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The Impacts of an Entrepreneurial Course on Secondary Students' Entrepreneurial Self-Efficacy and Entrepreneurial Intentions

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The Impacts of an Entrepreneurial Course on Secondary Students' Entrepreneurial Self-Efficacy
and Entrepreneurial Intentions

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Dissertation Submitted to the College of Education and Human Services

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Abstract

The Impacts of an Entrepreneurial Course on Secondary Students' Entrepreneurial Self-Efficacy and Entrepreneurial Intentions

Toi Hershman

There is considerable agreement that promoting entrepreneurship stimulates economic development and job creation, which helps maintain a country's economic competitiveness. Entrepreneurship education is a key to increasing the likelihood of potential entrepreneurs. While substantial research has documented strategies for enhancing students' entrepreneurial mindset and building entrepreneurial skills in higher education, entrepreneurship is rarely incorporated into or studied in secondary education. This mixed-method study examined the impact of an online ten-lesson entrepreneurship course on secondary students' entrepreneurial self-efficacy and entrepreneurial intentions. Students took a pre-survey that measured their entrepreneurial self-efficacy and intentions before the course and a post-survey upon completing the course. Students' artifacts (elevator pitch frameworks and business canvas models) from the capstone lesson were collected. A paired-sample *t*-test compared students' entrepreneurial self-efficacy and intentions before and after the course, and artifacts were analyzed using a rubric. Survey results showed significant improvements in two dimensions of entrepreneurial intentions: Professional Attraction and Entrepreneurial Capacity. Students' entrepreneurial self-efficacy subscales (Searching, Planning, Marshaling) did not yield a significant improvement. The analysis of students' artifacts showed that students could identify problems and generate solutions to their problems. However, students did not clearly understand how to project revenue based on a target market.

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INTRODUCTION

Entrepreneurship is the driving force of our economy. Arming young people with an entrepreneurial mindset will promote future business creation and build a pipeline of entrepreneurial thinkers. Entrepreneurship education is essential for a nation's future because it encourages students' critical thinking, innovation, and creativity skills, preparing them for an uncertain future world of work (Y. Zhao, 2012b). While substantial research has documented strategies for enhancing students' entrepreneurial mindset and building entrepreneurial skills in higher education (e.g., Gargouri & Naatus, 2019; Neck & Corbett, 2018; Piperopoulos & Dimov, 2015; Zhao, 2012b), entrepreneurship is rarely incorporated in secondary (middle and high school) education (Schimmel, 2016). Entrepreneurship in secondary education is essential because it promotes entrepreneurial mindsets before students choose a college or career pathway, making them more likely to become entrepreneurs or select entrepreneurship coursework in higher education (Y. Zhao, 2012a). Entrepreneurship education develops students' self-confidence and their ability to think in creative ways. It helps students from all socioeconomic backgrounds and nurtures students' talents and skills (Neck & Greene, 2011; Sarasvathy et al., 2014; Zupan et al., 2018).

An entrepreneurial mindset paves the path to entrepreneurial intentions and success. Building entrepreneurial mindsets is key to influencing students' entrepreneurial intentions (Gargouri & Naatus, 2019; Gerhart & Melton, 2016; Y. Zhao, 2012b). An individual with an entrepreneurial mindset exhibits entrepreneurial characteristics, including entrepreneurial self-efficacy, entrepreneurial empathy, opportunity recognition, perseverance, risk-taking, value creation, leadership, and teamwork (Fayolle & Gailly, 2015). Entrepreneurial self-efficacy has been identified as a strong predictor of entrepreneurial intentions because it indicates an

individual's confidence in their ability to succeed in entrepreneurial work (Jung et al., 2001; Neck & Greene, 2011; Rae & Melton, 2016; Zhang et al., 2014). Entrepreneurial intentions are the best means of predicting entrepreneurial behaviors because they demonstrate one's willingness and preference to behave in a particular manner (Krueger, 1993). Therefore, entrepreneurial intention is a determining factor for entrepreneurial behavior (Kolvereid & Isaksen, 2006).

This study examined the impacts of an online entrepreneurship course on students' entrepreneurial self-efficacy and entrepreneurial intentions, which will provide implications for incorporating entrepreneurial education in secondary classrooms, critical for preparing future entrepreneurs. The study also offers one model as an example for teaching entrepreneurship.

RELEVANT LITERATURE

Importance of Entrepreneurship

Entrepreneurship can turn an idea into action and requires an innovative mindset to discover opportunities and create value for others (G. Chen et al., 2001; McGee et al., 2009; Tsai et al., 2016). Stevenson (1993) offers a more succinct definition "Entrepreneurship is the pursuit of opportunity beyond the resources you currently control" (p. 3).

Entrepreneurship is a crucial competency for all, helping to increase creativity and self-confidence in every aspect of people's lives, and is an essential driver of growth and sustainability (Neck & Corbett, 2018). Without the innovation and risk-taking of entrepreneurially minded individuals, we would not invent, empower, or thrive as a nation. Entrepreneurship can improve standards of living and create wealth not only for entrepreneurs but also for their employees, the community, and related businesses. Entrepreneurs drive change through innovation where new products and ideas are developed and new markets emerge.

Entrepreneurial individuals play a crucial role in economic growth and job creation (Kouakou et al., 2019).

Entrepreneurial Mindset

An entrepreneurial mindset is the state of mind that changes an individual's status to an entrepreneur. An entrepreneurial mindset concerns the analysis of the world, its opportunities and possibilities, and the understanding of how an individual can contribute to the progress of economic and social systems (Kouakou et al., 2019). An entrepreneurial mindset is simply how an entrepreneur thinks and acts (Fayolle & Gailly, 2015). At its core, it is a set of characteristics, behaviors, and skills that drive action. A person with an entrepreneurial mindset recognizes an otherwise overlooked opportunity, develops the confidence to take a risk, communicates ideas clearly, and adjusts to learn from setbacks. Having an entrepreneurial mindset, then, refers to someone who possesses a collection of valuable behaviors to increase the likelihood of becoming an entrepreneur. These are behaviors such as self-efficacy, empathy, creativity, opportunism, risk-taking, determination, and leadership, to name a few (Fayolle & Gailly, 2015). This state of mind allows individuals to think like and become entrepreneurs (Kouakou et al., 2019).

Moreover, the entrepreneurial mindset is necessary for achievement in existing businesses and organizations. It is beneficial for anyone because it is a mix of essential success-focused skills and behaviors (Y. Zhao, 2012b). Exposing students to entrepreneurship helps build an entrepreneurial mindset. In particular, exposure to entrepreneurship increases an individual's entrepreneurial self-efficacy. Entrepreneurial self-efficacy is a significant contributor to building entrepreneurial intention, which is the best predictor of future entrepreneurial behavior (C. C. Chen et al., 1998; Liñán et al., 2011; McGee et al., 2009; Tsai et

al., 2016). This study explores how entrepreneurial intention and self-efficacy are affected by an entrepreneurial intervention.

Entrepreneurial Self-Efficacy

Self-efficacy is an individual's perception of their ability to execute a specific behavior (Bandura, 1986). It is a motivational construct that influences an individual's choice of activities, goals, persistence, and performance (H. B. Zhao et al., 2005). Entrepreneurial self-efficacy refers to an individual's belief that they can become an entrepreneur. It is positively correlated with entrepreneurial intention (Naktiyok et al., 2010) and is considered a fundamental mindset to strengthen entrepreneurial intention (Kouakou et al., 2019). Individuals who perceive they can succeed in entrepreneurial endeavors are more likely to pursue them (Tsai et al., 2016). In entrepreneurship, students' low self-efficacy may relate to their lack of experience (Zhao, 2012b). Therefore, best practice entrepreneurship programs increase entrepreneurial self-efficacy by providing participants with opportunities to innovate and solve others' problems. In such experiences, students progress through real-world challenges improving their ability to perform tasks such as starting a business and pivoting in the face of adversity (Peterman & Kennedy, 2003). Providing opportunities for students to develop relevant skills such as solving real-world problems, creating a product or service, taking risks, and persevering through challenges increases their entrepreneurial self-efficacy.

Research shows that there is a positive connection between self-efficacy and entrepreneurial intentions. For example, Zhao et al. (2005) found that students with higher entrepreneurial self-efficacy are more likely to have less fear about an entrepreneurial career, perceive a greater sense of control over outcomes, and judge the likelihood of success higher than those with low self-efficacy. They found evidence that individuals formed entrepreneurial

intentions most directly because of their high entrepreneurial self-efficacy. Bacq and Alt (2018) found that an individual's self-views are essential in explaining entrepreneurial intent.

Specifically, when students feel confident in creating a product or service, they are more likely to act entrepreneurially. The theory of an entrepreneurial event stresses the importance of perceived feasibility which is related to self-efficacy. Perceived feasibility refers to what degree people consider something achievable similar to self-efficacy (Shapero & Sokol, 1982). Perceived feasibility is affected by an individual's perception they are able to perform a specific behavior (Krueger et al., 2000). In terms of entrepreneurship, this is an individual's perception that they possess the abilities to become an entrepreneur.

Entrepreneurial Intention

Entrepreneurial intention is a self-acknowledged conviction that an individual intends to act entrepreneurially and start a business sometime in the future (Liñán et al., 2011). According to the Theory of Planned Behavior, intentions capture motivational factors that influence a behavior and indicate how likely an individual is to perform the behavior. The more favorable one's belief, the more likely one will act (Ajzen, 1991). Shapero and Sokol's (1982) theory of an entrepreneurial event stresses the importance of perceived desirability which is related to intention. The level of perceived desirability varies based on individual characteristics and is affected by a person's values, needs, skills, and abilities. Without a desire or intention to begin with, individuals will avoid moving forward in creating a new business (Ding & Choi, 2011). Based on the premise that intention is the an effective predictor of behavior, there has been considerable interest in entrepreneurial intention research (Borchers & Park, 2010; Byabashaija & Katono, 2011; Farrukh et al., 2018; Hockerts, 2017; Hou et al., 2019; Lavelle, 2019; Liñán et al., 2011; Pruett et al., 2009; Wilson et al., 2007; Zhang et al., 2014; Y. Zhao, 2012b). These

studies show that entrepreneurial educational support can enhance students' entrepreneurial intentions (Stamboulis and Barlas (2014), Turker et al., 2008).

Study Purpose and Research Questions

While substantial research has documented strategies for enhancing students' entrepreneurial mindset and building entrepreneurial skills in higher education (e.g., Gargouri & Naatus, 2019; Neck & Corbett, 2018; Piperopoulos & Dimov, 2015; Zhao, 2012b), entrepreneurship is rarely incorporated or studied in secondary education (Schimmel, 2016). However, entrepreneurship in secondary education is critical because it promotes the entrepreneurial mindset before students choose a college or career pathway, making them more likely to become entrepreneurs or select entrepreneurship coursework (Y. Zhao, 2012a). It also nurtures students' talents and skills (Neck & Greene, 2011; Sarasvathy et al., 2014; Zupan et al., 2018). This study examined the impact of an online entrepreneurship course on secondary students' entrepreneurial self-efficacy and entrepreneurial intentions. The study addressed the following research questions (see Table 1):

1. How did an online entrepreneurial course affect students' entrepreneurial self-efficacy?
2. Did an online entrepreneurial course affect students' entrepreneurial intentions?

Table 1

Research Questions and Analysis Strategy

Research question	Data collection method	Data analysis strategy
RQ1: How did an online entrepreneurial course affect students' entrepreneurial self-efficacy?	<ul style="list-style-type: none"> • The Entrepreneurial Self-Efficacy Scale (ESE) • Artifact from Lesson 10: Pitch Perfect 	<ul style="list-style-type: none"> • Paired sample <i>t</i>-test • Scored artifacts using a rubric • Quantitative analysis of qualitative data.
RQ2: Did an online entrepreneurial course affect students' entrepreneurial intentions?	<ul style="list-style-type: none"> • The Entrepreneurial Intentions Questionnaire (EIQ) 	<ul style="list-style-type: none"> • Paired sample <i>t</i>-test • Scored artifacts using a rubric

METHODS**Research Design**

This study employed a concurrent triangulation mixed-methods design. Quantitative data included a pre-and post-survey. Qualitative data (the artifacts students created) were collected from the capstone lesson, Lesson 10 (See the section "The Online Entrepreneurial Course for High School Students" for a description of the ten lessons) in the course. Quantitative and qualitative data were collected at the same time. Mixing occurred during the interpretation phase.

Participants and Context

Participants were 76 secondary students in the northeastern region of the United States. Recruited from three schools, these participants were enrolled in an introductory entrepreneurship course. Most students were in the 11th grade at the time of the study. The course was not an elective but a required part of a business career track. Students who elected to participate in business courses were enrolled in the introductory course. Students were primarily

white (59%) and Latino (18%). There were a few Asian students (7%) and African American students (4%). The remaining students selected “choose not to answer.”

Students completed the lessons in about two weeks or one lesson per day. Due to school schedules, some of the schools used an additional day or two to complete the course. When available, teachers had students complete one lesson per day.

The Online Entrepreneurial Course for High School Students

The entrepreneurial course, conducted online over several weeks, included ten lessons. It took students from framing a business idea to creating a business model and pitch framework. Each lesson consisted of (a) an introductory video, (b) a learning activity, and (c) supplementary resources. The introductory videos provided students with background information, a description of the learning activity students completed for each lesson, and conceptual scaffolding support through the instruction on key concepts and ideas. The learning activities were designed for students to apply the knowledge and skills they acquired in the lessons. Supplementary resources provided additional insight for each lesson and included videos and readings. This section presents the summary of each lesson. See Table 2 for a tabular summary.

Table 2

Summary of Individual Lessons

Lesson	Description	Outcomes
Lesson1: Defining Entrepreneurship	Students defined entrepreneurship and researched an entrepreneur.	Developed an understanding of entrepreneurship.
Lesson 2: Engaging the Entrepreneurial Mindset	Students explored entrepreneurial mindsets and how they could develop the mindsets.	Gained insight into entrepreneurial mindsets and how to develop them.
Lesson 3: Insight into Action	Students used the 5 WHY method to uncover the root causes of problems.	Brainstormed ideas to uncover the root cause building self-efficacy.
Lesson 4: Human-Centered Design	Students interviewed potential customers to build empathy.	Built empathy and greater understanding of target audience.
Lesson 5: Innovation Ideation	Students ideated to discover innovative ideas to solve complex problems.	Expanded on business idea using new information to refine ideas.
Lesson 6: Minimum Viable Product	Students tested ideas and received feedback from classmates and community members to gain proof (maybe feasibility sounds better?) of a concept.	Gained authentic feedback from those in their customer demographic, friends, and family to understand the value of constructive feedback.
Lesson 7: Money Matters	Students explored entrepreneurial finance and build financial models.	Grew knowledge of financial literacy.
Lesson 8: Selling Proposition	Students completed a competition analysis.	Learned how markets and competition impact a business.
Lesson 9: Can't Sell to Everyone	Students explored TAM-SAM-SOM and sales funnels.	Explored and defined how market share and sales funnels impact business.
Lesson 10: Pitch Perfect	Students completed a business model canvas, developed an elevator pitch, and crafted a pitch framework.	Presented business ideas and used facts and data to support their ideas.

The course was designed to be an online course. However, at the time of the study, students were allowed to be in class in person but in a limited capacity. The teachers had the classes view the learning videos using either a projector, smartboard, or large television. Students

worked on the learning activities individually to maintain school social distancing protocols. Supplementary videos were viewed as a whole class, and supplemental readings were read by the students individually. After completing the lessons and related activities, students submitted artifacts (e.g., a description of the problem they wanted to solve, an empathy map showing the needs of potential customers) to Google Classroom.

Lesson 1: What is an Entrepreneur? Lesson one provided students with a definition of entrepreneurship and introduced three types of entrepreneurs (traditional entrepreneurs, social entrepreneurs, and intrapreneurs). After watching the video, students completed the activity called "An Entrepreneur Like Me." Students chose an entrepreneur to research and created an infographic answering questions about the entrepreneur.

Lesson 2: Engaging Your Entrepreneurial Mindset. Lesson two defined the entrepreneurial mindset and explored its characteristics. This section's activity, "Managerial v. Entrepreneurial Thinker," included a skit that students read and discussed during class. Students discussed who in the skit had an entrepreneurial mindset and what qualities of an entrepreneurial mindset were included.

Lesson 3: Insight into Action. The video described the 5WHY method used to identify a problem and uncover its root causes. The 5WHY approach challenged students to make their problem statement (e.g., Why isn't there a reliable dog sitting service?). After making the first statement, they ask why (e.g., Why does there need to be a reliable dog sitting service?) four more times to find the root cause of the problem. After watching the video, students identified a problem they would like to solve and its root causes. An example problem students identified was that traditional gyms do not accommodate those with mental health issues.

Lesson 4: Human-Centered Design. The lesson video explained empathy, why it is essential, and possible ways to develop empathy for customers. After watching the video, students identified potential customers who shared their problems, researched target customer segments, and created an empathy map showing the needs of potential customers.

Lesson 5: Innovation Ideation. Students explored ideation, its importance in entrepreneurship, and tangible methods to brainstorm innovative ideas to solve their problems.

Lesson 6: Who's the Real MVP? The lesson video demonstrated how to create a Minimum Viable Product (MVP). After watching the video, students identified their product's core features and built an MVP to test their solutions.

Lesson 7: Money Matters. The lesson video elaborated on the cost of goods sold, revenue, profit, personal expenses, business costs, and cost calculations. Students built their financial models upon watching the video that included startup costs, operating costs, and break-even analysis.

Lesson 8: Digging Your Moat. The lesson video explained why it is important to distinguish oneself in the market, identify other companies that compete for the same market share, and conduct a competitive market analysis. Students researched their competitors to develop a unique selling proposition for their product or service.

Lesson 9: Can't Sell to Everyone. This lesson explored the entrepreneurial concepts of TAM-SAM-SOM (Total Available Market – Serviceable Available Market – Serviceable Obtainable Market) and sales funnels to sell a product. Students were tasked with discovering their market using these concepts.

Lesson 10: Pitch Perfect. This lesson served as the capstone for the course. The video introduced students to creating a business model canvas and developing a pitch framework.

Students created a pitch framework that they could use to sell their idea to potential investors along with a business model canvas (i.e., a one-page business model).

Course Design Rationale

The Kern Engineering Entrepreneurship Network (KEEN) framework, also known as the Three C's, guided the entrepreneurial course design (see Figure 1). The KEEN framework was created by the Kern Family Foundation to increase the quantity and quality of engineering talent in the United States by incorporating entrepreneurial mindsets in students across all disciplines at the university level. The framework has been validated (Bosman & Fernhaber, 2018) and has been used to integrate entrepreneurial mindsets into science, technology, engineering, and mathematics courses (Rae & Melton, 2016; Santiago & Guo, 2018).

The framework consists of the three C's: Curiosity, Connections, and Creating Value (see Figure 1). *Curiosity* is fostered when students demonstrate an interest in the world and explore views counter to the status quo in their quest to solve problems for others. *Connections* are concerned with students using a variety of inputs and research sources, integrating them into their solutions, and assessing and managing risk propositions. *Creating value* is about students uncovering problems and finding innovative solutions to these problems to create value for others. The three sections below detail how each lesson in the course related to the three C's of the KEEN Framework (see Table 3).

Figure 1

KEEN Framework Entrepreneurial Mindset to Business Creation

Note. KEEN's Three C's Model for the components of entrepreneurial mindsets. Adapted from Engineering Unleashed, <https://engineeringunleashed.com/framework>.

Table 3

KEEN Framework Rationale for Course Lessons:

3 C's of KEEN Framework	How KEEN Guided Course Design
Curiosity	Lesson 2: Students explored a contrary view to the status quo. Lesson 4: Students used empathy to challenge standard solutions. Lesson 5: Students ideated to challenge standard solutions. Lesson 8: Students researched market data and analyzed their competition. Lesson 10: Students developed a pitch.
Connections	Lesson 3: Students integrated information from various sources. Lesson 4: Students gained insight from interviews. Lesson 7: Students integrated information sources to determine costs/risks. Lesson 9: Students researched their market to evaluate competition risk. Lesson 10: Students assessed the landscape and risk of their ideas.
Creativity	Lesson 3: Students uncovered novel solutions through probing questions. Lesson 4: Students identified new ideas from feedback. Lesson 6: Students used feedback to prototype solutions. Lesson 10: Students used feedback to develop a pitch.

The course engaged students in developing an understanding of curiosity by exploring a contrary view to the status quo in Lesson 2, Engaging Your Entrepreneurial Mindset. In Lesson 4, Human-Centered Design, students developed curiosity when using customer empathy to challenge standard solutions to a customer's problem. Lesson 5, Ideating for Innovation, used curiosity to challenge traditional solutions by having students ideate many unique ways to solve problems. Lesson 8, Digging Your Moat, required students to be curious about the market and their competition, challenging conventional solutions by evaluating their competition. Lesson 10, Pitch Perfect, leveraged curiosity as students asked probing questions to develop their business pitch framework and business model.

To encourage students' connections in entrepreneurship, the course helped students become aware of the benefits of using many different inputs from research and other sources, integrating them into solutions, and assessing and mitigating risks associated with ideas. Lesson 3, Insight Into Action, required students to integrate information from various sources such as online research and interviews with classmates and neighbors. Students explored connections as they uncovered new ideas through the 5WHY method. In Lesson 4, Human-Centered Design, students made connections to gain insight from customer interviews and research. In Lesson 7, Money Matters, students explored connections by using information collected for their business ideas to determine costs and assess the level of risk associated with those costs. Lesson 9, Can't Sell to Everyone, enlisted students' connections when they researched market segments and evaluated the risk level associated with competition in those segments. Lesson 10, Pitch Perfect, promoted connections as students assessed their ideas' scope and risk.

Creating value is about students finding novel solutions to problems and persisting through failure as they iterate to meet customer needs. In Lesson 3, Insight Into Action, students

created value as they uncovered novel solutions through the 5WHY method focused on identifying a problem's root cause or causes. In Lesson 4, Human-Centered Design, students created value by identifying new ideas from customer research. In Lesson 6, The Real MVP, students used feedback from classmates and potential customers to prototype solutions and demonstrate their value proposition. In Lesson 10, Pitch Perfect, students received feedback on their idea from classmates and homed in on specific solutions to create value for potential customers.

Data Collection

Overview of Procedure

The three educators teaching an introductory entrepreneurship course received training on how to use the entrepreneurial course, including using the introductory videos, guiding students to work on the activities, and using supplementary resources. The teachers responded to a post on social media about the course and participation in the study. The teachers received the course for free with support from the researcher. Teachers were told they would be able to continue to use the course and all future updates of the course as an incentive to participate in the research study.

The researcher met with teachers online via zoom to discuss how to access the course, how to upload student artifacts, how to deliver the course in class and answer any questions before they got started.

All three classes used the course the same way. They played the course videos and shared supplementary resources as a whole class. Teachers shared the instructional videos and supplemental resources on a screen or smartboard. The students attended class in person but could not interact closely with peers. They worked individually and submitted artifacts through

their schools' learning management system. Teachers were instructed to support students through the course by answering questions and helping with technical issues.

Participants took a pre-survey before the course and a post-survey upon completion of the course. The pre-survey and post-survey were the same, measuring participants' entrepreneurial self-efficacy and entrepreneurial intentions. The artifacts students created in the course capstone, Lesson 10, were collected. The main reason for collecting and analyzing these artifacts was to provide evidence of student learning across the course. Lesson 10, *Pitch Perfect*, served as a capstone for students who completed all previous lessons. Since lessons were cumulative, the final capstone lesson, Pitch Perfect, captured all learning from the entire course. Students had to use what they learned throughout the course to complete the capstone lesson. This way, Lesson ten, was a natural choice for artifact selection.

Students created a pitch framework and business model canvas for potential stakeholders – those who could buy or invest in their idea and business model. Participants described the problem they were trying to solve, the solution, the target market, their product's uniqueness/competitiveness, and projected revenue for their business model using the pitch framework and canvas.

Once surveys were collected, scores from students who had not completed either the pre or post survey were removed to ensure samples were truly paired.

Measures

Students' entrepreneurial self-efficacy was assessed using the Entrepreneurial Self-Efficacy scale (ESE) (McGee et al., 2009). Responses to the ESE questions used a 5-point Likert Scale with response options ranging from 1 (Very Difficult) to 5 (Very Easy). The ESE consisted

of 10 questions and the value of Cronbach's Alpha for the pre-survey was $\alpha = 0.90$. The Cronbach's alpha for the post-survey was $\alpha = 0.94$.

Students' entrepreneurial intentions were measured with the Entrepreneurial Intention Questionnaire (EIQ) (Liñán et al., 2011). All responses used a 5-point Likert scale with response options ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The EIQ consisted of 24 questions and the value of Cronbach's Alpha for the pre-survey was $\alpha = 0.92$. The Cronbach's Alpha for the post-survey was $\alpha = 0.92$.

Entrepreneurial self-efficacy

Participants' entrepreneurial self-efficacy was assessed using the Entrepreneurial self-efficacy (ESE) scale (McGee et al., 2009) (see Table 4 for the instrument sub-scales and sample items and see Appendix A for survey questions). The responses were on a 5-point Likert scale with options ranging from 1 (Very Difficult) to 5 (Very Easy). For example, students were asked to indicate how easy it would be to "determine customer demand for a new product or service."

The ESE scale included five dimensions: Searching, Planning, Marshaling, Implementing-people, and Implementing-financial. The "Implementing-people" and "Implementing-financial" subscales were not used as they focused on employee supervision and large organizational financial demands that do not apply to secondary students. The ESE subscales of Searching, Planning, and Marshaling were used to measure entrepreneurial self-efficacy and capture students' perceived feasibility in becoming an entrepreneur.

Entrepreneurial intentions

Students' entrepreneurial intentions were measured with the Entrepreneurial Intention Questionnaire (EIQ) (Liñán et al., 2011) (see Table 4 for the instrument sub-scales and sample items, and see Appendix A for survey questions). The EIQ comprises eight subscales

incorporating items that utilize 5-point Likert responses with response options ranging from 1 (Strongly Disagree) to 5 (Strongly Agree) when asked how they feel towards specific statements. For example, students were asked to indicate how much they agreed with the statement, “being an entrepreneur would be a very personally satisfying career option.”

The subscales included Education and Experience, Entrepreneurial Knowledge, Professional Attraction, Social Valuation, Entrepreneurial Capacity, Entrepreneurial Intention, Entrepreneurial Objectives, and Entrepreneurship Education. The three subscales used to measure secondary student’s Entrepreneurial Intention were Professional Attraction, Entrepreneurial Capacity, and Entrepreneurial Intentions. The other subscales were not used because they did not apply to secondary students. Entrepreneurial Education and Experience questions were geared towards university students’ prior work and school experience in general and not appropriate for high school students. The entrepreneurial knowledge subscale measured student’s familiarity with entrepreneurship through close friends and family and was not relevant for this study. The Social Valuation subscale was based on the country one resides in and not applicable to a one-country sample. The Entrepreneurial Education subscale measured students’ experience with university-level entrepreneurship education and how it could be improved, which was irrelevant to the high school sample. Table 4 summarizes the scales and subscales included in this study.

Table 4

The Instruments Used in this Study and Subscales of and a Sample Item for Each Instrument

Dependent variable	Instrument	Sub-scale	Sample item
Entrepreneurial self-efficacy	Entrepreneurial self-efficacy (ESE)	<ul style="list-style-type: none"> • Searching • Planning • Marshaling 	Your ability to design a product or service that will meet the needs of a real customer.
Entrepreneurial intentions	Entrepreneurial Intention Questionnaire (EIQ)	<ul style="list-style-type: none"> • Professional Attraction • Entrepreneurial Capacity • Entrepreneurial Intention 	I feel being an entrepreneur has more advantages than disadvantages.

Artifacts

Artifacts were analyzed using a rubric based on the Kern Engineering Entrepreneurship Network (KEEN) Framework (see Table 5). The rubric criteria included problem identification; solving problems; identifying customers or target market; identifying strategies, competitiveness, or uniqueness; projecting revenue; and explanation. Participants could receive one of the five possible scores on each criterion: 4 (exceeding the criterion), 3 (meeting the criterion), 2 (approaching the criterion), 1 (beginning), and 0 (when the work a participant submitted was left blank).

Table 5

Scoring Rubric

Criteria	Exceeding	Meeting	Approaching	Beginning
Problem Identification	Clearly frames a problem to be solved and indicates the need for a solution to this problem.	Using information given, clearly frames a problem to be solved.	Identifies a clear problem to be solved without reason.	Does not identify a clear problem to be solved.
Solving Problems	Develops a logical plan to solve the problem and articulates a reason for choosing the solution.	Develops a logical plan to solve the problem.	Develops a plan to solve a problem that is unclear or incomplete.	Not much consistency in problem solution, areas are left unfinished.
Identify Customers or Target Market	Clearly defines specific target customer types and the problem the business solves for the customer.	Clearly defines a specific customer types the problem the business solves for the customer.	Clear understanding of a specific customer type but does not identify how the business solves a problem for this customer.	No clear understanding of the customer base or target market.
Identifying Strategies/ Competitiveness/ Uniqueness	Clearly identifies multiple advantages for solving the problem over competition.	Clearly identifies an advantage for solving the problem over competition.	Identifies a single advantage for solving the problem over the competition but isn't clear.	Does not identify advantages for solving the problem.
Projecting Revenue	Demonstrates a clear understanding of the different revenue streams for the business based on customer/target market.	Demonstrates a clear understanding of revenue streams but is less clear on the connection to the customer/target market.	Demonstrates an understanding of at least one revenue stream but does not connect it to the customer/target market	Does not demonstrate a clear understanding of at least one revenue stream.
Explanation	Explains Ideas clearly in a logical manner utilizing the business model canvas framework making connections between each section.	Explains ideas clearly in a logical manner following the business model canvas framework.	Ideas are explained but may be a little unclear, and/or the business model canvas framework is incomplete.	Ideas are not explained clearly, and little to no information is added to the business model canvas framework.

Data Analysis

Survey analysis

Entrepreneurial self-efficacy was measured in three dimensions; Searching, Marshaling, and Planning. Entrepreneurial intentions were also measured in three dimensions; Professional Attraction, Entrepreneurial Capacity, and Entrepreneurial Intentions. The scores of the three dimensions of self-efficacy and three dimensions of entrepreneurial intentions were computed. A paired sampled *t*-test was used to compare the scores of these dimensions before and after the course.

Artifact analysis

The artifacts were scored using a rubric created based on the KEEN framework (see Table 5). Thirty-nine artifacts were randomly selected and scored in total, which equates to 51percent of total participants. To ensure the validity and reliability of the qualitative analysis, my advisor and I were involved in scoring the qualitative artifacts. I created a rubric based on the KEEN framework. My advisor and I used the rubric to score three artifacts initially. We then met to revise the rubric and discuss scoring. Next, we used the revised rubric to score five artifacts independently. Then, we met to finalize the rubric, after which we independently scored ten additional artifacts. The inter-rater reliability was 0.90. We discussed our differences and reached a consensus. I scored the remaining artifacts.

Since each artifact was scored using a rubric, the qualitative data was analyzed quantitatively. Specifically, student scores in each category were analyzed to provide a clearer picture of how students processed their learning from the course. The mean, median, standard deviation and standard error of the mean were calculated for each of the six categories. Student

quartiles scores were also summarized to attain further clarity on where students scored with relation to others.

RESULTS

Survey Results

Paired-samples *t*-tests showed that participants' Professional Attraction toward entrepreneurship significantly increased from the pre-survey ($M = 3.58, SD = 0.60$) to the post-survey ($M = 3.76, SD = 0.67$) ($t = -2.60, p = 0.01, d = 0.59$) (see Table 6). The effect size was $d = 0.59$, suggesting a medium effect (Cohen, 1977). Entrepreneurial Capacity significantly increased from the pre-survey ($M = 3.10, SD = 0.69$) to the post-survey ($M = 3.35, SD = 0.70$) ($t = -3.24, p = 0.00, d = 0.65$). The effect size was $d = 0.65$, indicating a medium effect. The third dimension of entrepreneurial intentions as well as entrepreneurial self-efficacy did not improve significantly.

Table 6

Pre- and Post-test Means, Standard Deviations, and t-Test Results

Dependent Variable	Dimension	Pre-survey <i>n</i> = 76		Post-survey <i>n</i> = 76		<i>t</i>	<i>p</i>	<i>Cohen's d</i>
		Mean	<i>SD</i>	Mean	<i>SD</i>			
Entrepreneurial Intention	Professional Attraction	3.58	0.70	3.76	0.67	-2.62	0.01	0.59
	Entrepreneurial Capacity	3.10	0.69	3.35	0.70	-3.24	0.00	0.65
	Entrepreneurial Intentions	2.94	1.15	3.05	1.06	-0.94	0.35	0.97
Entrepreneurial Self-Efficacy	Searching	3.34	0.73	3.41	0.86	-0.66	0.51	0.93
	Planning	3.32	0.71	3.47	0.80	-1.74	0.09	0.77
	Marshaling	3.41	0.80	3.37	0.87	0.41	0.68	0.75

Note.

All scores ranged from 1 to 5.

Significant results are in bold.

Artifact Results

Two categories, Problem Identification and Solving Problems, averaged over 3 (see Table 7). Specifically, the mean of Problem Identification was 3.54 (out of 4) with a median of 4.0, and that of Solving Problems was 3.18 with a median of 3.0. The mean of Projecting Revenue was 1.44 with a median of 1.0 and was the lowest of all categories.

Table 7

Mean and Standard Deviations of Artifact Scoring by Rubric Category

Category	Mean	Median	Standard Deviation	Standard Error Mean
Problem Identification	3.54	4.0	0.72	0.12
Solving Problems	3.18	3.0	0.76	0.12
Identifying Customer/Target Market	2.77	3.0	1.04	0.17
Identifying Strategies/Competition	2.44	2.0	1.02	0.16
Projecting Revenue	1.41	1.0	1.45	0.23
Explanation	2.41	3.0	1.19	0.19

Note.

The highest score of each category was 4.

Total scores for each participant were placed into quartiles to look at their distribution (see table 8). Most scores were in the first and second quartiles. Specifically, 28.20% were in the first quartile (between 19 and 24 points), and 51.28% were in the second quartile (between 13 and 18 points), indicating that most of the participants' overall scores were above 60% of the total score.

Table 8

Participants' Total Score Quartiles

Quartile	Students Scoring in Quartile	Percentage of Total
1 st Quartile Score of 19-24	11	28.20%
2 nd Quartile Score of 13-18	20	51.28%
3 rd Quartile Score of 7-12	7	17.95%
4 th Quartile Score of 0-6	1	2.56%

This study examined the impact of an online entrepreneurship course on secondary students' entrepreneurial intentions and entrepreneurial self-efficacy.

How did an online entrepreneurial course affect students' entrepreneurial self-efficacy?

The survey results did not indicate a significant change in students' entrepreneurial self-efficacy across the online course. Each subscale was examined separately to gain a better understanding of why this occurred.

The Searching dimension of entrepreneurial self-efficacy did not improve significantly, which can be attributed to the fact that students did not have an opportunity to interact with real customers. Most items in the searching subscale asked students whether they could identify real customer needs and design a product or service to meet those needs. The course required students to interact with potential customers to gain feedback on their product idea and design. However, due to the COVID-19 pandemic, students could not interact with real customers and relied on secondary research.

The Marshalling dimension of entrepreneurial self-efficacy did not improve. This is explained by how students engaged with the learning activities. The Marshalling subscale included questions about students' confidence in their abilities to get others to believe in their business ideas, make contact and communicate with others to exchange ideas, and explain concepts verbally and in writing. Due to the COVID-19 pandemic, students had to maintain social distance and could not work with each other in a meaningful way. They completed learning activities individually. They could not discuss with other students the problems they identified or the business ideas they generated. Nor could they practice their pitch or receive robust peer feedback. Therefore, they did not gain much experience explaining entrepreneurial concepts or communicating business ideas to others, leaving them uncertain of their abilities.

The planning dimension of self-efficacy did not show a significant improvement. This was corroborated by the artifact analysis that suggested students did not do well in projecting

revenues. Students scored a mean of 1.41 out of 4.0 for this criterion. The survey corroborated this result, showing that entrepreneurial self-efficacy's planning dimension (e.g., determining a competitive price for a new product, estimating the amount of startup funds) did not improve significantly.

There are several possible reasons why student scores were low in projecting revenues. The course's projecting revenue lesson was more complicated than other lessons and involved financial terminology and algebraic calculations that may have been unfamiliar to students. It also required students to use an Excel spreadsheet to create financial models for their business ideas. The spreadsheet included the projected cost of goods sold, net startup, and operating expenses and was designed to help students calculate projected revenues and costs for an entire year. The financial terms, spreadsheet, and application of mathematics skills to compute projected revenues may have been overly challenging for high school students. Financial literacy is difficult for secondary students to grasp. The OEDC Programme for International Student Assessment Excellence and Equity in Education (2015) found that only 10% of 15-year-olds achieved financial literacy proficiency.

Further, the lesson asked students to conduct a break-even analysis and calculate when the amount of product or service sold equaled the amount spent to create the product or service. Students may have had difficulty solving algebraic tasks required because it is challenging to see relationships between expressions in words with algebraic formulas and equations, where they may lack algebraic visualization skills (Muchoko et al., 2019; Wahyuni et al., 2020). This is especially true when the calculations are in unfamiliar or new contexts, such as financial literacy.

For these reasons, the learning activity may have caused a cognitive load. Cognitive load refers to the amount of information held in our working or short-term memory, which has limited

capacity (Paas et al., 2010). The information becomes stored in long-term memory when we have built schemas to help categorize and make sense of new information (Sweller, 1994). The less familiar with a topic, the more we depend on our working memory to complete tasks. Since entrepreneurship and financial terminology were new for students, they had not built schemas to help them work with the new information. Adding the additional level of advanced mathematics could have overtaxed students.

The projecting revenue lesson can be improved with additional procedural and conceptual scaffolding to avoid overloading students' short-term memory. Including more relevant, everyday examples like saving allowance money to purchase a game or tickets may activate students' prior knowledge to connect financial terms to what they already know. Since worked examples can lighten cognitive load (Bannert, 2002), additional procedural scaffolding should be incorporated to walk students through worked examples using the included spreadsheet. After that, the video lesson could provide guided practice to demonstrate how students should input data into the spreadsheet for a fictional business. This way, students would be familiar with the tool (spreadsheet) and confident using it with their business ideas.

Did an online entrepreneurial course affect students' entrepreneurial intentions?

Survey results showed significant improvements in two dimensions of entrepreneurial intentions: Professional Attraction and Entrepreneurial Capacity. The third subscale of entrepreneurial intention (Entrepreneurial Intentions) was not significant. Students' entrepreneurial self-efficacy subscales (Searching, Planning, Marshaling) did not yield a significant improvement. The analysis of students' artifacts showed that students did identify problems and generate solutions to these problems. However, many students' artifacts did not

demonstrate a clear understanding of the projected revenue for the business based on a target market.

The survey results showed that the Professional Attraction dimension of secondary students' entrepreneurial intentions increased upon completion of the course indicating that students find the idea of pursuing entrepreneurship an appealing career option after completing the course.

The survey also showed that the Entrepreneurial Capacity dimension of secondary students' entrepreneurial intentions (i.e., recognizing an opportunity that could be a business idea, generate solutions to other people's problems) increased upon completion of the course. Findings from the artifacts corroborated the survey results. The artifacts provided evidence of students' ability to identify problems and develop solutions. Both opportunity recognition and problem solving are essential to entrepreneurship. Specifically, the first crucial step into entrepreneurship is identifying an opportunity for a new business, product, or service. (Nicolaou et al., 2009; Shane & Venkataraman, 2000). Shane & Venkataraman (2000) define entrepreneurship as a search for potential opportunities to create products or services and how one exploits those opportunities. Entrepreneurs focus on developing unique solutions that generate value for others (Hsieh et al., 2007; Sarasvathy et al., 2014). Given the central role of opportunity recognition and problem-solving in entrepreneurship and students' improvement in these two aspects, the online course indeed equipped students with valuable entrepreneurial skills.

Limitations

Several limitations were present in this study. First, due to the COVID-19 pandemic, it was impossible to interview teachers and students due to issues with consent forms. Interview

data could have provided additional insights into the challenges students experienced and their attitudes towards the course.

Second, students primarily worked on the project individually due to restrictions. They were able to gain some peer feedback, but not in an ideal way. The initial design of the course suggested students work in teams on the learning activities, give formal pitch presentations to their classmates and local entrepreneurs, and receive constructive feedback and encouragement to move forward. Although this was an online course, grouping students and managing student online teams in a hybrid environment were beyond the scope of the educators.

Lastly, the course was run at the end of the school year in an expedited fashion. It may have been advantageous to complete one lesson per week, allowing students to work on it intermixed with other schoolwork throughout the week. This would have allowed more time for students to explore their ideas, ask questions, and talk to more potential customers.

Directions for Future Research

Future research can include interviews with students and teachers to gain in-depth understanding of secondary students' experience with the entrepreneurial course and how the course impacts students' entrepreneurial self-efficacy and intentions.

Studying student growth across the course using a pre and post artifact analysis may also provide additional insight into how much the students learned. Since the business model canvas was used, students could have filled out a preliminary canvas before the course's first lesson, then create their final canvas during the capstone lesson. A pre and post artifact analysis could show the researcher student growth and be very helpful for students to review and reflect upon their own personal development.

Future research can also study all artifacts collected from each of the ten lessons to examine how students' entrepreneurial mindset is developed over time. Additionally, the entrepreneurship education field can benefit from experimental studies. For example, the control group can do what participants in this study did. The experimental group, however, can interact with real potential customers to gain feedback on their ideas. An experimental study would also control for students' level of interest in entrepreneurship.

Implications and Conclusions

This study contributes to entrepreneurship education in the K-12 arena as few studies have attempted to cultivate entrepreneurial intentions in the K-12 population. This study provides a starting point for research in how to develop secondary students' entrepreneurial intentions. It also demonstrates that a guided entrepreneurial experience can increase students' attraction to the field of entrepreneurship and their overall capacity to become entrepreneurs. It highlights the design of an online experiential entrepreneurship course, guided by the KEEN framework, that can help shape and improve the design of future coursework in K-12 entrepreneurship education.

References

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Bandura, A. (1986). The explanatory and predictive scope of self-efficacy theory. *Journal of Social and Clinical Psychology*, 4(3), 359–373. <https://doi.org/10.1521/jscp.1986.4.3.359>
- Bannert, M. (2002). Managing cognitive load: Recent trends in cognitive load theory. *Learning and Instruction*, 12, 139–146.
- Borchers, A. S., & Park, S.-H. (2010). Understanding entrepreneurial mindset: A study of entrepreneurial self-efficacy, locus of control and intent to start a business. *The Journal of Engineering Entrepreneurship*, 1(1). <https://papers.ssrn.com/abstract=3109171>
- Bosman, L., & Fernhaber, S. (2018). Integrating the entrepreneurial mindset as an engineering educator. In L. Bosman & S. Fernhaber (Eds.), *Teaching the Entrepreneurial Mindset to Engineers* (pp. 47–49). Springer International Publishing. https://doi.org/10.1007/978-3-319-61412-0_6
- Byabashaija, W., & Katono, I. (2011). The impact of college entrepreneurial education on entrepreneurial attitudes and intention to start a business in Uganda. *Journal of Developmental Entrepreneurship*, 16(1), 127–144. <https://doi.org/10.1142/S1084946711001768>
- Chen, C. C., Greene, P. G., & Crick, A. (1998). Does entrepreneurial self-efficacy distinguish entrepreneurs from managers? *Journal of Business Venturing*, 13(4), 295–316. [https://doi.org/10.1016/S0883-9026\(97\)00029-3](https://doi.org/10.1016/S0883-9026(97)00029-3)

- Chen, G., Gully, S. M., & Eden, D. (2001). Validation of a new general self-efficacy scale. *Organizational Research Methods*, 4(1), 62–83.
<https://doi.org/10.1177/109442810141004>
- Cohen, J. (1977). *Statistical power analysis for the behavioral sciences*, Rev. Ed. Lawrence Erlbaum Associates, Inc.
- Ding, W., & Choi, E. (2011). Divergent paths to commercial science: A comparison of scientists' founding and advising activities. *Research Policy*, 40(1), 69–80.
<https://doi.org/10.1016/j.respol.2010.09.011>
- Farrukh, M., Alzubi, Y., Shahzad, I. A., Waheed, A., & Kanwal, N. (2018). Entrepreneurial intentions: The role of personality traits in perspective of theory of planned behaviour. *Asia Pacific Journal of Innovation and Entrepreneurship*, 12(3), 399–414.
<https://doi.org/10.1108/APJIE-01-2018-0004>
- Fayolle, A., & Gailly, B. (2015). The impact of entrepreneurship education on entrepreneurial attitudes and intention: Hysteresis and persistence. *Journal of Small Business Management*, 53(1), 75–93. <https://doi.org/10.1111/jsbm.12065>
- Gargouri, C., & Naatus, M. K. (2019). Building entrepreneurial mindsets in the classroom. *Journal of Entrepreneurship Education*, 22(3), 20.
- Gerhart, A. L., & Melton, D. E. (2016). Entrepreneurially minded learning: Incorporating stakeholders, discovery, opportunity identification, and value creation into problem-based learning modules with examples and assessment specific to fluid mechanics. *ASEE Annual Conference & Exposition Proceedings*, 30296. <https://doi.org/10.18260/1-2--30296>.

- Hockerts, K. (2017). Determinants of social entrepreneurial intentions. *Entrepreneurship Theory and Practice*, 41(1), 105–130. <https://doi.org/10.1111/etap.12171>
- Hou, F., Su, Y., Lu, M., & Qi, M. (2019). Model of the entrepreneurial intention of university students in the Pearl River Delta of China. *Frontiers in Psychology*, 10. <https://doi.org/10.3389/fpsyg.2019.00916>
- Hsieh, C., Nickerson, J. A., & Zenger, T. R. (2007). Opportunity discovery, problem solving and a theory of the entrepreneurial firm. *Journal of Management Studies*, 44(7), 1255–1277. <https://doi.org/10.1111/j.1467-6486.2007.00725.x>
- Jung, D. I., Ehrlich, S. B., De Noble, A. F., & Baik, K. B. (2001). Entrepreneurial self-efficacy and its relationship to entrepreneurial action: A comparative study between the US and Korea. *Management International; Montréal*, Vol. 6(No 1), 41–53.
- Kolvereid, L., & Isaksen, E. (2006). New business start-up and subsequent entry into self-employment. *Journal of Business Venturing*, 21(6), 866–885. <https://doi.org/10.1016/j.jbusvent.2005.06.008>
- Kouakou, K. K. E., Li, C., Akolgo, I. G., & Tchamekwen, A. M. (2019). Evolution view of entrepreneurial mindset theory. *International Journal of Business and Social Science*, 10(6). <https://doi.org/10.30845/ijbss.v10n6p13>
- Krueger, N. (1993). The impact of prior entrepreneurial exposure on perceptions of new venture feasibility and desirability. *Entrepreneurship Theory and Practice*, 18(1), 5–21. <https://doi.org/10.1177/104225879301800101>
- Krueger, N., Reilly, M. D., & Carsrud, A. L. (2000). Competing models of entrepreneurial intentions. *Journal of Business Venturing*, 15(5), 411–432. [https://doi.org/10.1016/S0883-9026\(98\)00033-0](https://doi.org/10.1016/S0883-9026(98)00033-0)

- Lavelle, B. A. (2019). Entrepreneurship education's impact on entrepreneurial intention using the theory of planned behavior: Evidence from Chinese vocational college students. *Entrepreneurship Education and Pedagogy*. <https://doi.org/10.1177/2515127419860307>
- Liñán, F., Rodríguez-Cohard, J. C., & Rueda-Cantuche, J. M. (2011). Factors affecting entrepreneurial intention levels: A role for education. *International Entrepreneurship and Management Journal*, 7(2), 195–218. <https://doi.org/10.1007/s11365-010-0154-z>
- McGee, J. E., Peterson, M., Mueller, S. L., & Sequeira, J. M. (2009). Entrepreneurial self-efficacy: Refining the measure. *Entrepreneurship Theory and Practice*, 33(4), 965–988. <https://doi.org/10.1111/j.1540-6520.2009.00304.x>
- Muchoko, C., Jupri, A., & Prabawanto, S. (2019). Algebraic visualization difficulties of students in junior high school. *Journal of Physics: Conference Series*, 1157, 032108. <https://doi.org/10.1088/1742-6596/1157/3/032108>
- Naktiyok, A., Nur Karabey, C., & Caglar Gulluce, A. (2010). Entrepreneurial self-efficacy and entrepreneurial intention: The Turkish case. *International Entrepreneurship and Management Journal*, 6(4), 419–435. <https://doi.org/10.1007/s11365-009-0123-6>
- Neck, H. M., & Corbett, A. C. (2018). The scholarship of teaching and learning entrepreneurship. *Entrepreneurship Education and Pedagogy*, 1(1), 8–41. <https://doi.org/10.1177/2515127417737286>
- Neck, H. M., & Greene, P. G. (2011). Entrepreneurship education: Known worlds and new frontiers. *Journal of Small Business Management*, 49(1), 55–70. <https://doi.org/10.1111/j.1540-627X.2010.00314.x>
- Nicolaou, N., Shane, S., Cherkas, L., & Spector, T. D. (2009). Opportunity recognition and the tendency to be an entrepreneur: A bivariate genetics perspective. *Organizational*

- Behavior and Human Decision Processes*, 110(2), 108–117.
<https://doi.org/10.1016/j.obhdp.2009.08.005>
- OECD Programme for International Student Assessment Excellence and Equity in Education*.
 (2015). [Annual]. <https://www.oecd.org/education/pisa-2015-results-volume-i-9789264266490-en.htm>
- Paas, F., van Gog, T., & Sweller, J. (2010). Cognitive load theory: New conceptualizations, specifications, and integrated research perspectives. *Educational Psychology Review*, 22(2), 115–121. <https://doi.org/10.1007/s10648-010-9133-8>
- Peterman, N. E., & Kennedy, J. (2003). Enterprise education: Influencing students' perceptions of entrepreneurship. *Entrepreneurship Theory and Practice*, 28(2), 129–144.
<https://doi.org/10.1046/j.1540-6520.2003.00035.x>
- Piperopoulos, P., & Dimov, D. (2015). Burst bubbles or build steam? Entrepreneurship education, entrepreneurial self-efficacy, and entrepreneurial intentions. *Journal of Small Business Management*, 53(4), 970–985. <https://doi.org/10.1111/jsbm.12116>
- Pruett, M., Shinnar, R., Toney, B., Llopis, F., & Fox, J. (2009). Explaining entrepreneurial intentions of university students: A cross-cultural study. *International Journal of Entrepreneurial Behaviour & Research; Bradford*, 15(6), 571–594.
<http://dx.doi.org/www.libproxy.wvu.edu/10.1108/13552550910995443>
- Rae, D., & Melton, D. E. (2016). Developing an entrepreneurial mindset in US engineering education: An international view of the KEEN Project. *The Journal of Engineering Entrepreneurship*, 7(3), 16.

- Santiago, J., & Guo, J. (2018). Developing an entrepreneurial mindset using the KEEN framework for a digital communication system course. *2018 ASEE Annual Conference & Exposition Proceedings*, 30296. <https://doi.org/10.18260/1-2--30296>
- Sarasvathy, S., Kumar, K., York, J. G., & Bhagavatula, S. (2014). An effectual approach to international entrepreneurship: Overlaps, challenges, and provocative possibilities. *Entrepreneurship Theory and Practice*, 38(1), 71–93. <https://doi.org/10.1111/etap.12088>
- Schimmel, I. (2016). Entrepreneurial educators: A narrative study examining entrepreneurial educators in launching innovative practices for K-12 schools. *Contemporary Issues in Education Research (CIER)*, 9(2), 53. <https://doi.org/10.19030/cier.v9i2.9615>
- Shane, S., & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. *The Academy of Management Review*, 25(1), 217–226. <https://doi.org/10.2307/259271>
- Shapero, A., & Sokol, L. (1982). Social dimensions of entrepreneurship. In *Encyclopedia of Entrepreneurship* (pp. 72–90). Prentice-Hall, Inc.
- Sweller, J. (1994). Cognitive load theory, learning difficulty, and instructional design. *Learning and Instruction*, 4(4), 295–312. [https://doi.org/10.1016/0959-4752\(94\)90003-5](https://doi.org/10.1016/0959-4752(94)90003-5)
- Tsai, K.-H., Chang, H.-C., & Peng, C.-Y. (2016). Extending the link between entrepreneurial self-efficacy and intention: A moderated mediation model. *International Entrepreneurship and Management Journal*, 12(2), 445–463. <https://doi.org/10.1007/s11365-014-0351-2>
- Wahyuni, R., Prabawanto, S., & Herman, T. (2020). Students' difficulties in solving algebra tasks in middle school. *Journal of Physics: Conference Series*, 1521, 032071. <https://doi.org/10.1088/1742-6596/1521/3/032071>

- Wilson, F., Kickul, J., & Marlino, D. (2007). Gender, entrepreneurial self-efficacy, and entrepreneurial career intentions: Implications for entrepreneurship education. *Entrepreneurship Theory and Practice*, 31(3), 387–406. <https://doi.org/10.1111/j.1540-6520.2007.00179.x>
- Zhang, Y., Duysters, G., & Cloudt, M. (2014). The role of entrepreneurship education as a predictor of university students' entrepreneurial intention. *International Entrepreneurship and Management Journal*, 10(3), 623–641. <https://doi.org/10.1007/S11365-012-0246-Z>
- Zhao, H. B., Seibert, S. E., & Hills, G. E. (2005). The mediating role of self-efficacy in the development of entrepreneurial intentions. *The Journal of Applied Psychology*, 90(6), 1265–1272. <https://doi.org/10.1037/0021-9010.90.6.1265>
- Zhao, Y. (2012a). Flunking innovation and creativity. *The Phi Delta Kappan*, 94(1), 56–61. JSTOR.
- Zhao, Y. (2012b). *World class learners: Educating creative and entrepreneurial students*. Corwin Press.
- Zupan, B., Cankar, F., & Cankar, S. S. (2018). The development of an entrepreneurial mindset in primary education. *European Journal of Education*, 53(3), 427–439. <https://doi.org/10.1111/ejed.12293>

APPENDIX A: Survey Questions

PRE/POST SURVEY

Entrepreneurial Self-Efficacy Questions:

1. For the following list of questions, please indicate how much confidence you have in your ability (right now) to do these things. There is no judgment here. Rank from 1(strongly disagree) to 5(strongly agree) on the following:

Searching

- a. Brainstorm or come up with a new idea for a product or service?
- b. Identify the REAL need in the world for a new product or service?
- c. Design a product or service that will meet the needs of a real customer?

Planning

- d. Estimate or determine customer demand for a new product or service?
- e. Determine a competitive price for a new product or service?
- f. Estimate or determine the amount of startup funds to start a business?
- g. Design effective marketing campaigns for a new product or service?

Marshaling

- h. Get others to believe in your business idea?
- i. Make contact and communicate with others to exchange ideas?
- j. Explain my ideas in writing or verbally clearly and understandably?

Entrepreneurial Intention Questions:

Professional Attraction

2. What would you like to do right after high school or college? Rank the following from 1(strongly disagree) to 5 (strongly agree)
 - a. Work as an employee in a company
 - b. Start your own company
 - c. Continue training (school) and preparation
3. Think about the longer term, think about all the advantages and disadvantages (money, social status, social recognition, stability, etc.), indicate how you feel about the following career options from 1(strongly disagree) to 5 (strongly agree).
 - a. Salaried work (steady paycheck working for a company or someone else)
 - b. Freelance work (work for someone else, but choose the work like a consultant or temporary worker)
 - c. Entrepreneur (start a business and work for yourself)
4. How much do you agree with the following sentences from 1(strongly disagree) to 5 (strongly agree)?
 - a. Being an entrepreneur has more advantages than disadvantages, in my opinion.
 - b. A career as an entrepreneur seems cool to me.
 - c. If I had the opportunity and resources, I would start a business.
 - d. Being an entrepreneur would be a very personally satisfying career option.
 - e. Among other options, I would like to be an entrepreneur

Entrepreneurial Capacity

5. How much do you agree with the following statement from 1(strongly disagree) to 5 (strongly agree)
- a. Starting a business and keeping it going would be easy for me.
 - b. I feel confident I can control the creation of a new business.
 - c. I know what it takes to start a business.
 - d. I know how to develop an entrepreneurial project.
 - e. If I tried to start a business, I would probably succeed.
6. How do you rank yourself on the following capabilities of entrepreneurship? Select from 1(very difficult) to 5(very easy).
- a. Opportunity recognition. The ability to recognize an opportunity in the world that could be a business idea.
 - b. Creativity – Your ability to come up with new or innovative solutions to other peoples' problems.
 - c. Problem-solving – Your confidence in working to solve problems for other people.
 - d. Leadership and communication - Your ability to lead a team and communicate with your team.
 - e. Development of new products or services
 - f. Networking and making business contacts – Networking or meeting new people who can help me.

Entrepreneurial Intentions

7. Indicate how strongly you feel about the following statement from 1(strongly disagree) to 5(strongly agree)
- a. I am ready to make anything to become an entrepreneur
 - b. My goal is to be an entrepreneur
 - c. I will make every effort to start my own business
 - d. I have seriously thought about starting my own business

APPENDIX B: Example Artifacts

Student 18:

PITCH PERFECT

Use this handout as a guide for essential elements of your pitch. Then build out an accompanying pitch deck and be prepared to deliver your pitch in 3 minutes or less!

What is the problem you are trying to solve?

We are trying to solve the problem of people choking.

What is your solution?

Our solution is creating a device that has a tube on it that will insert into the persons throat while they're choking and suck the food out or whatever they are choking on.

Who is your target market?

It is meant for anyone, but our main target market is mainly older people, because they are more prone to choking because of the loss of teeth at an older age.

How are you different?

Unlike the Heimlich maneuver, we provide

[Competitor]

a 100% guarantee to save the persons life and make sure they aren't damaged.

[USP]

What design considerations should you have for the pitch deck?

<p>CUSTOMER WHO DO YOU SERVE?</p> <p>We serve everyone but our main customer is older people because they are more prone to choking because of the loss of teeth at an older age.</p>	<p>PROBLEM WHAT IS THE PROBLEM YOUR CUSTOMER HAS?</p> <p>the problem is people choking and dying every single day.</p>	<p>SOLUTION WHAT DO YOU WANT YOUR CUSTOMER TO GET?</p> <p>TCP-1 is the solution to people choking, it will remove food from the persons throat while choking</p>	<p>MESSAGE WHAT IS YOUR STORY? HOW DOES YOUR CUSTOMER HEAR IT?</p> <p>buying this product could save you or your family members life</p>	<p>REVENUE HOW DO YOU MAKE MONEY FROM YOUR CUSTOMER?</p> <p>we make money from customers who want to keep this device around their house to ensure they will never die from choking</p>
<p>ALTERNATIVES HOW IS YOUR CUSTOMER? WHAT ARE THE ALTERNATIVE SOLUTIONS TO THE PRODUCT AND IS NOT GUARANTEED TO SAVE YOUR LIFE WHILE CHOKING</p> <p>the Heimlich maneuver is the only alternative to our product and is not guaranteed to save your life while choking</p>	<p>BENEFIT WHY DOES YOUR CUSTOMER WANT YOUR PRODUCT OR SERVICE? HOW DO YOU SOLVE THE PROBLEM?</p> <p>the benefit is you will not die from choking and can save anyone's life.</p>	<p>DISTRIBUTION HOW DOES YOUR PRODUCT OR SERVICE GET TO YOUR CUSTOMER?</p> <p>you will be able to buy these from any local pharmacy for the price of 75 dollars</p>	<p>NAME _____</p> <p>CO.STARTERS® CANVAS</p>	
<p>STARTUP NEEDS WHAT FACTORS DO YOU NEED TO GET STARTED (MONEY, PEOPLE, THINGS, TECHNOLOGY, ACTIVITIES)?</p> <p>we need money, all of the products, and a place of production like a factory</p>			<p>COSTS WHAT ONGOING NEEDS ARE ESSENTIAL TO KEEP YOU GOING (MONEY, PEOPLE, THINGS, TECHNOLOGY, ACTIVITIES)?</p> <p>50 thousand for the building and the machines, and 50 thousand for all the devices to be made at a high rate</p>