

# Stem Focused High School And University Partnership: Alternative Solution For Senioritis Issue And Creating Students' Stem Curiosity

Mustafa Icel   Matthew Davis  
University of Missouri of Saint Louis

## Abstract:

The purpose of this study is to evaluate how the high school-college partnership reflects on "senioritis" and students' STEM curiosity. The term "senioritis" described in this paper refers to high school senior students who have completed most of their graduation requirement courses in their third year of studies. During the fourth year of high school, students may only need two or three credits to graduate which inherently causes the students to lose motivation. This then results in the aforementioned senioritis. Least credit requirements cause senior students senioritis and they have a lack of motivation in the fourth year of high school. This study aims to illustrate how K-16, a model high school-college partnership with local colleges, builds a scientific community that urban students can benefit from.

**Keywords:** STEM, high school-university partnership, urban education, STEM workforce, SCCT

## Introduction

Scholarly research and the U.S. Bureau of Labor Statistics (BLS 2014) point out the need for focus on jobs requiring STEM skills (e.g., Caprile et al., 2015; Honey et al., U.S. Bureau of Labor Statistics, 2014). It is estimated that by 2018, nine of the ten fastest-growing fields will require at least a bachelor's degree in math or science. It is estimated that a great number of science and engineering occupations will grow faster than the average rate for all other occupations (Lacey & Wright, 2009; National Science Board, 2010). This growth rate is consistent with national trends of job growth (U.S. Department of Labor, 2007). The STEM jobs are projected to grow by 12% between 2014 and 2024, compared to 8% for all other jobs 34% (U.S. Bureau of Labor Statistics, 2014). Filling the pipeline to ensure companies come and stay in the U.S is extremely crucial. Data from the U.S. Bureau of Labor Statistics (BLS 2014) show STEM employment is projected to grow by 13% between 2012 and 2022. The STEM "employment is faster than the 11-percent rate of growth projected for all occupations over the decade" (p.3, 2014). This research examines a model to fulfill the future STEM workforce. The high school-college partnership model requires collabora-

tion between high schools and local colleges. Additionally, the national demand is to motivate high school students to enter STEM field majors, but high school seniors' lack of motivation and "senioritis" issues hinder this necessity (e.g., Noble et al., 2006; Wang, 2013). According to the National Science Foundation (2014), the employment rate in science and engineering fields rose an average of 3.3% annually between 1960 and 2011, compared to an average of 1.3% annual increase in all other occupations.

## History of High School College Credit Programs

Dual enrollment or college credit courses challenge high school students during their high school years and help them to earn dual credits while still attending high school (Chapman, 2011). These advanced courses are offered to selected students in junior and senior years to challenge them academically. They are also called "transition programs", which are designed to meet the needs of those selected students who are usually above average in their classrooms (Boswell, 2011a). Those transition programs are the Advanced Placement (AP) Program, Credit-Based Transition Programs, International Baccalaureate (IB) Program, Post-Secondary Enrollment Program (PSE-OP). The Maryland K-16 initiative, a partnership between local colleges and high schools, is an excellent example of partnership between high schools and colleges. The initiative resulted in more high school students going to college and fewer students taking remedial college courses. Both the colleges' and high schools' staff worked together to design the curriculum to meet their goals (Nunley & Gemberling, 1999). Advancement Via Individual Determination (AVID) was another program aiming at schools with low and high graduation rates (Watt, et al., 2008). At the end of the program, graduation rates increased in both types of schools. Research on the AVID program showed that AVID cohort students had significant college acceptance rates, 28 out of 30 students who enrolled in the program (e.g., Mehan et al., 1996; Watt et al., 2008). Research indicates that high school-college readiness programs not only help students' academic success but also create strong bonds between families and schools. The AVID program achieved this goal and increased student

and parent involvement in the college preparation process (Swanson, 2000; Watt et al., 2008).

## The Benefit of STEM-focused High School-University Partnership (STEMHSUP)

This model mainly focuses on high school students' senior year to eliminate "senioritis" and prepare students for college. Multiple studies on "senioritis" demonstrate the need for addressing this problem through scholarship and implementation. Research on the high school-college partnerships shows a great number of students who need remedial education before taking college-level courses (e.g., Frost et al., 2012; Morgan et al., 2015; Noble et al., 2006; Nunley & Gemberling, 1999; Watt et al., 2008). A recent study with high school math teachers and college math teachers indicates that partnerships pave the way to college success (Frost et al., 2012). The participants came together to eliminate freshmen college students' difficulties on college level math courses. In the beginning, high school math teachers and college math teachers assigned blame for the discrepancies first-year students display in their math course. Throughout the partnerships, both groups learned from each other and created more efficient teaching strategies for high school students (National Staff Development Council, 2012).

A federally funded initiative, Gaining Early Awareness and Readiness for Undergraduate Program (GEAR UP), reviews aspects of high school-college partnership and talks about its benefits for economically disadvantaged students in urban areas (Watt et al., 2008). Research indicates that high school students who are taking more challenging courses do better in colleges and graduate on time (e.g., Horn and Nuñez 2000; Horn and Kojaku 2001; Frost et al., 2012; Morgan et al., 2015; Noble et al., 2006; Nunley & Gemberling, 1999; Watt et al., 2008). The overall benefits of high school-university partnership programs are:

1. Increases the number of students interested in STEM majors
2. Eliminates the problem of "senioritis" during senior year of urban students
3. Academically prepares students for college

4. Increases the number of students graduating from urban high schools (preventing drop-out)
5. Utilizes senior year of high school cost-effectively for all stakeholders

This study aims to show the necessity of high school-college partnerships that should result in reform, especially in secondary schools' curricula.

## High school-college partnership Model Study

The high school-college partnership is a distinct program focused on increasing students' interests in Science, Math, Engineering, and Technology (STEM) offered by Gateway Science Academy of St. Louis (GSA). This program began in 2015 with the collaboration of Lindenwood University (LU). The beneficiaries of this school-college partnership are GSA students from ninth to twelfth-grade. In earlier years, the high school-college partnership began with GSA high school students doing college visits and some students working on advanced science projects with LU professors. The high school-college partnership expanded in 2017 to other local colleges such as: Saint Louis University (SLU), Saint Louis Community College (STLCC), University of Missouri-Saint Louis (UMSL) and Washington University-Saint Louis (WASHU). In 2017, the high school-college partnership will expand to include the GSA young scientists program, college trips, dual credit, dual enrollment, and articulated credits. The brief description of these programs as follows:

**GSA Young Scientist Program:** GSA students will have an opportunity to enroll in a six-week summer internship program and work on advanced scientific research with college professors. Three GSA students will collaborate with a WASHU biology professor in the summer of 2017.

**College Trips:** All GSA high school students must attend one college visit; however, many students attend more college visits.

**Dual Credit and Dual Enrollment:** GSA holds a dual credit agreement with LU, SLU, UMSL, and STLCC.

**Articulated Credits:** GSA and STLCC created a partnership in 2016, and GSA students earned articulated credits in all technology courses.

### Senioritis

"Senioritis" is not a new issue discussed in literature. In 1972, local high school administrators in Syracuse were the first ones who brought this issue to the table (Syracuse University, 2005). As a response to the problem, local public school leaders collaborated with universities in Syracuse to challenge their high school seniors to over-

come senioritis problems. Those students had already completed their graduation requirements by the end of junior year. This collaboration between high schools and universities inspired local leaders and universities to implement a new program called "Project Advance" (Syracuse University, 2005). However, the symptoms of senioritis in the U.S are still deep due to high drop-out rates and a decrease in college graduation rates (Syracuse University, 2005.) The Maryland K-16 initiative and many other states also started adopting the K-16 approach to decrease high school drop out rate and enrollment of remedial courses in colleges (Nunley & Gemberling, 1999).

The study conducted by Nunley and Gemberling (1999) indicates that many high school students go to schools to socialize, along with other teenage motivation issues. The focus group in that study admits that the reasons for being in a remedial college course are their impervious behaviors and inability to socialize.

### Theoretical Framework

The purpose of the study is to create a STEM focused high school-college partnership model to produce future STEM workforce. The study uses Social Cognitive Career Theory (SCCT) which is a relatively new theory that demands rationing the foundation of high school-college partnerships. The SCCT was developed by Robert W. Lent, Steven D. Brown, and Gail Hackett in 1994. The SCCT recently drew the attention of educators regarding students' career choices (e.g., Betz & Hackett, 1983; Byars et al., 2010; Hackett et al., 1992; Lent et al., 1993; Lent et al., 1994; Lent et al., 2010). The SCCT shows three aspects of career development: (1) how basic academic and career interests develop, (2) how educational and career choices are made, and (3) how academic and career success is obtained (<https://career.iresearchnet.com/career-development/social-cognitive-career-theory>). The SCCT was founded on Albert Bandura's general social cognitive theory, an influential theory of cognitive and motivational processes that has been stretched to the study of many areas of psychosocial functioning, such as academic performance, health behavior, and organizational development (<https://career.iresearchnet.com/career-development/social-cognitive-career-theory>). The core aspects in SCCT include self-efficacy beliefs, outcome expectations, interests, environmental supports and barriers (Lent et al., 2010). SCCT suggests a proper theoretical lens to study the problem of career choice (Lent, Brown, & Hackett, 1994, 2000) and has been applied in a small number of studies on STEM-related academic choice intentions (Betz & Hackett, 1983; Byars et al., 2010; Hackett et al., 1992; Lent et al., 1993; Lent et al., 2010).

The self-efficacy beliefs control the way people think, feel, and motivate themselves and their behaviors (<https://www.uky.edu/~eushe2/Bandura/BanEncy.html>). The SCCT explains that interest in subject choice is related to personal self-belief and learning experience.

This study suggests that forming a model high school-college partnership based on STEM focused curriculum throughout the high school years will give a strong foundation in STEM subjects. If students were given math early, the experience became of fundamental importance in future STEM education (e.g., Adelman, 1999; Bowman, 1998; Marshall et al., 2011; National Science Board, 2004). The early exposure will be a huge impact on students' self-efficacy on math and science subjects. Alhaddab and Al-natheer (2015) studied STEM major choice finds, which indicated that increasing math self-efficacy through K-12 in urban schools would increase their chances of majoring in STEM disciplines. Wang, X. (2013) states that mathematical self-efficacy belief has an essential role in pursuing STEM majors not only in minority students but all races. A strong math and science background plays a crucial role in producing a future STEM workforce.

The outcome expectation is another key component of SCCT. Bandura (1986) defines an outcome expectation as an individual's judgment of the likely consequences of behavior. This self-efficacy has a crucial role in development of an individuals' behaviors. Therefore, creating such a model for high school-college partnerships based on STEM focused curricula will affect individuals' self-efficacy on STEM subjects. The SCCT researchers, such as Lent et al. (1994), theorized that individuals make occupational decisions in concert with their judgments about likely work based outcomes (e.g., expected salary, the level of prestige).

Another key component of SCCT is the environmental factor. Bandura (1986) states that in an open environment that rewards performance achievements, the outcomes people expect depend heavily on their self-confidence that they can perform the skill (<https://www.nap.edu/read/2303/chapter/13#175>). According to Bandura (1986), environmental factors, not only physical factors but also people behaviors create self-efficacy beliefs (<https://www.uky.edu/~eushe2/Pajares/eff.html>). Therefore, a model high school-college partnership based on STEM focused curricula requires that students be surrounded by STEM advocate teachers. Exposure to STEM subjects is the core of the model. Students developed a strong foundation when they exposed the self-efficacy belief in STEM subjects.

The interest development is another key component of SCCT. There is a strong connection between self-efficacy and interest development (e.g., Lent et al., 1994; Nauta et al., 2002). Findings of both Nauta et al., (2002) and Lent et al., (1994) indicates that there is a correlation between self-efficacy and the formation of interests. The model high school-college partnership, the Young Scientist Program is focused on interest development for the individual. During the program, students are exposed to scientific research by college professors at local college science laboratories.

The barriers are the final key component of SCCT.

The model high school-college partnership is focused on students' senioritis issue, and college readiness standards are two of the major barriers for future STEM workforce. Wang (2013) states that mathematics is the most challenging subject and one of the biggest barriers for most students not choosing STEM majors in college. In his book, "The Math MYTH", Andrew Hacker points out that demanding math requirements across college students has been the biggest reason for a college drop-out. He also states that math requirement for high school graduation can be a cause of many high school drop-outs. College readiness standards have been the most challenging factors for many high school and college dropout students. According to Goldrick-Rab et al. (2007), the secondary level curriculum and assessments perfectly align with the academic desires of post-secondary institutions. Noble et al. (2006) research on students' achievement on college entrance tests, ACT, and SAT indicates that the key reason for success on these standardized tests is students' high school grades and course selections. Noble et al. (2006) findings included that students' ethnicity and family background had only 5-10 percent effects on success on these tests.

Most college drop-out incidents occur during the first or second year of college ([http://www.slate.com/blogs/moneybox/2014/11/19/u\\_s\\_college\\_dropouts\\_rates\\_explained\\_in\\_4\\_charts.html](http://www.slate.com/blogs/moneybox/2014/11/19/u_s_college_dropouts_rates_explained_in_4_charts.html)). The high school-college partnership model targets students' college readiness standards by earning college credits during high school years. Within this model, students are not only earning college credits but will also have less tuition in college. Students are expected to go beyond from their high school achievement level on math and science subjects.

Figure 1: Theoretical Model for High School-College Partnership Model

## Research Questions

Research Question 1: How does your school's college partnership influence your beliefs towards a science related career choice?

Research Question 2: To what extent does the college partnership fulfill the students' STEM curiosity?

Research Question 3: To what extent do the dual credit and AP courses fulfill the students' seniorities issue?

## Method:

All the participants were recruited from Gateway Science Academy of St. Louis (GSA) districts. GSA is a public charter school located in Saint Louis City and managed by Concept Schools. The GSA district has three campuses and serves 1400 students in grades K-12. The participants were recruited from 9-12 grades at Fyler campuses of the GSA district. There were about 46 senior students and 55 junior students at GSA. The researcher's goal was to reach

all senior and junior students who were getting ready to complete their course requirements to graduate. All junior and senior students at GSA were asked to be part of current research in the consent and assent form to collect data. However, no data was collected from students who wished to be excluded from the study. All participants were informed that they could withdraw their consent to be a part of research at any time. The researcher is an employee of the GSA school district. After IRBN approval, the researcher distributed the student assent and parent consent forms to GSA students and gave brief information about the study in their classrooms. The researcher distributed forms on the third week of April 2017 to parents and then conducted the interviews and surveys the second weeks of May 2017. There are two parts of this project:

**Part One Interview:** Interviews were conducted to develop a deep understanding of students' experience in the high school-college partnership. The researcher used maximum variation sampling to select interview candidates. Such sampling procedures enabled the researcher to hear voices from different backgrounds, grade levels, and involvement structure. The expected duration for interviews was 10 minutes. Five subjects were selected to participate in an audio-recorded interview with the researcher to compare and contrast quantitative findings. The interview questions were based on participants' experience in advanced science projects and dual credit enrollment.

**Part Two Surveys:** Approximately 100 subjects were asked to fill out a questionnaire. The role of subjects during the questionnaire was to share their experience. The survey was conducted online. The researcher used Google forms to send the online survey. The survey was administered to all students to avoid creating an environment in which a feeling of discomfort could emerge, but student's responses without assent and consent were not used. The survey took approximately 10 minutes. All names used in this study are pseudonyms.

## Findings

This study adopts qualitative research and quantitative method and uses focus group interview as the main source of data. The focus group participants in this study were in a STEM-focused-curriculum at GSA High School. The focus group students were enrolled in dual enrollment courses in two different platforms: on a campus, and online. In addition to enrollment in a college course, the focus group members also participated in advanced science fair projects, summer internship programs, and college visits. During the study, the focus group students were interviewed and surveyed by the researcher to distinguish the most crucial aspects of high school-college partnership.

## Qualitative Findings:

Three key conclusions appeared for all five student participants interviewed. They had common points on 1) taking an AP/Dual credit, the influence of college exposure/partnership, 2) STEM-centered programs (advanced science lab, robotics), and 3) early college experience senior year enrollment. The results highlight the model high school-college partnership impact on students STEM career choice.

The role of the advanced courses and early math/science exposure have an essential role on STEM workforce (e.g., Adelman, 1999; Bowman, 1998; Marshall et al., 2011; National Science Board, 2004; Wang, 2013). Most participants agreed that AP and dual credit courses made them more motivated as students. The high school-college partnership model has an important component of AP/dual credit curriculum (Table 1). According to National Assessment of Educational Progress (2009), (NAEP) high school students who took Advanced Placement (AP) or higher level courses in high school years had average NAEP scores at the Proficient level in both mathematics and science. Participant Sean indicated that during his interview, "AP and Dual credits are like doing part of college course work in high school and going faster to become more prepare near future". The focus group participants who were surveyed and interviewed in this study took the End of Course Assessments (EOC) and NWEA, and their test scores results support the NAEP data as well. The challenging courses are not only preparing students for college but also doing better on standardized tests. High school students had better scores on standardized test such as ACT when they are taking a rigorous curriculum (e.g., Goldrick-Rab et al., 2007; Noble et al., 2006). The model proposes student can earn more than 30 college credit by the time they graduate from high school. One of the participants, Ashley, earned 36 credits when she graduated. Ashley took AP and dual credit courses while she was junior. She was not able to take all of the courses on her school campus, so she took online dual enrollment courses as well. Utilizing this model can further students' choosing of his or her major, as well as increasing focus and accountability in college. A student can enroll in online dual enrollment courses if the courses are not offered on the high school campus. Ashley earned a total of 36 dual credit with a combination of AP credits, dual credits (on high school campus), and online dual enrollment credits. The model also gives opportunities for students to spend less time and money on college years. Participants' reflection on working on advanced projects help prepare and motivate them on a college path. All participants indicate that the learning was more hands on and was a more enjoyable experience. Math and science exposure during high school years can be a pipeline between high school and the STEM workforce (e.g., Adelman, 1999; Alhaddab & Alnatheer, 2015; Bowman, 1998; Marshall et

al., 2011; National Science Board, 2004; Wang, 2013). Participant Lopez states before joined the robotic team, she thought STEM was only smart people, and she could not make it. Lopez's statements speaks to a prejudice about STEM in the traditional classroom. However, using the model addresses the lack of exposure and focus on science during high school years. (Table 1). Hands-on activities and STEM focused clubs/teams (Robotic team, Young Scientist Club) makes students think about STEM field opportunities (Alhaddab & Alnatheer, 2015; Authors, 2012; Sahin, 2013). STEM-focused curriculum and working on advanced projects is not only affecting students' academic growth but also creative thinking skills and innovation skills (Project Lead The Way, 2011). Participant James said, "Before working on college lab on my science fair project, I never think about physics now, I think physics is a cool subject, so working with college professor made me think about physics as future major." Students participating in advanced science projects and science fair had a positive effect on their education (Authors, 2012; Sahin, 2013).

All of the participants shared alike comments on high school college partnership programs like college visits, STEM-focused curriculum, and college exposure: an opportunity for a STEM career and to prepare for college. Research on early math and science exposure indicates that students are more prepared for college (e.g., Adelman, 1999; Alhaddab & Alnatheer, 2015; Bowman, 1998; Marshall et al.; National Science Board, 2004; Wang, 2013). The model offers students opportunity and can be advantageous to college motivation as well as preparation. (e.g., Ann et al., 2016; Nunley & Gemberling, 1999; Watt et al., 2008). Participant Lopez commented regarding STEM curriculum and college exposure. She states, "I did not know more about STEM; I only knew certain people could participate, but not how to do it. After I participated in robotics in my school as a class, it opened my eyes to the careers that STEM offers. Now I have a wide variety of options I can go into". As Lopez testified, urban students had biases about STEM subjects. The model offers a curriculum which targets their needs. The earlier exposure on STEM subjects will prepare urban students better on these topics. Hands-on activity and working science projects are making a positive effect on students' science education (e.g., Authors, 2012; Sadi & Cakiroglu, 2011; Sahin, 2013). Participant Sean said, "I feel that really important have a partnership with the college. I feel that not only great opportunity for school also for students feel alone when they apply to college or go to college fell more supported and definitely create a less stress-free environment for students and school."

For a significant number of urban students, college life and environment are not more than a dream. Field trips to college campuses are small steps to making college a reality. Our research participant reflects on the extremely supportive environment for the benefit of the

	2015/2016	2016/2017	% Change
<b>Kazakhstan</b>	<b>464</b>	<b>486</b>	<b>4.70</b>
<b>Kyrgyzstan</b>	<b>72</b>	<b>70</b>	<b>-2.80</b>
<b>Tajikistan</b>	<b>57</b>	<b>50</b>	<b>-12.30</b>
<b>Turkmenistan</b>	<b>52</b>	<b>56</b>	<b>7.70</b>
<b>Uzbekistan</b>	<b>187</b>	<b>159</b>	<b>-15</b>
<b>Azerbaijan</b>	<b>158</b>	<b>149</b>	<b>-5.70</b>
<b>Turkey</b>	<b>5125</b>	<b>4776</b>	<b>-6.80</b>
<b>World Total</b>	<b>383,935</b>	<b>391,124</b>	<b>1.9</b>

**Table 1: Turkish International Students' enrollment in U.S Graduate Schools**

high school-college model. For participant Simone, these opportunities in the Young Scientist Program as well as college visit have been a mile stone in her life: "otherwise I could not have had the opportunity to participate summer internship program and worked with a college professor on an advanced chemistry project." In an urban school, a great number of students will not get to chance to see a college campus. Parents of students had multiple jobs and could not find time take their students to explore the college campus. Participant Justin said that the campus visit made a positive influence on his pursuing a college education. The model components: STEM-center programs (such as Young Scientist Program, robotic team), and college visits programs are supporting research question 1 and 2. To create a pipeline between high school to STEM workforce is one of the purposes of this study. Exposing STEM subjects and building STEM curiosity during the high school year will be an essential pipeline for STEM workforce.

The model is an emphasis on a rigorous curriculum but also the "seniorities" issue. The model offers a demanding curriculum, such as AP/dual credit courses during junior and senior years. To address the seniorities issue, it is vital to encourage the students, to challenge them, and to understand the college-level courses requirements. Our research participants reported that their senior year was "highly college motivated" and that they now "feel that they are in college." Students who are highly motivated treat their senior year as freshman year in college (before, they only needed one or two credits to enroll in their senior years to graduate from high school). The

model offers a good number of on campus and online college credits, which highly motivated seniors to enrolled in these courses. The model motivated students during their senior year and defeated the seniorities issue. Ashley, who enrolled in pharmacy college, earned 36 college credit. She said, "it was the awesome thing I get the opportunity for dual credit and online dual credit. I would not have the opportunity another way." School leaders' commitment to the high school-college partnership was a vital role. It required high-level collaboration between high school and college leaders.

## Quantitative Findings:

Internal consistency analyses (i.e., Cronbach's alpha) estimate the degree to which a set of test items are correlated with each other within a single measure (Miller & Neil, 2002). Higher alpha coefficients indicate better internal consistency. To establish convergent validity, one needs to show that measures that should be related are in reality related. The item-correlations provide evidence that subscale items are related to the same construct (Miller & Neil, 2002). The items in our survey indicated that internal consistency is at the acceptable level ( $\alpha = .84$ ,  $k = 9$ ) with moderate to high item-total correlations (Table 1).

Table ( 2) Item Total Statistics

The exploratory factor analysis (EFA) is usually used to determine number of factors through examining results obtained from the analysis based on different types of extraction methods. It is suggested that EFA should begin with Kaiser-Meyer-Olkin Measure of Sampling Adequacy

School years	Number of international students enrolled in U.S. Colleges and Universities
2016/2017	1,078,822
2015/2016	1,043,839
2014/2015	974,926
2013/2014	886,052
2012/2013	819,644
2011/2012	764,495

Table 2: Historical International Students' Enrollment in U.S. higher institutions.

Fit Index	
CFI	.92
TLI	.91
NFI	.95
RMSEA	.021

Table 3: Fit Index

	Estimate	S.E.	C.R.	Beta
SA1	31.835	.217	146.956	-.178
SM1	34.740	.235	147.748	.153
SI1	26.962	.114	236.216	-.137
SS1	31.535	.190	166.137	.229

Table 4: Means: (Group number 1 - Default model)

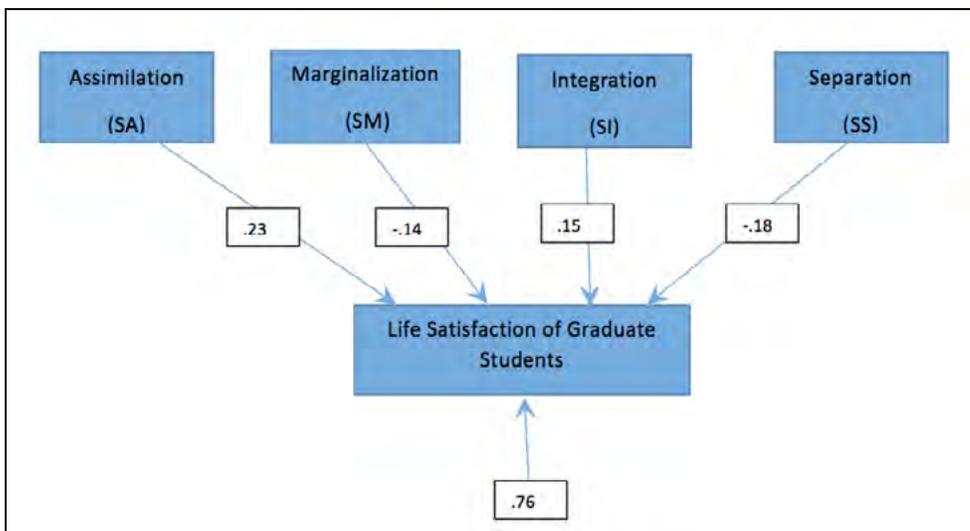


Table 5: Path analysis between life satisfaction and Turkish Ethnic Acculturation Measure Items (TEAMI)

(KMO). KMO value is .723, which means that the factor analysis will be appropriate. Bartlett's test of sphericity shows that the six indicators are related which supports KMO result (Table 3).

Table (3) KMO and Bartlett's Test for the Set of Nine Indicators of STEM curiosity and college readiness curricula.

Through examining scree plot and eigenvalues, one can figure out how many factors can be extracted from the data. The plot in Figure 2 and results in Table 4 provide contradictory results with regard to a number of factors to be extracted. When we use Kaiser Rule of one, the eigenvalue of two components are greater than 1.0, to three factors should exist. However, the screeplot indicates that two factor should be extracted because the line in the graph starts to level up after the second factor. Such results also are supported by the variance explained in the table. The third factor only explains 115 of the variation. The first two factors, on the other hand, explain more than 60% of the variation. Therefore, two factors will be extracted.

Figure 2 Scree plot of the Component vs Eigenvalue of the Set of Nine Indicators of STEM curiosity and college readiness curriculum.

Extraction Method: Principal Component Analysis

Table (4) Total Variance Explained for the Set of Nine Indicators of STEM curiosity and college readiness curriculum.

Table (5) Rotated Component Matrix for the Nine Items in Two Factors

Rotation matrix in table (6) indicated that items 7, 8, 11, 12, and 13 are in College Exposure and items 6, 9, 10, and 14 form the college readiness curricula.

After collection of data in order to test our research question, two types of analyses were conducted with the help of SPSS. First, descriptive statistics were run to have clear picture of the distribution of the means and standard deviation for each variable. Second, multivariate analysis was used to test the relationships between our two factors: number of courses students took and total college credits they accumulated at their senior year. Descriptive analysis of the each variable was conducted using SPSS in order to explore and investigate the distribution of the data. Based on the results in table (8), it can be seen that average mean score of two factors were 15.74 and 14.79, respectively. The mean number of courses students took at their senior year was 11.03 and the college credit they gained was 6.87.

Table 6: Means and Standard Deviations of Factor 1, College Exposure, and Factor 2, College Readiness

The results in table 6 indicated that College Readiness ( $F(34, 24) = .54, p = .95; \text{Wilks}' \Lambda = .32$ )

and College Exposure ( $F(26, 24) = .56, p = .92; \text{Wilks}' \Lambda = .39$ ) have no statistically significant influence on either the number of courses senior students took or the total number college credit they accumulated. The interaction

effects of Factor 1 and Factor 2 ( $F(44, 24) = .53, p = .97$ ; Wilks'  $\Lambda = .26$ ) did not show any significant result on either number of courses or college credit. Even though the statistical test did not demonstrate any significant results, the effect size of the analysis were between .38 and .50, indicating that scientific significance is present. In other words, The multivariate effect size was estimated at .50, which implies that 50.0% of the variance in the number of courses taken and the total number of college credits gained could be accounted for by College Readiness and College Exposure. Failing to reject null hypothesis could be the power of the analysis. As our results suggested, the observed power is quite low (less than .30). The analysis could be replicated with a large sample size to examine the relationship between the independent and dependent variables.

Table 7 Multivariate Tests Results with Wilks'  $\Lambda$

## Discussion and Conclusion

The goal of this study was to develop a theoretical frame work for high school-college partnership and evaluate the evolving model partnership between GSA and local colleges. The study evaluated the model partnership and created theoretical a model high school-college partnership (Table 1). Three main components of the SCCT: self-efficacy beliefs, outcome expectations, interests, environmental supports and barriers form the foundation of this theoretical model (Lent et al., 2010). The model emphasizes exposure to math and science curriculum highly during the high school years. The early exposure to these topics will eliminate the bias toward these subjects and create self-efficacy (Adelman, 1999; Bowman, 1998; Marshall et al., 2011; National Science Board, 2004; Wang, 2013). There is a shortage in STEM workforce ([https://www.bls.gov/emp/ep\\_table\\_103.htm](https://www.bls.gov/emp/ep_table_103.htm)). The reason for this shortage is students' self-efficacy beliefs on math and science subjects. This model has a potential to become a pipeline to the STEM workforce. A great number of research on high school college partnership indicates the benefits to students (e.g., Brewster et al., 2016; Nunley, & Gemberling, 1999; Watt et al., 2008). Interviewed participant Lopez affirmed that she had prejudged STEM. Once she joined the robotic team, her attitude changed, and now she is looking at a STEM career in college. The data from surveys support that there is a correlation between numbers of course enrollment in junior and senior years and a total number of college credits earned in high school. The model offers more advanced courses (AP and Dual credits) during junior and senior years. Students are more motivated on college credits courses. During senior years, students that are enrolled in more AP and dual credit courses, thus eliminating temptation of seniorities and making them more motivated to the challenges of college. The model has potential not only to decrease drop-out but prepare the students' college ready stan-

dards (Nunley & Gemberling, 1999).

The high school college partnership model has clear outcome expectation. The model creates a pipeline from secondary to the STEM workforce ([https://www.bls.gov/emp/ep\\_table\\_103.htm](https://www.bls.gov/emp/ep_table_103.htm)). The data from qualitative findings correlate with the need for this model. All focused groups' students stated that "they couldn't have the opportunity to participate in a summer internship program and work with a college professor on an advanced science project." The outcome expectation of theoretical model is reflected on students' career development. The model exposes math and science along STEM focused clubs and teams. As qualitative findings indicate STEM clubs and teams, it also shapes a future STEM workforce (e.g., Authors, 2012; Sadi, & Cakiroglu, 2011; Sahin, 2013). Qualitative data shows that STEM-focused college readiness curriculum encourages future student enrollment by allowing them to earn dual credit. The urban students benefit from this model and could potentially produce a future STEM workforce. The study on urban students' ACT success determined that strong high school curriculum to be the biggest reason for a high score on ACT (e.g., Goldrick-Rab et al., 2007; Noble et al., 2006).

In an age of golden technology, all students, regardless of their background, should prepare for higher education. To assure prosperity for postsecondary education, all students must have these opportunities in high school, which emphasize a demanding curriculum. We highly recommend comprehensive perspective between secondary education and college. Besides the long-term benefits and exposure to the students, STEM builds self-efficacy in math and science subjects. The study investigates model high school-college partnership initiatives, which have been done between the GSA and local colleges. The study proves that STEM focused high school curriculum and preparing students for college readiness subjects can increase student graduation rate and produce STEM workforce. The model partnership study proves that the more students that are exposed and explored STEM subjects, the more self-efficacy will increase in education, thus providing a more sustainable STEM workforce. Increasing student self-efficacy by demanding STEM curriculum and college exposure is the core component of this model. The relative new model high school-college partnership can be a solution to seniorities issues and STEM workforce. The model can be improved and pilot program studied by other secondary schools and colleges.

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My name is **Mustafa Icel**, and this is my 20th year in education as a teacher and school leader. I earned my BS in Physics Teaching (1997), Master in Education Leadership (2007), and currently Ph.D. student in University of Missouri of Saint. Louis (UMSL). I started my teaching career teacher in the Private High School. After 3 years of teaching in Private High School, I spend my entire career in urban districts in Cleveland, Ohio, Cincinnati, Ohio, Minneapolis, Minnesota and currently in St. Louis, Missouri. I'm highly motivated work on area of STEM education.



**Matthew D. Davis** is associate professor of educational foundations at the University of Missouri-St. Louis (USA). His major teaching and research interests are educational history, policy, and politics as well as critical race perspectives in educational research.



## Attachment 1:

Sample Partnership Agreement between High school and University:

1. This partnership creates a mutual benefit for high school students and university undergraduate/graduate students.
2. As a result of this partnership, university students will develop both academically and personally.
3. The university can use high school as a source for grants, research, publication, and other academic activities.
4. This sample partnership model can be used as a blueprint for further studies.
5. This sample partnership model can be theory to real life application.
6. This sample partnership model can be duplicated throughout the U.S.
7. This sample partnership model will contribute to decrease dropout rate and disconnection problem solving.
8. High school students will be given opportunity at the university for service learning.
9. High school students will be given opportunity at the university for individual researches.
10. High school students will be given opportunity at the university for working on advanced science projects by using university science labs.
11. This sample partnership model is an opportunity for university students to do their student-teaching/student practicum at high schools.
12. The university students will be given opportunity tutoring students at the high school.
13. The university students will be given opportunity mentoring advanced teams such as lego-robotic at the high school.
14. High school students will be given opportunity for a shadowing day -the major they are looking for at the university.
15. This sample partnership model can be departmental.