Dual Enrollment Student Achievement in Various Learning Environments

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ABSTRACT

The purpose of this study was to examine whether variations in student achievement in college courses exist between high school students who took the courses as dual enrollment (DE) courses and academically comparable high school students (AIMS scholars) who took the courses upon matriculation to college. Additionally, the researcher explored whether differences exist in DE course grade for students by course environment (online, face-to-face at a high school, or face-to-face at a college.) The researcher used final course grades as determinants of student achievement. The study focused on DE student and AIMS scholar grades in English 111, Biology 101, Math 163, and History 101 courses that were taken between the 2009-2010 and 2013-2014 school years at a community college in Southwest Virginia. The population consisted of 429 AIMS scholars and 2,015 DE students. For this study 3,639 DE student grades and 706 AIMS student grades were used in calculations. The dependent variables in this study were final course grades; the independent variables were DE participation and course delivery environment. Welch's t tests were used to examine the variations in final grades for DE and non-DE students; ANOVA procedures were used to examine variations in final course grades for DE courses based on delivery environment.

Introduction

The No Child Left Behind Act of 2001 furthered dialogue regarding a more rigorous high school curriculum; this dialogue has continued throughout the past decade, and it has culminated in strong educational rhetoric by President Barack Obama as he called for a 50% increase in students who were taking dual enrollment (DE) or advanced placement courses by 2016 (Obama for America, 2008). During the 2010-11 school year 53% of collegiate institutions hosted students taking DE courses on their campus (Marken, Gray, & Lewis, 2013). This number has since increased, and the overall DE population currently includes over two million students nationwide (Schachter, 2014).

Statement of the Problem

Due to recent legislation more students have an opportunity to take DE courses; however, the extent to which DE is successful in preparing students for college can vary based on locale and access to a participating postsecondary institution (Edwards, Hughes, & Columbia University, 2011). This varying access has resulted in multiple methods of DE delivery that span various classroom environments. The U.S. Department of Education (2007) has demonstrated that such varying methods of course delivery are a nationwide norm. Because of this variation, researchers have raised questions about the effectiveness of varying methods of DE course delivery (Howley, Howley, Howley, & Duncan, 2013).

Despite research regarding the benefits of DE programs in general, there are few existing studies that disaggregate

DE student success according to DE course setting. Ozmun (2013) suggested that "disaggregating students by delivery modality" would provide a richer analysis of DE programs (p. 70).

The purpose of this comparative study is to examine if variations in student achievement exist between dual enrollment (DE) English, biology, history, and mathematics course environments and between dual enrollment students' grades and the grades of academically comparable peers. For the purpose of this study academic achievement is defined as final grade in class. Introductory English, biology, mathematics, and history courses were chosen for this study because they are often offered as DE options and because they are included in many general education curricula.

Background

Because of the popularity of DE programs in recent decades, states have begun to provide policies that govern such high school and college interactions. As of 2012, 46 states had policies that governed DE, and 12 of those states had mandatory participation from postsecondary institutions (Hofmann & Voloch, 2012). Although states have mandated participation, DE program delivery environment differs with instructor availability and region. Because of this, factors such as course delivery environment are left to the participating high school and college partnerships.

Program Benefits for Students

There are many academic advantages of DE that increase the likelihood of matriculation after high school. Fincher-Ford (1997) demonstrated that early objectives of these programs included transitioning seamlessly from high school to college, earning college credits before entering higher education, and "shorten[ing] the time required for high school students to complete an undergraduate degree" (p. xiii).

Accelerated learning programs such as DE were intended to provide the opportunity for students to be introduced to academic rigor so that they have an increased chance of continuing college beyond the first semester. A lack of college readiness accounts for many college students' initial academic failings; however, DE courses promote college readiness in multiple content areas including both technical education and transfer-level courses (Ganzert, 2014; Martin, 2013). Another key advantage of DE programs is that students who have taken these courses are more likely to continue their education beyond high school (Columbia University, 2012). Ozmun (2013) found that because DE students are more familiar with college norms, students who take DE courses may be more likely to "persist beyond their first semester or first year of college" (p. 62). Additionally, researchers have found that upon matriculation to a college or university, students who have taken DE courses perform better academically than students who had no previous DE experience (Jones, 2014).

Dual Enrollment in the Online Environment

Online delivery of DE courses occurs much less frequently than delivery on a high school or college campus (Blackboard Institute, 2010). Though Mellander (2012) contended that "students who attend superior high schools do not expect to take classes on the web" (p. 68), he also demonstrated that postsecondary academic institutions (including the Maryland and Minnesota university systems) required their students to take a certain percentage of courses that were delivered via an "alternative learning" method (p. 67).

Dual Enrollment in the High School Environment

Although original concurrent enrollment partnerships were designed to take place on the high school campus ("About NACEP," n.d.), college administrators and faculty express concern "about their ability to ensure the quality of the courses taught in high schools by high school faculty" (Kinnick, 2012, p. 40). Additionally, many college instructors felt that the dialogue with high school instructors was dominated by focus on paperwork and deadlines rather than course content (Howley et al., 2013). In contrast, high school instructors believed that their lack of knowledge about college policy and procedures acted as a distinct impediment to performance (Howley et al., 2013). Zimmerman (2012) critiqued, exclusively, the impact of the physical high school setting to DE progress. Because, he argued, the high school setting has its own etiquette and decorum that is distinctly different from the college setting, DE students within the high school setting are not fully benefitting from courses that are meant to be transitional.

Dual Enrollment in the College Environment

Instead of being confused and daunted by a college atmosphere, studies have found that DE students thrive when DE courses are taken at a college or university. For instance, the Community College Research Center (CCRC) found that students in Florida, New York City, and California who took DE courses on a college campus were 9% more likely to enroll in college, 6% more likely to pursue a bachelor's degree, and 5% more likely to attain a bachelor's degree than students who took DE courses on a high school campus (Columbia University, 2012, p. 5). CCRC also reported that there were no distinguishable benefits for students who had taken DE courses on a high school campus versus those students who had not taken DE at all.

Conclusion

Research has demonstrated that participation in an effective DE program increases the likelihood that students will be emotionally and academically prepared for the rigor of either a 2-year college or 4-year university. While there is conflicting evidence regarding the extent of the academic benefits of DE, the generally stated conclusion among schools and policymakers is that DE is an effective method of bridging the gap between high school and college.

Methodology

The purpose of this comparative study was to examine whether variations in student achievement in college courses exist between high school students with dual enrollment (DE) credit and academically comparable high school students with no DE credit. Additionally, the researcher explored whether differences exist in course grade for DE students by course environment (online, face-to-face at a high school, or face-to-face at a college.)

Design

Within this study the grades of non-DE students were compared with the grades of DE students respective to each content area. Additionally, the grades of DE students were compared based on DE course environment (online, F2F at a high school, and F2F at a college).

The design of this study was focused on the impact of DE delivery method on DE course achievement as well as the DE student grades in comparison with their non-DE peers. In order to evaluate the impact of DE delivery method, the research questions focus on method of DE delivery and content area-specific DE course achievement. Because high school students who enroll in DE have higher levels of academic preparedness than the average high school student (Allen & Dadgar, 2012), selection bias was addressed by comparing DE students to a comparison group of AIMS scholars. In order to be an AIMS scholar at the college where the study is being completed, "students must achieve a grade of at least 'C' or better in each of the 17 approved high school courses" ("AIMS Higher Scholarship," 2014, para. 3). There is no GPA cutoff or requirement for DE participation (Virginia's plan for, 2008). For this reason AIMS scholars and DE students are academically comparable.

The following research questions were used to guide this study:

1. Is there a significant difference in English 111 final grade for students who took English 111 as a dual enrollment course and AIMS scholars who entered college with no English 111 dual enrollment credit?
2. Is there a significant difference in dual enrollment English 111 final grade for students who took dual enrollment English 111 online, face-to-face at a high school, or face-to-face at a college?
3. Is there a significant difference in Biology 101 final grade for students who took Biology 101 as a dual enrollment course and AIMS scholars who entered college with no Biology 101 dual enrollment credit?
4. Is there a significant difference in dual enrollment Biology 101 final grade for students who took dual enrollment Biology 101 online, face-to-face at a high school, or face-to-face at a college?
5. Is there a significant difference in Math 163 final grade for students who took Math 163 as a dual enrollment course and AIMS scholars who entered college with no Math 163 dual enrollment credit?
6. Is there a significant difference in dual enrollment Math 163 final grade for students who took dual enrollment Math 163 online, face-to-face at a high school, or face-to-face at a college?
7. Is there a significant difference in History 101 final grade for students who took History 101 as a dual enrollment course and AIMS scholars who entered college with no History 101 dual enrollment credit?
8. Is there a significant difference in dual enrollment History 101 final grade for students who took dual enrollment History 101 online, face-to-face at a high school, or face-to-face at a college?

Data Analysis

Data analysis began with descriptive statistics that provide an overview of the population by demonstrating the percentage of the population that had not taken DE courses

as well as those that had taken biology, history, English, and mathematics as DE courses. DE data were further separated by course environment (online, F2F at a high school, and F2F at a college) for DE Biology 101, History 101, English 111, and Math 163. After descriptive analysis the researcher examined research questions in terms of collected data. Student letter grades were treated as interval data, which is typical in educational research in order to run statistical procedures and gather means (Kaplan, 2011). Data indicating a grade of "Incomplete" or "Withdrawal" were not included in calculations.

Research questions 1, 3, 5, 7, and 8 were analyzed using an independent samples t test. The t test is also a statistical procedure that has a well-established history in research (Pelham, 2012). When the results of these procedures yielded significant results, the researcher continued analyses by "estimating the size of the underlying effect" (Witte & Witte, p. 285). Although the nature of research question 8 was appropriate for Analysis of Variance (ANOVA), the sample size for the group of History 101 DE students who had taken the course on campus was quite small (n=5). Because this population distribution was nonnormal, omission of this group yielded more trustworthy results.

Research questions 2, 4, and 6 were analyzed using Analysis of Variance (ANOVA). ANOVA "tests whether differences exist among population means categorized by only one factor or independent variable" (Witte & Witte, p. 338). For instances in which the ANOVA revealed significant differences among the means, post hoc analyses were completed by testing against the mean using the Games-Howell procedure, which works well with unequal sample sizes (Games & Howell, 1976). Where needed, effect size was calculated in order to gauge the "difference between population means" (Witte & Witte, p. 287). All statistical analyses were completing using an alpha level of 0.05, which is widely accepted in the field of educational research (Leahey, 2005).

Findings

The study was focused on DE student and AIMS scholar grades in English 111, Biology 101, Math 163, and History 101 courses that were taken between the 2009-2010 and 2013-2014 school years at a community college in Southwest Virginia. The population consisted of 429 AIMS scholars and 2,015 DE students. For this study 3,639 DE student grades and 706 AIMS student grades were used in calculations. The research questions outlined earlier were used to guide this study. The distribution of subjects between AIMS and DE by course is presented in Table 1. (Unequal sample sizes were taken into account during calculations.)

The dual enrollment population was also divided based on course delivery environment. Four of the eight research questions required such disaggregation. The breakdown of DE course delivery environment is provided in Table 2.

Results: Research Questions 1, 3, 5, and 7

Research questions 1, 3, 5, and 7 focused on the difference in final course grades for DE and AIMS students in four content areas, English, biology, mathematics, and history.

Table 1
Presentation of Student Grades by Course and Student Type

Student Type	Course							
	English 111		Biology 101		Math 163		History 101	
	n	%	n	%	n	%	n	%
Dual Enrollment	1,456	85	719	78	1,116	92	348	72
Non-Dual Enrollment	262	15	204	22	102	8	138	28
Total	1,718	100	923	100	1,218	100	486	100

Table 2
Dual Enrollment Sample Characteristics by Course Environment

Course Environment	Course							
	English 111		Biology 101		Math 163		History 101	
	n	%	n	%	n	%	n	%
DE Online	239	16	65	9	102	9	72	21
DE at High School	1,062	73	618	86	984	88	271	78
DE at College	155	11	36	5	30	3	5	1
Total	1,456	100	719	100	1,116	100	348	100

All *t* tests yielded significant results, demonstrating that DE students performed higher (based on final course grade) than non-DE students. The results of these research questions aligned with the results with many other studies that have demonstrated the success of DE programs (Ganzert, 2014; Jones, 2014; Karp, 2012; Martin, 2013). The difference between DE and AIMS student grades was most evident in Math 163, with a mean difference of 1.25 in final letter grades for DE and AIMS students. (One point is representative of one letter grade). Although this content area had the highest mean difference in final course grade, there were also mean differences in English, biology, and history that were 0.89, 0.83, and 0.86 respectively.

It is possibly because the students who took these courses as DE courses had additional support systems in place that they were more successful than their non-DE peers. Farrell and Siefert (2007) as well as Karp (2012) reported the importance of emotional scaffolding and the feelings of academic safety that accompany DE programs. Because a comparison group of AIMS scholars was used in this study, it is not accurate to say that these DE students were simply better students than the AIMS group. Instead, factors such as student support services and academic rigor may be better indicators of this variation in student success.

Results: Research Question 2

Research question 2 focused on the mean difference between final course grade in DE English 111 based on course delivery environment: online, F2F at a high school, or F2F at a college. An ANOVA yielded significant results, and *post hoc* procedures demonstrated that final course grades in DE English 111 that was delivered on a college campus were significantly lower than DE English 111 that was delivered on either a high school campus or in an online environment. There was no significant difference in final course grades between the high school and online environments.

There are multiple factors that could contribute to both the lower grade in the college environment as well as higher grades in online and high school environments. Firstly, it is possible that the DE English 111 course that was delivered on a college campus was more rigorous. Columbia University (2012) demonstrated that there were no benefits for students who had taken DE courses on a high school campus versus those who had not taken DE courses at all. It is possible that students who took English 111 on a college campus were simply not prepared for the rigor of a college course or for the freedom of the college environment.

Results: Research Question 4

Research question 4 was focused on the mean difference between final course grade in DE Biology 101 based on course delivery environment: online, F2F at a high school, or F2F at a college. An ANOVA did not yield significant results, and *post hoc* procedures demonstrated small variations among the means. The means for each delivery environment ranged from 2.86 (online environment) to 3.09 (high school environment). The college environment mean final course grade was 3.0 (a B in the class).

Results: Research Question 6

Research question 6 was focused on the mean difference between final course grade in DE Math 163 based on course delivery environment: online, at a high school, or at a college. An ANOVA did yield significant results, and post hoc procedures (via the Games-Howell procedure) outlined significant differences between the online group and the college group and between the high school group and the college group. There was no significant difference in DE Math 163 final course grade between high school and online DE Math 163 groups.

These results are fairly similar, in terms of areas of variation, to the English 111 groups. It is evident in both analyses that students who took the courses on a college campus performed significantly lower than the students who took the course online or at a high school. The students who took DE Math 163 online had a mean final course grade of 3.07, those who took the course at a high school had a mean final course grade of 3.10, and those who took the course at a college had a mean final course grade of 2.20.

Results: Research Question 8

Because the sample size for students who had taken DE History 101 on the college campus was so small (n=5) a Welch's t test was used to examine the variations between final course grade for students who had taken the course online and at a high school. The results of this test were statistically significant; students who took the course online had higher final course grades than students who had taken the course on a high school campus. DE students who took the course high school had a mean final course grade of 3.60, whereas students who took the course online had a mean final course grade of 3.89.

These specific findings conflict with many perceptions of the online course environment reported by educational researchers such as El Mansour and Mupinga (2007) and Bergstrand and Savage (2013). Students are often unfamiliar with online course platforms, due dates, and

decreased instructor interaction, and they often feel disconnected from the course and their grades suffer. Two main issues could account for these differences. Students now are more familiar with technology because they have interacted with it both personally and within educational settings. For this reason a more self-paced, low-interaction course could serve both acceleration and enrichment for advanced students. Additionally, there could be an issue in terms of rigor in one of the educational settings. Because, for this content area, there was little difference in student success in online and F2F courses, it is evident that these online courses could present a cost-effective alternative to F2F courses at a high school if they are as rigorous and provide the same amount of college preparation (in the long term) as F2F courses.

Conclusions

Recommendations for Practice

Because DE programs are associated with increased student success, it is imperative that colleges continue to grow, fund, and support them. Not only do such programs result in increased Full Time Equivalency (FTE) for colleges, but they also provide necessary scaffolding and preparation for collegiate studies. For this reason, the following recommendations are been made in light of this study's findings.

In English 111 and Math 163, students who had taken the courses F2F at a high school performed better than students who had taken the courses on a college campus. For this reason DE courses delivered on a high school campus should also be evaluated according to college standards, including course observations. Although DE course syllabi are evaluated according to college standards, further review of environment would strengthen programs across the board.

Secondly, the online courses examined within this study did not yield significantly lower final course grades. For this reason, colleges and high schools should work to provide more of these online courses and also to monitor them in a way that colleges can continue to ensure their effectiveness. Because more students can often be put in an online class than in a F2F one (because of seating restrictions), these online courses can be a convenient, cost-effective solution to staffing issues .

Recommendations for Further Research

Although results of this study demonstrated both that DE is effective and that student success for English, mathematics, and history (but not biology) based on DE delivery environment does differ, there are still many areas of DE research that could yield significant benefits to the field. Data-driven research, in all fields, is necessary to promote program growth and development. Studies such as those suggested below would significantly address many of the areas of inquiry that this study's results show are necessary for advancement in the field of DE.

1. A study that expands the study to multiple colleges and college types (community college and 4-year college or university) could demonstrate whether this study's findings are commensurate across a college system.
2. This study could be expanded into a paired-samples study that addresses the question of whether higher final course grades, based on environment, equate to increased college success.

In conclusion, the results of this study demonstrated that DE is effective insofar as it results in higher course grades as compared to comparable non-DE students. Although there were significant differences in final course grades for English 111, Math 163, and History 101 based on DE course delivery environment, this type of analysis should be further carried out by colleges that offer DE courses within various environments at least on a bi-yearly (every 2 years) basis.

Ensuring that DE programs do shift with the nature of instruction and technology is not only a way to make sure that DE programs remain effective but that they are also efficient in carrying out the goal of promoting student success. Dual enrollment is an area that remains rich as an area for research; it is only through a study of the nuances of these programs that colleges can best serve their students and communities.

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