supports (College in High School Alliance, 2019). These categories provide insight to weaknesses in current models for dual credit that impact the transition from high school to college, especially for first-generation scholars (College in High School Alliance, 2019; Horn et al., 2018; Weissman, 2020; Zinth, 2018). This suggests that the way in which current dual credit programs are offered may be excluding the very students for which it could be most beneficial (Weissman, 2020).

Accordingly, a relatively new model for obtaining dual credit, the facilitator model, has been developed to address many of these concerns. Through this approach, a university faculty member serves as the "instructor of record" while the teacher facilitates the course on-site at the high school. The model has three key features: (a) high school students learn the course content and meet learning objectives as students enrolled at the university, (b) the university instructor of record oversees course activity via the university's learning management systems and provides feedback to students, and (c) the high school teacher serves as the facilitator for the day-to-day course activities within the high school while assigning separate high school grades for their students. Additionally, the university instructor of record provides just-in-time support, both to high school

teacher-facilitators to assist course implementation and to students to ensure that appropriate progress is being made toward the course objectives in congruence with university deadlines and processes (Thorne et al., 2022).

This study focused on examining the implementation of the facilitator dual credit model with an undergraduate design course from a large research-intensive public university and two urban public charter schools focused on increasing access to higher education for minoritized youth. Specifically, this research investigated: (1) teachers' needs while implementing, and perceptions of, the dual credit facilitator model for minoritized youth in an undergraduate design course, and (2) the relationship of this model to student learning in an urban public charter school.

Literature Review

Theoretical Framework

Investigation of dual credit challenges and barriers to support teacher preparation and perceptions of a new dual credit model aligns well with Tinto's theory of departure focusing explaining why students leave college, and the support systems that impact success and persistence. According to this theory, students who leave college prior to completion lack support mechanisms required for a positive college experience. Previous experiences, prior academic preparation, academic expectations, and the degree to which students adopt academic norms of the college are essential for separation, transition, and persistence (Tinto, 1987). The need for previous experiences is addressed by facilitator model through providing students with an authentic college course experience while still in high school. As the considered college in the year or two following this experience, the dual credit not only gets them closer to college graduation but it also becomes a successful previous college experience. The facilitator model provides prior academic preparation by fostering close collaboration between teachers and university instructors such that students are academically well prepared as secondary teachers are implementing college coursework with fidelity. Academic expectations and academic norms are communicated to the students by the university instructors and reinforced by their secondary teachers as university instructors are evaluating student work to ensure grading is well calibrated with university practices. Based on this theory, we believe there is potential for success with the facilitator model as it builds support mechanisms while providing a low-risk, high-reward college experience.

The Need for an Aligned Dual Credit Model

While there are several advantages of participating in dual credit courses, students may be dissatisfied with these experiences. Taylor & Pretlow (2015) found that dual credit students often feel disconnected from peers and teachers, and the promise of college credit falls short of their expectations. Students under the assumption that credits they accumulate in high school will help to reduce their time to

college degree are often disappointed to find that these are not recognized as required courses in their plans of study as they enter postsecondary education (Taylor & Pretlow, 2015). This can be true for many college-credit programs, including established programs such as advanced placement (AP) where "86% of the top 153 universities and colleges in the United States restrict the awarding of AP credit" (Weinstein, 2016, p. 2). This resistance to accept college credit from dual-credit programs can stem from concerns regarding the rigor and fidelity of implementation of the coursework (Hanover Research, 2014; Tobolowsky & Ozuna, 2016a; Troutman et al., 2018). Resultingly, many states require the same qualifications of high school teachers as college-level instructors which can include holding a master's degree as well as 15 graduate credit hours in their subject area (Hanover Research, 2014; Tobolowsky & Ozuna, 2016a; Troutman et al., 2018). This may further limit course offerings in schools with high teacher turnover. As such, these course experiences can limit student participation in traditional dual credit coursework, reduce the value of the learning experiences, place barriers for schools to offer dual credit and for students to access these courses, and reduce the motivation for colleges to offer these experiences to students.

Additional Barriers to Overcome

While credit transfer and articulation can pose a barrier to earning dual credit, studies suggest weaknesses of other models include the collaboration between the high schools and colleges which include affordability, accessibility, limited instructor capacity due to high and potentially unreachable qualifications, and a lack of supports as students matriculate to college (College in High School Alliance, 2019; Horn et al., 2018; Weissman, 2020; Zinth, 2014). Though these barriers impact all students, low-income and underrepresented minority students continue to show lower enrollment in dual credit programs (Hoffman, 2003; Indiana Commission for Higher Education, 2019; Zinth, 2014).

One contributing factor of lower enrollment for low-income and underrepresented minority students is financial, as many schools are unwilling or unable to financially support students in dual credit opportunities, with fees ranging from $85 to $600 to obtain credits (Bertram, 2006; Tobolowsky & Ozuna, 2016b; Troutman et al., 2018). This is further magnified by the number of students that are counseled out of enrolling in dual credit courses as prior academic performance may impact eligibility requirements (Jameson et al., 2022). Though dual credit coursework was originally intended for mid-achieving students who may not have considered post-secondary education (Chatlani, 2018), restrictions on teacher qualifications have resulted in districts focusing only on already college-bound students, discouraging populations who may benefit most from the coursework (Chatlani, 2018; Zinth, 2014, 2018). Additionally, teacher qualification requirements, reduced tuition that a college may earn for these courses, and concerns with the rigor of learning experiences have placed several institutional and bureaucratic obstacles for 4-year degree granting institutions, especially research-intensive universities, to offer dual credit experiences that directly align with the requirements and rigor of their degree programs.

Facilitator Model

One proposed model to overcome challenges associated with traditional dual credit programs is the facilitator model (see Fig. 1). Unlike most models where the high school teacher is specially certified or a faculty member directly teaches the course, in the facilitator model, the high school teachers help to facilitate the day-to-day course activities during the school day collaboratively with the university instructor of record. The high school teacher then plays a supporting, mentoring, and guiding role, offering coursework feedback before assignments are submitted to the university for assessment by the instructor of record.

This is not unlike the way in which many undergraduate courses are taught by graduate students, with a faculty representative serving as the course coordinator to ensure the quality of course implementation. The university instructor of record also typically meets regularly with high school teachers throughout the school year, providing on-going and just-in-time support, feedback, and strategies for instruction. An instructor of record from the partnering university can allow more students to participate in dual credit offerings as schools can allow for teachers to facilitate content without extra certifications such as a master's degree in the subject.

Utilizing a university faculty member as the instructor of record ensures that course activities are equivalent to the on-campus version of the course which (1) enables teachers to facilitate course implementation with fidelity, (2) allows students to earn required credit toward graduation on their plan of study, and (3) reduces teacher requirements, such as a master's degree in the subject area to teach the course within the school. Not requiring teachers to have a masters in STEM areas such as engineering and technology may help expand accessibility as there are limited opportunities for teachers to earn master's degrees in these subjects, supporting broader access to dual credit programs.

Problem Statements

Early studies on the facilitator model investigated the impact of dual-credit mathematics on high school students in college algebra and trigonometry in preparation for a

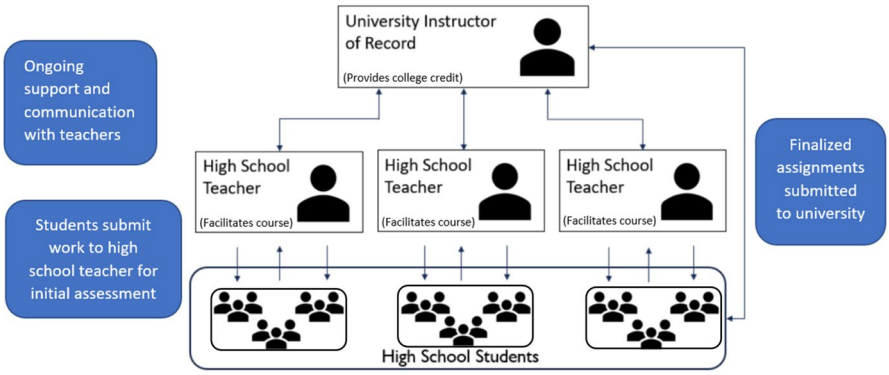

Fig. 1 The facilitator model for dual credit

first-year on-campus calculus course. Findings indicated that facilitator model participants matriculated to the university at higher rates (Pyzdrowski et al., 2011, 2016) and improved ACT scores (Pyzdrowski et al., 2006, 2011) compared to students from the same secondary schools prior to implementation of the facilitator model. On average, high school students who earned dual credit through the facilitator model actually outperformed their on-campus peers (Pyzdrowski et al., 2006, 2011, 2016). While the model shows promise, existing literature does not explore key elements of the close collaborative relationship between key stakeholders including teachers, schools, districts, and university faculty or how to initiate or sustain these relationships. Further, pedagogical approaches appropriate for mathematics education may be different from those central design education which is situated in technology and engineering.

An investigation into the advantages and disadvantages of traditional dual credit models as well as unintentional barriers was conducted in an effort to identify a sustainable new model that would provide high-need schools access to dual credit opportunities. Studies indicate that supporting and scaffolding students through such a process may provide experiences and preparation that are thought to impact success and persistence for matriculation (Tinto, 1987). Early studies on the facilitator model with dual-credit mathematics courses show advantages with college access and turning high school partnerships into college enrollment (Pyzdrowski et al., 2006, 2011, 2016). The gap exists, however, with the implementation of such a model in open-ended and project-based courses within the context of design, technology, and engineering where evaluation of student work and curricular supports can be challenging. This form of coursework is of particular interest as a meta-analysis of 225 studies found project-based, active learning in STEM disciplines has been shown to raise grades, reduce failures, and benefit female and under-represented minority students (Freeman et al., 2014). Therefore, this study focuses on investigating teacher preparation and supports needed when implementing and sustaining a facilitator dual credit model for an undergraduate design course, as well as the perceived influence of such a model on student learning.

Research Questions

The research questions that guided this study were the following:

RQ1: What are teachers' needs while implementing and perceptions of a sustainable dual credit facilitator model for minoritized youth in an undergraduate design course emphasizing project-based learning?
RQ1a: How, and in what ways, can professional development prepare teachers to facilitate a dual credit design course that emphasizes project-based learning?
RQ1b: What ongoing support is appropriate for teachers and how does the support meet their needs while facilitating a dual credit design course?
RQ2: What are the teachers' and students' perceptions of how the dual credit model influenced student learning in an undergraduate design course in an urban public charter school?

Study Context

This study was focused on investigating the needs of high school teachers in an urban public charter school to serve as facilitators for an undergraduate design course emphasizing project-based learning for dual credit. These needs were analyzed in terms of (1) preparation for facilitating the course and (2) ongoing support needs throughout the school year. Additionally, data were collected to investigate the perceived influence of this model on student learning. In the context of this study, the facilitator model for an undergraduate design course was piloted through a partnership between one large research-intensive public university and two innovative urban public charter schools. The data to answer the research questions were collected during the pilot of this program in the summer and fall of 2020. As 2020 was the start of the COVID-19 pandemic, public safety measures were required such as social distancing in classrooms and virtual interactions between researchers and teacher participants. The instructor of record supported this course as part of their course load, while a graduate student provided additional support at 0.25 time, offset by student tuition. The graduate student supported both professional development and ongoing support, as well as student enrollment. High school faculty were not compensated for their time during summer professional development.

Undergraduate Design Course Description

The curriculum implemented using the facilitator model was an undergraduate introductory design course within an engineering technology college emphasizing design thinking methodologies. This course is a core requirement and typically taken within a student's first academic year and one of three courses required for a minor in design and innovation. Course activities focus on human-centered design principles and consists of three major projects over a 16-week period, scaffolded in such a way that while design concepts are repeated, the depth of skills and expectations increases with each project iteration. In the final design project, student teams develop a prototype addressing a self-selected problem framed within an engineering grand challenge (National Academy of Engineering, 2020).

Upon successful completion of the course, the dual credit high school students earn directly transcripted credits with the partnering university, marking the start of many students' college GPA. As a grade of a "C" or lower in the course could have a negative influence on qualifications for financial aid or admittance into post-secondary education, checkpoints were incorporated into the dual credit offering of the course. At each checkpoint the instructor of record from the university met with facilitating teachers to suggest students receiving a C or below consider withdrawing from the college course. A total of three checkpoints were established, based on university withdrawal deadlines.

Participants

This study consisted of four sections across two high schools, one team-taught, with five high school teachers serving as facilitators. All participating teachers were recruited following approved Institutional Review Board protocol. The teachers

were White, mid-western teachers, both male and female, representing an age range of 30–60 years old. The schools involved were innovative urban public charter schools, with an approach to curriculum emphasizing integrated STEM learning and design projects. The schools are considered innovative as they have been in partnership with a 4-year degree-granting institution focused on novel approaches to teaching and learning designed to increase access to higher education as well as the future of work and learning, specifically for minoritized youth. As a result, both participating students and teachers had prior experiences with problem-based learning and human-centered design.

Approximately 60 students were enrolled in the four sections for high school credit, with 43 initially enrolled for dual credit. Due to counseling students out of the course at major checkpoints who were academically struggling and unforeseen circumstances including the COVID-19 pandemic, 26 students completed the course for dual credit. Most remaining students completed the same coursework for high school credit. Participating students were in grades 10–12, predominantly male, from a variety of ethnic and racial backgrounds, many qualifying for free/reduced lunch. Data were collected from all five teachers and 11 students who provided assent and whose guardians provided consent.

Professional Development for the Facilitator Model

Following Tinto's (1987) theory of departure, professional development (PD) focused on preparing teachers to serve as authentic course facilitators over four consecutive, 7-h days in an online learning environment by aligning academic expectations and providing first-hand experience with the academic norms of the college (see Fig. 2). During this time, teachers were provided with (a) a broad course overview, (b) opportunities to speak with student alumni, (c) discussions with related faculty from other programs to share the relevance of learning outcomes to their courses, (d) a question-and-answer session with a university recruitment panel to address requirements and support toward post-secondary matriculation, (e) exemplar curricular artifacts, (f) sample assignments to practice grading and evaluating, (g) guided navigation of the university's learning management system (LMS), and (h) experiential learning of selected lessons from the course. A total of six lessons were selected to represent the core learning outcomes of the undergraduate course. The first of these lessons was modeled and delivered by a university instructor, engaging the participating teachers as students. Subsequent lessons were delivered such that each individual teacher facilitated the delivery of one lesson and served as a student for the other four lessons delivered by their peers.

Several steps were taken to preemptively address grading-alignment concerns during the summer PD session, including providing deidentified student assignment samples, and practicing with university rubrics to calibrate grading. Rubrics were modified for the PD experience such that teachers indicated the score and reason for deducting points to the student on a Google Slide (see Fig. 3). This facilitated group discussion around each assignment and alignment of feedback and grading expectations with the university.

<table>
<tr><th></th><th>Monday</th><th>Tuesday</th><th>Wednesday</th><th>Thursday</th></tr>
<tr><th></th><th>June 8 - Project 1</th><th>June 9 - POV</th><th>June 10 - Interviews/Observations/ Literature</th><th>June 11 - Prototyping</th></tr>
<tr><td>8:30</td><td>Design Introduction</td><td>Orientation Dialogue KWL</td><td>Orientation Dialogue KWL</td><td>Orientation Dialogue KWL</td></tr>
<tr><td>9:00</td><td>Welcome and Overview of the Course Venn diagram</td><td>Guest Talk (Faculty Panel)</td><td>Guest Talk (Recruitment Panel)</td><td rowspan="2">Discussion:
Assignment submission as a student
Assignment grading / feedback as a teacher</td></tr>
<tr><td>9:30</td><td rowspan="2">Design and Innovation Competition</td><td rowspan="2">Research Details for Fall</td><td rowspan="3">Teacher: Model a lesson M6, M7 - A day in the life of Tech120 class meeting</td></tr>
<tr><td>10:00</td><td rowspan="2">Design Journal Review
Final Project Grading
Rubrics</td></tr>
<tr><td>10:30</td><td rowspan="2">Teaching Assignments</td><td>Timeline of critical University Add/Drop enrollment events</td></tr>
<tr><td>11:00</td><td rowspan="3">Individual working lunch</td><td>Venn diagram - between PPHS and Tech120</td></tr>
<tr><td>11:30</td><td rowspan="2">Individual working lunch</td><td rowspan="2">Individual working lunch</td><td rowspan="3">Collaborative working lunch - Discussion - Implementation - PPHS detail Academic Year Support</td></tr>
<tr><td>12:00</td></tr>
<tr><td>12:30</td><td rowspan="3">Facilitator: Model a lesson M4 (Design Critique) - A day in the life of Tech120 class meeting</td><td>Guest Talk (Tech120 Alum Panel)</td><td rowspan="2">Teacher: Model a lesson M8 - A day in the life of Tech120 class meeting</td></tr>
<tr><td>1:00</td><td rowspan="3">Teacher: Model a lesson M3 (POV) - A day in the life of Tech120 class meeting</td><td>Dissertation on challenges of Black female students in STEM</td></tr>
<tr><td>1:30</td><td>Teacher: Model a lesson M10 (ideation) - A day in the life of Tech120 class meeting</td><td rowspan="3">Teacher Led Collaborative Planning</td></tr>
<tr><td>2:00</td><td rowspan="2">Q&A (Prep)</td><td rowspan="2">Facilitator: Lesson discussion M20, 21, 24, 25 (Prototyping)</td></tr>
<tr><td>2:30</td><td>CATME - Measure of "team member effectiveness"- Overview and Experience</td></tr>
<tr><td>3:00</td><td rowspan="2">Focus Group / Reflection</td><td rowspan="2">Interview - Researcher A
Structured Prep - Researcher B</td><td rowspan="2">Prep for grading - submit and grade
Interview - Researcher A
Structured Prep - Researcher B</td><td rowspan="2">Interview - Researcher A
Structured Prep - Researcher B</td></tr>
<tr><td>3:30</td></tr>
<tr><td>After hours</td><td>Reading/Video - Prep</td><td>8:00 Virtual Social Hour</td><td>Fall implementation prep/Prototyping</td><td></td></tr>
</table>

Fig. 2 Professional development schedule

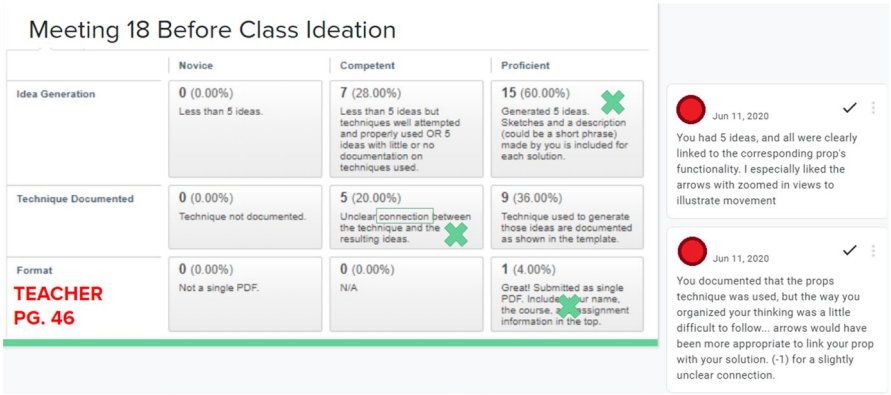

Fig. 3 Grading practice with course rubrics

Additionally, a know, want to know, Learned (KWL) chart (see Fig. 4) was used to start each day of the PD. The KWL chart provided immediate formative feedback, enabling PD leaders to quickly address misconceptions/concerns and allow for flexibility in the schedule to meet teachers at their most relevant needs.

Lastly, in conjunction with the KWL charts, an ongoing document referred to as the implementation parking lot was maintained and organized around central themes relevant to course facilitation (see Fig. 5). Items that would take too long to respond to in KWL discussions or would need further research before addressing were added to this document for later discussion. The implementation parking lot was introduced on the first day of PD, with the expectation that all questions would be addressed by the end of the week. Themes ranged from teacher supports and grading practices to transitioning to college after graduation.

Ongoing Support

Ongoing support for the teachers occurred weekly in a virtual setting for 1 h with each school and followed Tinto's (1987) recommendations for support mechanisms by encouraging teachers to provide experiences and academic preparation while

June 11 - Topic:	Dual Credit Course - Facilitator Model	
What I know	What I Want to Know	What I Learned
From [Teacher]: Much of the schedule will be dependent on our opening plan. We've got 5 scenarios in the works, everything from "business as usual" to	Aside from the Brightspace assignments, what other deliverables do students have to complete along the way? (I'm assuming it's the design journal, but not sure if there is more).	Award money from pitch contest goes towards tuition (it's scholarship money currently), but they are working to let it be used for starting a business.

Fig. 4 KWL chart

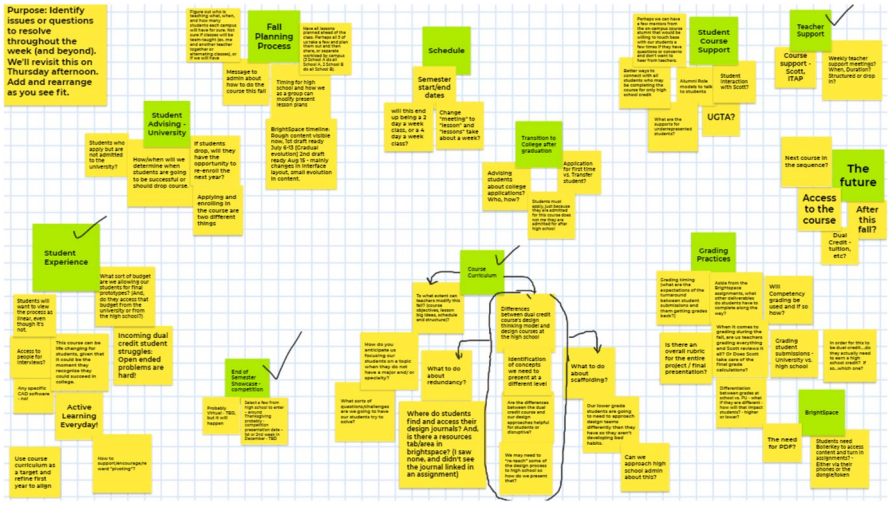

Fig. 5 Implementation parking lot

facilitating course content. The instructor of record met with all teachers from each school in a group setting where time was allocated for questions, needs from the university, generalized assignment feedback, and a preview of upcoming lessons and assignments with teaching strategies and learning goals. Agendas were shared with teachers preceding each meeting to facilitate discussion on the week's topics.

Methodology

A theory-seeking qualitative case study was chosen to assess teacher needs in preparation through PD and throughout the academic year, as conveying the resulting generalizations to a broader audience was a major goal (Bassey, 1999). Interviews, focus groups, field notes, questionnaires, surveys, and observations were conducted and analyzed alongside curricular artifacts such as PD exercises, weekly itineraries, and lesson plans to draw plausible and trustworthy conclusions and recommendations (Bassey, 1999; Merriam & Tisdell, 2015). A thematic content analysis was conducted using both axial coding and code-recode techniques, with themes and data organized using NVivo software.

Data Collection Procedure

Data were collected during the summer PD prior to fall implementation by recording and transcribing all daily sessions and teacher interactions, coded in alignment with the research questions. At the conclusion of the first day of the workshop, a semi-structured focus group interview was led between the researcher and the five teacher participants (see Appendix A for questions).

As each teacher modeled a core lesson, observations were guided by the *Reformed Teaching Observation Protocol* (RTOP) instrument (Sawada et al. 2000). On the final day of the professional development, individual semi-structured interviews were conducted with each teacher (see Appendix B for questions). Observations and artifacts were also collected during this time.

Qualitative data were collected from the teacher facilitators during the implementation of the undergraduate course by recording and transcribing weekly ongoing support, as well as individual, hour-long teacher interviews that occurred three times throughout the semester, at the beginning, mid-term, and conclusion of the course, coded in alignment with the research questions. Interview questions focused on observations from weekly meetings, a retrospective analysis of professional development preparation, and a forecasting of anticipated needs.

In an effort to triangulate data, student participants completed pre- and post-surveys to capture how the course may influence students' thoughts and feelings about college preparedness. Students were also asked to participate in a semi-structured interview at the conclusion of the course (see Appendices C and D for interview protocol and survey questions). Only four students participated in this interview. However, their insights served well to triangulate results related to research question 2.

Data Analysis

Collection procedures resulted in sufficient data to meet saturation as a means to answer the study's research questions, consisting of 93 h of interviews, observations, and weekly recorded professional development. The analysis of these data used a combination of transcription and NVivo coding (a software program capable of sorting audio and video clips, images, and other artifacts). All meetings were captured as video recordings, with the audio transcribed, pseudonyms assigned to each speaker, and proofreading/editing for accuracy. Once satisfactory, the transcription was exported as a.docx file including speaker pseudonyms and timestamps. This document was uploaded to NVivo, where the transcription was read again to identify themes. Based on a review of literature on dual credit programs (College in High School Alliance, 2019; Horn et al., 2018; Weissman, 2020), and with the aid of the research team, a flowchart of perceived teacher needs was created to establish initial nodes (see Fig. 6), while other nodes were created as themes emerged. These nodes were used as a basis for interviews throughout the research project, and later condensed into themes such as "experiencing course content through peer instruction" which includes aspects of "professional development" and "aligning with the university" or "providing guidance toward an academic safety net" that incorporates parts of "identifying barriers," "ongoing support," and "aligning with the university." For a complete codebook for the data analysis, see Appendices E and F.

After themes were identified, member checks were performed with teacher facilitators as a measure of dependability and checked with other researchers as a means of enhancing trustworthiness. Lastly, student interview and survey data were used to help triangulate the results of the analysis by each research question.

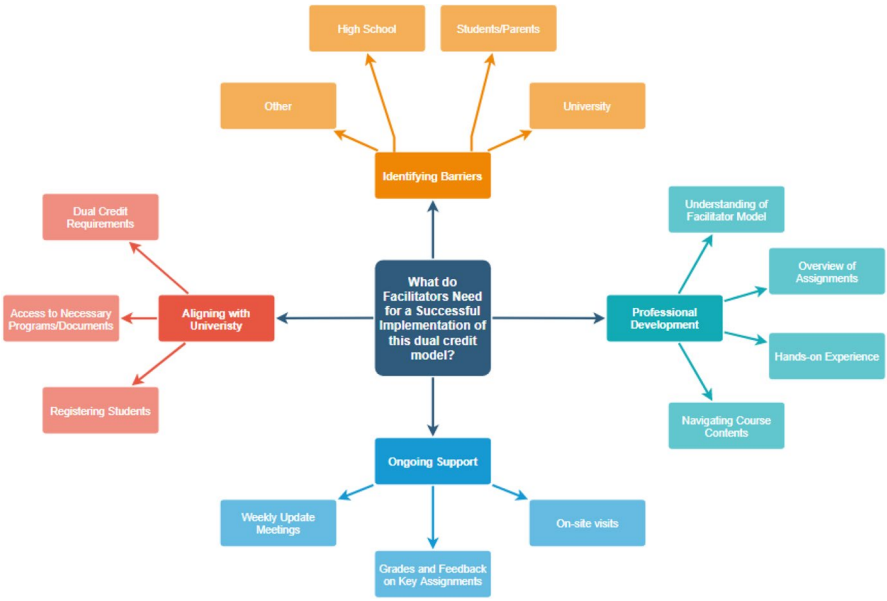

Fig. 6 Perceived need flowchart

Trustworthiness, Credibility, Confirmability, and Transferability

It is the case with qualitative studies that in addition to interpreting the data, the researchers become an instrument for collecting it as well (Poggenpoel & Myburgh, 2003). As the research team makes observations, conducts interviews, and analyzes survey responses, it is possible that the role of the researchers may affect the outcome of the study, especially as members of the research team were involved in course delivery. Therefore, measures were taken to increase trustworthiness of data analysis as part of the study through credibility, transferability, dependability, and confirmability (Creswell, 1998; Merriam & Tisdell, 2015; Poggenpoel & Myburgh, 2003).

To address the trustworthiness and credibility of findings, the sample consists of the entire population of teachers as facilitators of the curriculum, with student participant data to help triangulate results and support analysis related to the research questions. To confirm accuracy of findings, several member checks on conclusions drawn from the data were conducted with participants. Interviews were analyzed in depth, using a code-recode procedure to address dependability (Poggenpoel & Myburgh, 2003; Saldaña 2013). Observations were conducted using the RTOP instrument (Sawada et al. 2000) and transcribed using thick rich descriptions for depth of detail to enhance transferability (Poggenpoel & Myburgh, 2003). A triangulation of methods using literature, observations, and interviews was used to enhance credibility (Merriam & Tisdell, 2015). To elevate confirmability, conversations were recorded to capture audio from the video before being transcribed to create an audit trail, while using pseudonyms to preserve anonymity.

To address transferability, notes are highly detailed, including descriptions of activities, participant comments, and researcher comments (Creswell, 1998; Malu 2015; Merriam & Tisdell, 2015). These observations helped inform questions for individual interviews to ensure credibility as a means to "member check" assumptions and findings (Maxwell, 1996; Merriam & Tisdell, 2015). Having member checks as an ongoing process increases the credibility of the study as assumptions are refined and confirmed by the end of the process. Lastly, a research team approach was leveraged to ensure themes and findings emerged from data themselves rather than one's individual perspective.

Findings

Research question 1—What are teachers' needs while implementing and perceptions of a sustainable dual credit facilitator model for minoritized youth in an undergraduate design course emphasizing project-based learning?

A triangulation of methods was used to investigate teacher needs and perceptions of a facilitator model for a dual credit undergraduate design course with a diverse population, which included data collected during (a) the summer preparation for the course as well as (b) the implementation of the course in the fall semester. The following sections will present the findings in alignment with the two sub-questions for research question 1.

Research question 1a—How, and in what ways, can professional development prepare teachers to facilitate a dual credit design course that emphasizes project-based learning?

Research question 1a sought to determine how, and in what ways, PD can prepare teachers to facilitate a dual credit course that emphasizes design and project-based learning. The identification of themes regarding needs and supports in PD is the result of observations and interviews during the week-long training for facilitating the course and interviews through the lens of a retrospective analysis at three points throughout the school year. Three major themes emerged for the preparation of facilitating teachers: experiencing the course content through peer instruction, communicating context with content scaffolding, and meeting the expectations of the university faculty. These themes are in alignment with Tinto's (1987) recommended support mechanisms for scaffolding student's transition to college, as they work toward providing students with college experiences while maintaining appropriate academic preparation, academic expectations, and the adoption of the academic norms of the college.

Experiencing the Course Content Through Peer Instruction

When preparing teachers to facilitate this course, there was a consensus from every teacher at multiple times throughout the semester that experiential learning through teaching a mock lesson from the course during the PD was of immense

value. It provided the opportunity to navigate and apply course content, and teachers expressed in interviews that they were more confident delivering lessons they had either presented or participated in during PD. One teacher reflected that, while they were intimidated to present in front of their peers, it helped them navigate how they would deliver the course content to their students:

I would definitely keep giving instructors a chance to give a lesson. When I heard we'd have to do that I was like, oh man, you know? Like, I knew it'd be work, but my back of mind is like, 'Okay, good. I'm glad they're making me do this.' Because even though I'm a teacher, it's kind of putting myself in that mind-space, where I'm going to be teaching a curriculum that was designed somewhere else, and sort of forcing me to engage with it in a way that isn't just 'student' with that session.

Because teachers were presenting lessons on a variety of topics from the course curriculum, preparatory work for each lesson was also completed to facilitate participation from participants. Completing modified versions of these lessons provided analogous experiences, allowing teachers to engage in cognitive apprenticeship with students using "talk-out-loud" methods to describe how they approached and completed various assignments. One teacher described how they shared their summer experience:

It helped that as we walked through it, they would have finished step one, and I could say, 'All right, so you just finished up one, maybe you've written some things like this. When I did it this summer with another teacher, these were some of the things I noticed as I talked to my user.' And I can say 'Your user's different', but you know, we can pull out this sort of experience of being in the project. That was helpful.

Teachers pointed out the variety of software that was unique to the university curriculum, such as the LMS, student accounts, Microsoft Teams, peer evaluation software, and No More Marking comparison software. Professional development by experiential learning provided a relevant context for each of these, while also allowing a safe space to navigate and explore the programs, asking questions when needed.

Communicating Context with Content Scaffolding

Providing an adequate course overview is important in communicating the context of lessons and identifying when to provide supports or scaffold difficult material. This point was echoed by teachers throughout the semester in comments such as.

The thing that I keep going to with all of this is that it's so hard to teach a class that you've never taken before, that you didn't have any, you know, help writing the curriculum for, and, and I think you guys did a great job of everything that you did this summer. But for me, it was hard wrapping my head around what the expectations were and what's next, or what this means.

Student learning outcomes remained a central focus, and teachers were encouraged to make modifications to provide scaffolding and supports as needed, referring to the learning outcomes of the course when making their decisions. At times throughout the semester, curriculum was modified to address challenges due to COVID or to better fit a high school setting. These changes were collaborated on with the instructor of record from the university. When asked at the end of the course if teachers felt they could have made changes to the curriculum, one reflected.

> *I feel like I did get that message. I think that at the time, being sort of new, I think I erred on the side of sticking more to what I thought was being given at the university level, mostly just because of it'd be my first time through it. I was definitely given, and felt, that I could have made it my own. I'm not sure if I did as much as I would next time through.*

For this specific undergraduate design course, there were three major design projects. Two of these used Gantt charts to better visualize assignment types and when they occur throughout the semester (see Fig. 7). Sharing these charts during PD seemed to help provide teachers with the context of how long students would have to complete various assignments, and at which point they would occur in the curriculum.

Teachers indicated that they appreciated this form of communication, both from a planning standpoint and for communicating with students. One teacher noted that while it provided a good overview of projects, they would like one specific to their school's calendar:

> *One thing I would add, is I do really like the Gantt chart. It would be nice to have one that's fully for (our school) with the day's meeting, and the, you know, like one that (we used over the summer), and this might be something to put on to the (course website), our Gantt chart.*

Throughout the PD and fall semester, teachers indicated that Gantt charts, panels from the summer, and other efforts to provide a big picture of the course helped them feel prepared from week to week. This was reiterated in weekly discussions

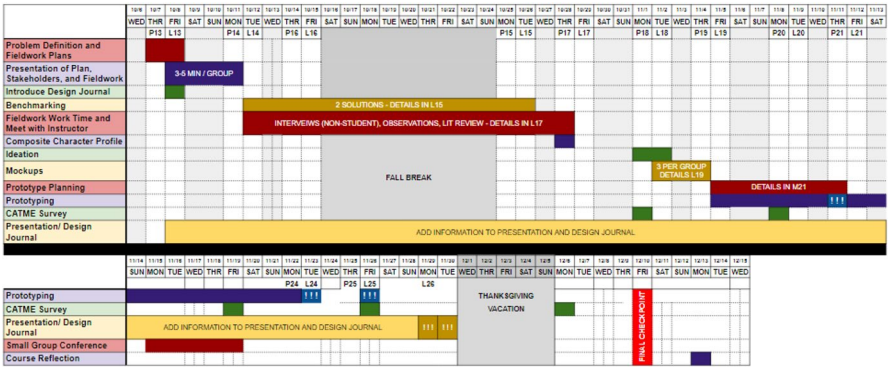

Fig. 7 Final design project Gantt chart

with the instructor of record, as they frequently referenced summer experiences or used Gantt charts when previewing lessons.

Meeting the Expectations of the University Faculty

As the facilitator model maintains a university instructor as the instructor of record to assess student performance, the teacher facilitators continued to express concerns, maybe even anxiety, about meeting university expectations. One such concern during the professional development was grading. Because students had the opportunity for the facilitating teachers to provide feedback on assignments before submitting to the university for the final assessment, teachers were anxious to know more about the grading process. This theme emerged again early into the semester where teachers voiced comments such as "*I thought they did exceptional. So, the question is, was I grading too easy, or did they really do as well as I thought they did? So, I'll be interested to see where my feedback on [the LMS] meets yours.*"

At the end of the semester, teachers made retrospective analyses of supports they found most helpful from the summer PD. One teacher indicated that having their questions addressed through the KWL charts and implementation parking lot stood out as being very beneficial, "*Just the documents that you guys had. (You would prompt with) 'Okay, so write down what you think you know. (Write) what questions you still have.' I guess it was the KWL chart and (implementation parking lot)*." The combination of the KWL chart and implementation parking lot provided a model for teacher collaborations and contributions of how best to implement the course and helped facilitate collaboration with the university throughout the school year.

In summary, teachers indicated that a hands-on experience, course overview, and understanding of expectations during PD helped meet their needs throughout the semester. The PD offered an atmosphere that welcomed questions by establishing specific times for them each day, provided experiential learning opportunities through delivering/participating in the lessons, and used multiple methods to convey learning outcomes, sequencing, and application of skills beyond the scope of the course including Gannt charts and discussions with university faculty and alumni student panels.

Research question 1b—Ongoing support to meet teacher needs throughout the academic year for facilitating an undergraduate dual credit design course with minoritized youth.

While the professional development format for the facilitator model may be like many other dual credit course models, what may differentiate the facilitator model is the ongoing support teachers receive from the university instructor of record throughout the semester. The instructor of record met weekly with teacher facilitators to provide just-in-time support and investigate what was most essential for implementation of the undergraduate course. In addition to weekly meetings, interviews at the beginning, middle, and end of the semester prompted teachers to conduct immediate and retrospective evaluations of their needs and supports. These needs were categorized into four major themes: (1) support to embolden facilitator agency in the classroom, (2) providing guidance toward an academic safety net, (3)

establishing an ongoing calibration of assessment with facilitator expectations, and (4) maintaining meaningful connections between the schools and the university.

Support to Embolden Facilitator Agency in the Classroom

Interviews and observations indicated that weekly communication emboldened teachers to create modifications and additional supports to the curriculum, while collaborating with the instructor of record. One way teachers approached this was by providing students extra time on assignments, an opportunity made possible due to the university having a later start date than the high school. Every teacher in this study extended at least one lesson to provide extra time and scaffolding for students, with most extensions occurring at the beginning of the semester. One teacher shared this decision at a weekly meeting, "*We had to stretch it into a second day because the writing the PoV [Point of View] statements as a group, just, they were really meticulous. So, we gave them some extra time the next class period to do it.*" While lessons were occasionally extended, with emphasis on getting it right the first time and an iterative curriculum, teachers did not find the need to return to concepts missed in previous lessons.

Teachers also found or created supplemental material to better serve their students. One teacher shared their supports for developing point of view (PoV) statements, necessary for defining a design problem, noting "*They [students] needed a lot more guidance on how to actually do them. I went to a lot of different websites and gave them and showed them different PoV statements from other websites.*" Another teacher reflected on how they planned to teach interviewing skills "*I might spend more time with them to explain, you know, what good interviews look like. Maybe even model that, like, bring somebody in and do an interview in front of them.*"

As the design course was implemented during the pandemic, multiple assignments that were intended to be interactive needed revisions to be practical during social distancing and remote learning. University strategies to keep students engaged were shared with teachers as they fluctuated between face to face, a mixture of face to face and remote, and all remote delivery, which seemed to benefit the facilitating teachers.

Providing Guidance Toward an Academic Safety Net

Other support for course implementation included monitoring student progress on grades and coursework. Many students may feel that a grade of a "C" in a challenging high school course is acceptable. This can be reinforced by the fact that students may have already participated in dual credit courses where credits they received were pass/fail, without any direct bearing on their grade point average. The facilitator model, however, provides a level of accountability that allows for directly transcripted grades. As this may be the only transcripted grade for students, there was

significant risk that a poor performance in this course could impact their financial aid status or outlook on admissions for post-secondary applications. For this reason, students earning a "C" or below were counseled to withdraw from the college-credit portion, completing the remainder of the course for high school credit only. The instructor of record helped to identify which students may need extra scaffolding and supports at three different checkpoints throughout the semester. Following the third checkpoint, all students met with their classroom teachers and the instructor of record where they were presented with the opportunity to continue or withdraw from the course, as after this point the university did not allow for withdraws. These actions were successful as all students completing the course for college credit earned at least a "B." Teachers indicated their appreciation for this level of support, noting "*I know where to go. I don't feel like I'm alone on my raft. I feel like I know where to send questions and emails and someone's looking out for our students.*"

Ongoing Calibration of Assessment with Facilitator Expectations

Following each of the three assessment checkpoints, the instructor of record would identify patterns of misconceptions, collaborate on learning outcome strategies, and calibrate expectations of student work. Aggregated, de-identified written feedback from the college submissions was also shared with facilitating teachers to compare alignment with rubric expectations and comments left on student assignments. Based on interviews and observations, the calibrating of assessment with facilitating teacher expectations was closely aligned with the instructor of record. While not dramatically different, gradebook scores from the instructor of record were slightly higher than those from facilitating teachers, especially toward the beginning of the semester. While this could be due to students correcting assignments based on teacher feedback, teacher motivation styles were another contributing factor. Two teachers indicated that when in doubt they would intentionally give the student the lower rubric grade to encourage students to make corrections before submitting to the instructor of record from the university, a practice discontinued later in the semester.

Maintaining Meaningful Connections Between Schools and the University

Based on the observations, one of the most valuable features of the facilitator model seemed to be the level of feedback that facilitating teachers received throughout the duration of the course. Weekly meetings with the instructor of record addressed topics such as lesson planning and pacing and helped to foster a strong connection between the teachers and the university. One teacher reflected on how these meetings helped maintain a fidelity of implementation:

> *One thing that's been super helpful for getting prepared for each class, our Wednesday meetings. Since I teach lessons on Thursday, and Friday, and we meet with you the day before, I might have started a lesson already, and then*

we meet with you, and what you share with us can either confirm or deny what I was already thinking. So, it helps me to see if I'm on the right page, or if there's something I didn't think was important. And I'm realizing, 'Oh, that is important!', or 'Oh, I accidentally skipped over that.' Or if there's something I was confused on how to explain or lead, you usually end up explain, like walking us through it, and so then I end up not having any questions about it. So that's been like one tremendously helpful piece for planning lessons.

Students also received communication on a variety of levels. Teachers would invite the instructor of record to speak with the whole class to introduce projects and answer student questions, and meet with student teams as they worked on their final project. Additionally, students received several emails throughout the semester, prompting them to check their gradebook and assignment feedback. Students choosing to withdraw from the college credit portion of the course met with the instructor of record to discuss their experience, withdraw procedure, and other options. Many of these students, still wanting to apply to the university after high school graduation, realized through conversation that this was a required course for many majors on campus, and decided to only withdraw from the college credit portion to be more prepared for taking it again on campus.

In summary, when reflecting on on-going support throughout the semester, teachers indicated their needs were met through weekly just-in-time support, feedback on grading and expectations, and the connection to, and communication with, the partnering university. This further supports Tinto's (1987) recommendations for academic integration to help scaffold students into a post-secondary environment. The facilitator model seemed to provide situational, flexible, and multifaceted support throughout the semester to support both the needs of teachers and participating students.

Research question 2—What are the teachers' and students' perceptions of how the dual credit model influenced student learning in an undergraduate design course in an urban public charter school?

It was made clear to students by facilitating teachers, administrators from the high school, and the instructor of record from the university that the coursework and expectations were no different from those on campus, and that grades were indifferent to the student's academic level or location. Teachers commented on how this increased student confidence for future success in college:

I think that there probably was a feeling of belonging of, 'hey, we're doing this dual credit course, isn't that kind of cool?' Like we're seeing they feel like, upperclassmen may kind of picture their foot going out the door and into the next space.

This was also reflected in end-of-semester student surveys, indicating how their performance and success in the course helped increase their confidence on performance with college-level work at the partnering university. One student remarked "*It has helped me understand what type of work will be expected at (the university) which made me more confident*."

One theme shared by student participants through the interviews and survey responses was how much they enjoyed the course, especially hands-on portions

such as prototyping, which may be different from more traditional dual credit offerings. As this took place during the COVID-19 pandemic, strategies and modifications made to the on-campus version of the course to maintain hands-on and interactive portions of the curriculum were shared with facilitating teachers, another observed benefit of the facilitator model.

Students who participated in surveys and interviews shared many rich details about their experience including what they found most enjoyable, beneficial, and motivational, with results indicating an overall positive course experience. While only seven participants completed the survey, it served to triangulate comments made throughout the semester by teachers on student engagement. At the final interview, teachers were asked to share their viewpoint of student perceptions of the course. One teacher shared, "*I think a lot of them, after they kind of had that initial sort of feel (for the course), they were sort of proud of what they were doing. And they seemed to really, you know, realize their capability*." Similarly, when asked if the course impacted their confidence toward college coursework, one student responded "*YES!* (This) *experience has given me lots of confidence.*"

Though the survey and interview data indicated that the students enjoyed the course experience, they also expressed that increased homework and deadline expectations posed a real challenge. Teachers shared, "*I think sometimes the amount of homework maybe felt like too much of a challenge for some of them just with the time and how much of it there was at times."* Teachers also indicated that may have been outside the expected course load for students:

> *I do have a couple students that are panicking just a little bit because they're not used to the pace and it's something that we've never required, like due dates, which I can see how it's kind of hurt them. And so they're just, and they're good students, just panicking a bit.*

Students confirmed that while other high school courses have deadlines, they are flexible due dates with minimal penalties. Additionally, while students had the opportunity to submit papers first to their teachers to strengthen submissions before submitting to the university, the finality of submitting work for assessment through the LMS continued to be a source of both stress and motivation throughout the semester. In interviews, student participants indicated that these checkpoints required greater time management and were a source of learning and increased confidence.

One curricular challenge for students was conducting research. For many students, this was their first experience locating and reviewing scholarly articles or evaluating source quality when justifying potential solutions to open-ended design problems. This experience was indicated as a key influence and source of learning and confidence for college. One teacher summarized.

> *That real level of research and the triangulating from the different points of view, sort of getting them on board with APA citations, and the rigor of documentation of your interview. And all of that, I think that is the hardest thing to translate for them.*

The undergraduate design course in this study features student choice, accountability for teamwork, project-based learning, and an industry sponsored competition

for the final project to aid motivation. Teachers, however, indicated that as a dual credit course, the college credit was the most influential factor on academic performance, stating "*I think it is definitely more of just excitement that they even have the opportunity to take a dual credit course.*" This sentiment was echoed by students.

A challenge discussed by teachers on adapting college content is that students are operating outside the college environment. Unlike on-campus students who can plan to meet at a common study area, high school students have limited time to work together outside of class. This is further complicated by the fact that many are involved in after-school programs, clubs, or sports that provided obstacles for working on various assignments. This could bring about concerns of equity when working across demographic groups as out-of-class requirements can disadvantage some students without resources necessary to engage in such experiences.

In summary, teacher data triangulated through student surveys, observations, and interviews seemed to indicate that the facilitator model had an influence on student confidence toward completing college-level work and may have increased their intent to enroll at the partnering university. While the students seemed challenged by college deadlines and expectations, these same constructs also seemed to be contributing factors to their learning and confidence in performance transferability to other college courses.

Discussions

In reviewing the findings of this study, it is important to keep outside influences in perspective. The entirety of this study, from PD to the end-of-course evaluations, took place during a global pandemic where teachers were asked to fluctuate between teaching face to face, partially remote, and all remote facilitation. Additionally, this dual-credit coursework is hands-on, interactive, and project based. This does not make for an ideal implementation, and yet there were several successes throughout the process that may speak to the strength of this model.

First, teachers successfully facilitated a new curriculum. With only 4 days of professional development, teachers formed a big picture idea of learning outcomes, and ongoing support throughout the semester provided what teachers needed when they needed it, including modifications and teaching strategies to compensate for social distancing. There was a constant line of communication with the university, and because open dialogue was maintained throughout the semester, teachers continued to gain confidence in grading and delivering university course materials, with all teachers indicating excited anticipation to teach it again to a new group of students.

Teachers indicated that student confidence levels increased throughout the school year as students dispelled misconceptions of college level work. Even students withdrawn from the course at the final checkpoint indicated that they were not deterred and continued to ask for feedback to be better prepared to take the course on-campus, as one teacher shared.

> *The students that are taking the course without credit, they wanted to take it for credit. And it was either [the university] didn't approve their application or*

something didn't get submitted on time, and so they were disappointed about that. But rather than just not taking the class, they like they were so interested in the class anyway, that they're like, I'm still going to take it. And so, it's not changed the dynamic of our class at all. They are equally passionate, equally engaged, and they, they treat it just as serious as our for-credit students.

Students received directly transcripted college credit for a core course, potentially reducing their workload and plan of study at a major university. While initial feedback was provided by the facilitating teachers, all coursework was assessed and validated by university instructors. All students in danger of finishing with a "C" or below were identified and counseled out of the course by late October, such that all completers earned at least a "B," with most earning an "A." Coupled with COVID complications, this resulted in just over 60% of the students completing the course with an "A" or a "B" compared to 88% for their on-campus counterparts. While this may seem low, it was not unexpected as the message to students enrolling was "*If you are not sure you are ready, go ahead and give it a try! We will support you. If you discover the course is not a good fit, that is OK, you can withdraw from the college course without withdrawing from the high school course. Our goal is for you to get to [the university] with a strong college GPA*." This helped navigate issues related to a student's GPA that could impact future college enrollment if they did not perform as expected due to a wide range of factors that a high school student may be dealing with. This is important as a dual credit program should not create any additional barriers to college.

Along with successes, there also came challenges such as course content and deadlines. For high school students that are familiar with relaxed deadlines, this course was outside of their zone of comfort, but not unmanageable. Many students seemed to find the course as a safe space to develop more efficient time management skills, leading to increased confidence in completing college-level work.

Both teachers and students required continuous support, which was made more apparent by the chaos caused by COVID-19. Lessons were modified, deadlines extended, and calendars updated to better accommodate all participating individuals while still aligning with learning outcomes. While this was challenging and required more resources from the university, weekly meetings provided the scaffolding and supports to equip teachers with the resources they needed to stay on track and finish the semester without compromising on the integrity of the program. This is not unlike the normal administration of an undergraduate course where graduate students facilitate a course on-campus, meeting weekly with a course coordinator, typically a university faculty member.

Class sizes should be a consideration for course dynamics when implementing a facilitator model dual credit course. For this course, it is common to see on-campus class sizes of 40 students or more, typically with undergraduates who have never met one another. This provides some complications when transitioning to a high school class of 8–12 students. Discussion board posts and "getting to know you" assignments become unnecessary, and while on-campus students in teams of 3–5 can have the opportunity to choose a topic of interest with like-minded peers, a smaller high school class group is forced to make more compromises when selecting project topics.

Other challenges seemed to be attributed to the academic traditions related to offering dual credit coursework from a 4-year research intensive university. Typically, these universities do not engage in dual credit coursework and, as such, innovative programs challenge the traditional systems in place. However, the facilitator model may provide a novel pathway to college learning experiences for more students and challenge the educational status quo to broaden access to dual credit. For example, the model can help navigate institutional and bureaucratic barriers to dual-credit implementation, such as limited teacher capacity due to high qualifications to become an instructor of record, that can limit participation especially from low-income and minoritized students. According to Tinto (1987), by integrating students into the college culture, they are more likely to persist and succeed. This facilitator model integrates the college culture into the dual credit process by providing teacher and student experiences navigating LMS software, repeated use of university rubrics, and emphasizing connections to the college environment throughout summer professional development and weekly meetings. Therefore teachers, through daily interactions with students, are better able to explain college and help students step between the high school and university environment fluently by providing support mechanisms beyond content scaffolding. The facilitator model then seems to be an approach that can institute change at the university level and help more students successfully transition through participation in dual credit courses. While other models may transition students into the college environment, the uniqueness of this approach is the support provided to teachers to meet the needs of students to matriculate and persist.

Recommendations for Practice

Based on the results of this study, the researchers have several recommendations for implementing the facilitator model with undergraduate design courses or other project-based STEM courses. We argue that the supports and academic preparation of the facilitator model align with theory of departure recommendations (Tinto, 1987), while offering three key advantages over other dual-credit models.

First, we found that getting directly transcripted credit requires navigating and negotiating academic policies from two institutions that were not designed around teaching collaborations outside of campus, as 4-year research intensive universities do not typically offer dual credit coursework from their main campuses. This could be attributed to policies related to offering dual credit such as teacher qualifications that could impact an institution's accreditation, a lack of interest in offering such experiences due to the minimal financial incentives with the reduced tuition, the belief that high schools cannot deliver the quality or rigor of instruction that the university can offer, and/or minimal interest in university faculty participation as the institution may not readily count the offering of the course within their normal course load (meaning offering the dual credit course would not be credited toward their workload). These factors are critical to understand when navigating the university structures to offer such programs. However, as seen within this study, the facilitator model can be beneficial to student learning, enhance confidence for

college, increase intent to apply to the partnering institution, and help build pathways between participating schools and the university. As these benefits can align with a university's goals, it may be best to position such programs as a means to engage with the university's state/community, increase access to higher education, and recruit students to the university.

Second, high quality and rigorous implementation mean teachers invest significant additional effort. The teachers in this study were flexible, motivated, and highly involved with the implementation of the facilitator model for an undergraduate design course. For teachers to effectively scaffold students and meet learning targets, teachers need detailed rubrics on all assignments. This provides the necessary transparency and clarity to meet expectations. One of the key pieces of this model, and arguably why it may have worked well during a global pandemic, was scheduling time each week for the high school teachers to meet with the university instructor of record. Expectations of open communication and collaboration with the university, established in the summer, allowed the opportunity for teachers throughout the school year to ask questions or gain clarifications. In addition, they were provided with strategies for teaching the course, previews of upcoming lessons and assignments, and administrative needs and updates such as checkpoint due dates or withdrawing students to protect their GPA. The school administrators were also supportive by providing all participating teachers a prep period 1 day a week during the school day to meet with the university instructor.

Lastly, high-quality implementation with student and teacher satisfaction in focus means that the university instructor of record initially does a lot of work. To start, the instructor of record communicated weekly with facilitating teachers and routinely with participating students while also assessing and providing feedback on course submissions. In addition, once the groundwork for the program was finalized, the university representatives had to work closely with the offices of admissions, the registrar, and the bursar throughout the school year as students were enrolled or withdrawn from the dual credit section. This level of work is likely to scale back as routines and procedures are established.

The experiences of piloting this facilitator model have helped to refine future iterations of the dual credit course offering, resulting in the following suggestions. Communications should be made with parents and perspective students for fall as early as February to address questions about the course and build rapport before counselors schedule courses. Students completing the course for dual credit should continue to use the university LMS to submit assignments with migration of course content to a password protected website. This prevents registration issues from interfering with student participation. Lastly, teachers should be provided with exemplars for every assignment to further align expectations and share at their discretion with students.

Recommendations for Future Research

This study focused on identifying strategies and supports to meet the needs of teachers facilitating a dual credit undergraduate design course and the perceived influence of the facilitator model on student learning. Whether it be access to course content,

challenges with the curriculum, or quality of assignments, throughout the study the student performance acted as an indicator of teacher needs. Therefore, the following are recommendations for future research:

1. While students succeeded in all five teachers' classes, each teacher provided a different level of support. Some teachers graded students more rigorously and provided little in terms of reminders, pushing students toward independence, while other teachers provided schedules and emails of deadlines and one-on-one scaffolding. A longitudinal investigation into the successes and struggles in the first 2 years of students who matriculate to a major university from a facilitator model program is recommended to further refine support for teacher facilitators.
2. Teachers in this study indicated the support from the university instructor of record was a major factor to their confidence and student success rate, but if they were to teach the course again, they would not need the same level of support. A follow-up study of the needs of the same teachers after completing multiple iterations of the course would provide a more accurate indication of the number of resources required to scale up such a program.
3. While ongoing support provided by the university instructor was found to be advantageous, this level of support is likely not scalable or sustainable. Future studies may investigate the effectiveness of a facilitator model with the necessary roles of the instructor and university student success staff to meet the need of the schools, teachers, and students in a manner that can be sustained and scaled to more schools under the same instructor of record.

Conclusion

This case study used a qualitative descriptive approach with the researchers in the role of participant observers to explore teacher needs and perceptions of a dual credit facilitator model and the perceived influence on the learning experience of high school students. Data collection techniques included teacher and student interviews, observations, and documentation of artifacts such as emails and teacher-generated work to develop rich, thick descriptions of the facilitator model for an undergraduate design course for dual credit. Data were analyzed using axial coding and code-recode techniques to ascertain emerging themes related to the support needs of teachers when using a facilitator model to implement a dual-credit course as well as the perceived influence of this model on student learning.

As evidenced in interviews and observations, the week-long professional development prepared teachers to facilitate an undergraduate design course for dual credit. This preparation involved providing a hands-on experience, a guided course overview, and detailed expectations for the school year. Hands-on experiences included facilitating lessons, navigating the LMS, and completing assignments from the curriculum. The guided course overview provided teachers with exemplars, end goals, student learning outcomes, and the sequence of lessons for facilitating the course. Expectations were shared with teachers regarding ongoing

support throughout the semester, and roles and responsibilities for teachers and the university instructor of record when facilitating the course.

Teacher interviews and observations revealed how ongoing supports throughout the academic year met their needs when facilitating an undergraduate design course for dual credit. These supports included just-in-time meetings, transparency in grading, and communication with the university systems. This also included navigation of software programs and the LMS, lesson modifications, and identifying students needing extra supports to meet learning outcomes.

Results indicated that the university instructor of record was an invaluable component of the facilitator model, as they fostered a strong partnership with the university and provided individualized support for teachers navigating a new curriculum. It is critical that the person serving in the role of the instructor of record is actively involved in professional development to provide assignment context when meeting with teachers throughout the semester and build relationships/rapport with facilitating teachers. The instructor of record seemed to serve an integral role in ongoing supports throughout the school year as well, as they met with teachers weekly to provide focus on central themes to upcoming lessons, as well as feedback, supports, and lesson modifications as needed, aligning with the recommendations of College in High School Alliance (2019) to strengthen university-high school collaborations and support mechanisms recommended by Tinto's theory of departure (Tinto, 1987).

While overall a positive experience, the amount of involvement and communication with the instructor of record from the partnering university may have contributed to anxiety and stress of participating teachers. Knowing that their students' work was to be graded by someone from the university introduced a level of doubt throughout the semester that they were providing the level of feedback and scaffolding needed for students to be successful. Ultimately students were successful, all earned at least a "B," and comments from teachers indicated increases in self-efficacy especially in the final weeks of the semester. It is worth considering, however, if a teacher's philosophy toward teaching aligns with this level of partnership and shared responsibility with the university.

By providing ongoing supports and professional development to facilitating teachers, and ensuring earning direct, and meaningful college credit, the facilitator model has potential to change the way that students earn dual credit. Communications are strengthened between the participating teachers and students and the partnering university. Survey and interview data indicate that not only may this have a positive influence on student confidence on college-level coursework, but that students transfer that confidence to their ability to succeed at the partnering university. Survey data from this study, and support by other studies on the facilitator model (Pyzdrowski et al., 2011, 2016), indicate that students are more likely to apply to the universities who are willing to offer meaningful dual credit opportunities. Providing students with extra scaffolding and supports and an instructor of record from the university helps alleviate bureaucratic barriers to offering dual credit courses, allowing for schools to transition teachers more easily to facilitator roles, providing college credit opportunities and participation to more students.

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