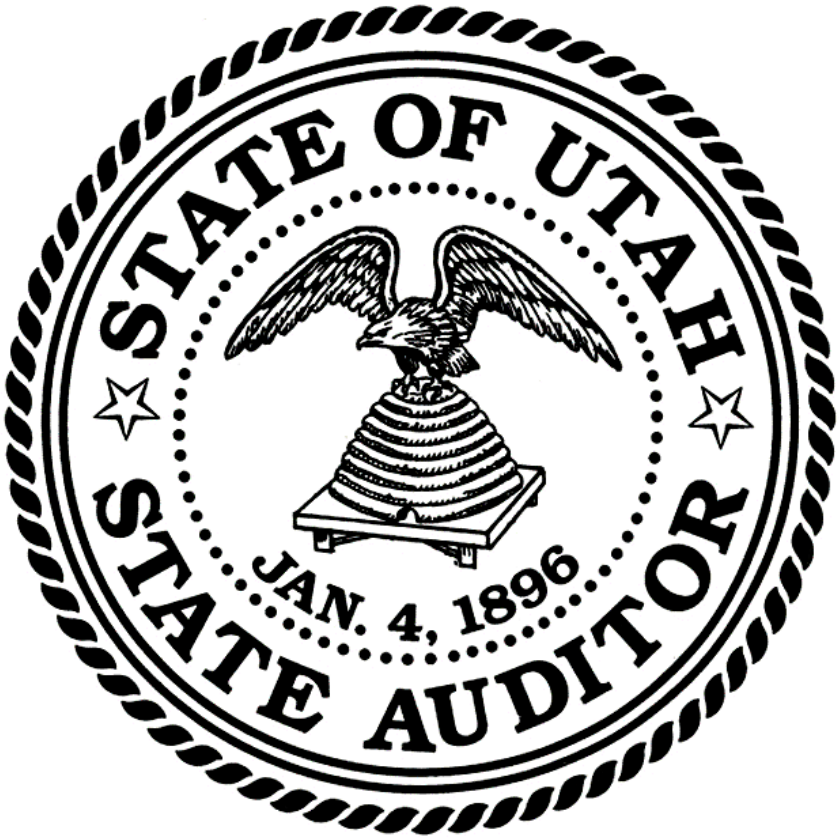
Analysis Report No. AR 15-01

Steps to Improve College Graduation Rates

College Preparation and Student Success

April 21, 2015



OFFICE OF THE
UTAH STATE AUDITOR

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Table of Contents

Introduction 1

Section 1: Preparation for College Readiness 1

Most High School Graduates are Unprepared 2

High School Graduates Have High Hopes 3

Access to College Not a Limiting Factor 4

Comparing Utah's Preparation 5

Section 1: Recommendations 5

Section 2: Performance Measures Related to College Graduation 6

Definition of Graduation Rates 6

Performance Measure: Enrolled Semesters 9

Performance Measure: Course-Hour Completion 10

Performance Measure: Average Enrolled Hours 12

Performance Measure: ACT Scores 13

Performance Measure: Remediation Hours 14

Performance Measure: GPA 15

Performance Measure: Other Factors 15

Performance Measures: Combined Model 16

Section 2: Recommendations 17

Section 3: Earning STEM Degrees Requires High Preparation 18

High School Preparation Affects STEM Graduation 18

STEM Graduates are Different 20

High Performing Students Were Attracted to Certain Degrees 21

Section 3: Recommendations 23

Conclusion 24

Supplementary Background - Data and Methodology 26

Supplementary Background - Public Finance Related to Education 28

References 29

Agency Response 30

List of Figures

Figure 1. ACT Benchmarks Passed by 2014 Utah High School Graduates by Subject 2
Figure 2. ACT Benchmarks Passed Relative to Taking Recommended Courses 2
Figure 3. Plans of Utah High School Graduates Compared to Historical Degree Attainment 3
Figure 4. High School Enrollment Expectations Compared to Historical College Enrollment 4
Figure 5. Share of High School Graduates at or below Composite ACT Scores 5
Figure 6. Graduation Rates by Enrolled Semesters.....6
Figure 7. Total Degrees Earned 7
Figure 8. Percentage of Students by Highest Undergraduate Degree Earned 8
Figure 9. College Achievement by Enrolled Semesters 9
Figure 10. Graduation Rate & Degree Share by Enrolled Semesters.....9
Figure 11. Degrees Granted and Time to Graduate By Average Course-Hour Completion Rate 10
Figure 12. College Achievement by Average Course-Hour Completion Rate.....11
Figure 13. Graduation Rate & Degree Share by Average Course-Hour Completion Rate 11
Figure 14. Degrees Granted and Time to Graduate by Average Enrolled Hours per Semester 12
Figure 15. College Achievement by Average Enrolled Hours per Semester 12
Figure 16. Graduation Rate & Degree Share by Average Enrolled Hours per Semester 13
Figure 17. College Achievement by ACT Scores.....13
Figure 18. Graduation Rate & Degree Share by ACT Scores 13
Figure 19. College Achievement by Total Remedial Credit Hours 14
Figure 20. Graduation Rate & Degree Share by Total Remedial Credit Hours 14
Figure 21. College Achievement by Highest Semester Cumulative GPA 15
Figure 22. Graduation Rate & Degree Share by Highest Semester Cumulative GPA 15
Figure 23. Measures Predictive of Graduation 16
Figure 24. Distribution of Non-STEM and STEM Graduates by ACT Score 18
Figure 25. Relative Likelihood of Graduating with a STEM Degree by ACT Score 18
Figure 26. Share of Graduates Declaring Intent to Pursue a STEM Major 19
Figure 27. Share of Interested Graduates that Succeed in Earning a STEM Degree 19
Figure 28. Hourly Earnings by Educational Attainment by STEM Field.....20
Figure 29. Measures Predictive of STEM Degrees 20
Figure 30. Undergraduate ACT Distribution by 15 Largest Clusters of Study.....21
Figure 31. Undergraduate ACT Distribution by 15 Largest Majors.....21
Figure 32. Undergraduate ACT Distribution by the 80 Largest Fields of Study 22
Figure A. Summary of Data 26
Figure B. Age Group Population and Enrollment.....28
Figure C. State and Local Education Expenditure 28

Introduction

Vast public and private resources flow into Utah's education system. A knowledgeable and skilled workforce helps drive innovation and growth within the economy. Higher education provides many individuals with access to well-paying jobs and opportunities for a high quality of life. However, these gains are overwhelmingly concentrated among students who graduate with college degrees. Participation is also increasingly expensive; over recent decades tuition prices have increased faster[1] than medical inflation and price changes for most other goods and services. Funding mechanisms are under stress, student debt in the United States exceeds $1 trillion[2]—students, parents, public officials, the media, and researchers are demanding more accountability. Gauging successful performance in a timely, repeatable, and actionable way is critical to forming effective policies to guide future incentives, budgets, and delivery of higher education in Utah.

The Office of the Utah State Auditor analyzed 50 million higher education records related to student performance from 1999 through 2014 to look for good metrics that would predict which students completed undergraduate degrees in Utah's System of Higher Education. We found that the average percent of course-hours complete and the average hours enrolled per semester for students are excellent measures that predict graduation. We also found that predicting graduation for Associate and Bachelor degrees, and especially degrees in Science, Technology, Engineering, and Math (STEM) , depended on different factors. Performance funding programs should properly account for these complexities.

Section 1: Preparation for College Readiness

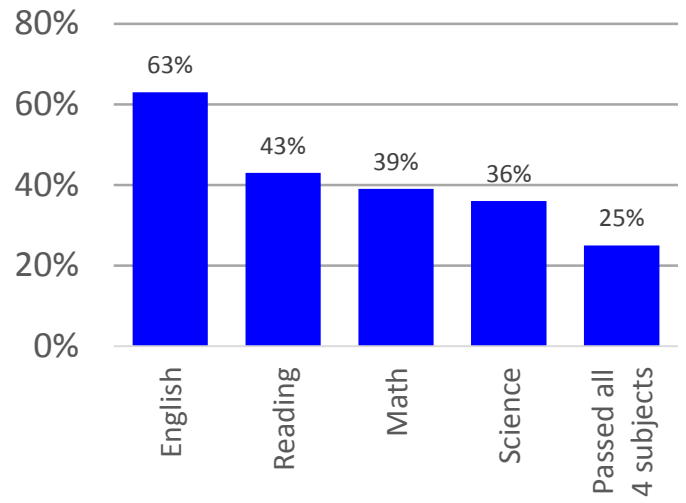
Findings

The majority of Utah's high school graduates are unprepared for initial success in college. We reviewed reports that gauged the preparedness of Utah's high school graduates. In analyzing this data, we found:

- Only 25% of recent high school graduates were considered prepared to succeed in entry-level college courses.
- Students taking the recommended college preparation courses during high school were much more likely to succeed in corresponding entry-level college subjects than students who did not take the recommended courses.
- While 84% of 2013 high school graduates want a college degree, only 40% enrolled in college within a year after graduation. However, 77% of 25 to 34 year olds have enrolled in college at some point. Thus, gaining access to college does not appear to be a problem for most students in Utah.

"Only 25% of Utah's 2014 graduating seniors were considered prepared for success in entry-level college courses."

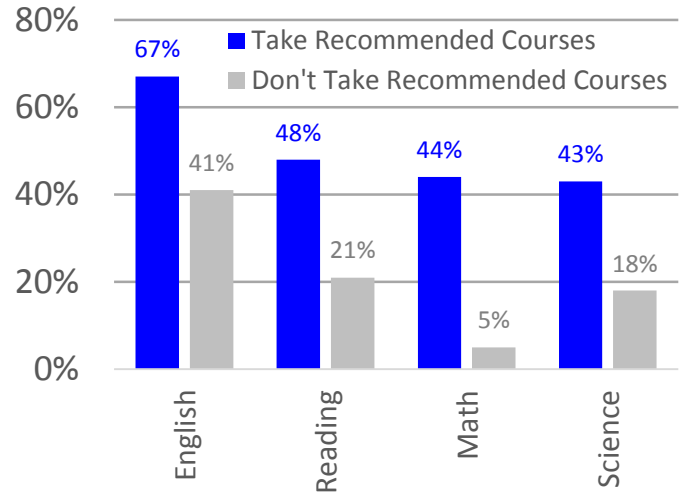
Figure 1. ACT Benchmarks Passed by 2014 Utah High School Graduates by Subject



Source: ACT, *The Condition of College & Career Readiness, Utah*

"Students that take recommended courses related to English, Reading, Math, and Science are better prepared for college."

Figure 2. ACT Benchmarks Passed Relative to Taking Recommended Courses



Source: ACT, *The Condition of College & Career Readiness, Utah*

Evidence

Most High School Graduates are Unprepared

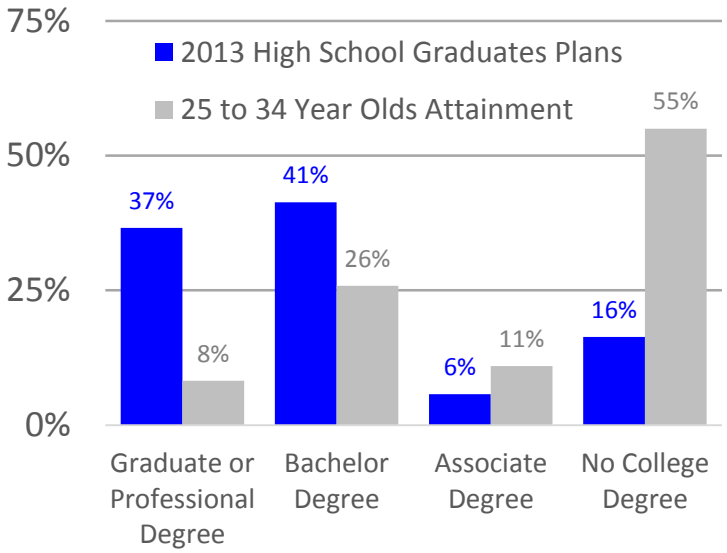
Current benchmarks show that the overwhelming majority of Utah's students hope to attend college, but most are unprepared for ultimate success by earning a college degree. In this report, reference to college encompasses the 8 public degree granting colleges and universities in Utah. The ACT provides annual reports[3] on the condition of each state's college and career readiness. **Figure 1** shows that only 25% of Utah's 2014 graduating seniors were considered prepared for success in entry-level college courses by passing subject benchmarks in all four areas of English, Reading, Math, and Science. Based on the empirical research of the ACT, they define the benchmark[4] for student success as college freshmen having a 50% chance of earning at least a B or a 75% chance of earning at least a C in corresponding entry-level college courses. The situation in Utah is similar to the rest of the nation.[5] The College Board created similar benchmarks[6] that showed 43% of students nationwide, who took the SAT, were likely to get a first-year GPA of a B- or higher. The National Assessment of Educational Progress (NAEP) showed that 40% of students nationwide were considered academically prepared in Math and Reading according to a preliminary indicator,[7] consistent with Utah's scores.

Figure 2 divides Utah's high school graduates into two groups—those who take the recommended college preparation courses[8] in a subject and those who do not. Students who report taking board recommended courses related to English, Reading, Math, and Science are better prepared for college. For example, students who took the recommended

Math courses pass that benchmark 44% of the time, but only 5% of students pass the benchmark who do not report taking recommended courses. This preparedness gap is not as wide in the other subjects, but is still around 25% in English, Reading, and Science. The 2014 ACT Profile Report[9] states that only 63% of Utah high school graduates report taking recommended courses across all subjects. Even for those who take recommended courses, less than half of the students pass the benchmarks in Reading, Math, and Science while two-thirds pass the English benchmark. The recommended high school courses[10] may need more rigor to prepare more students for college readiness. Students may think they are taking courses that will prepare them for college when they are not.

"High hopes for college degrees combined with poor preparation wastes students' time and money."

Figure 3. Plans of Utah High School Graduates Compared to Historical Degree Attainment



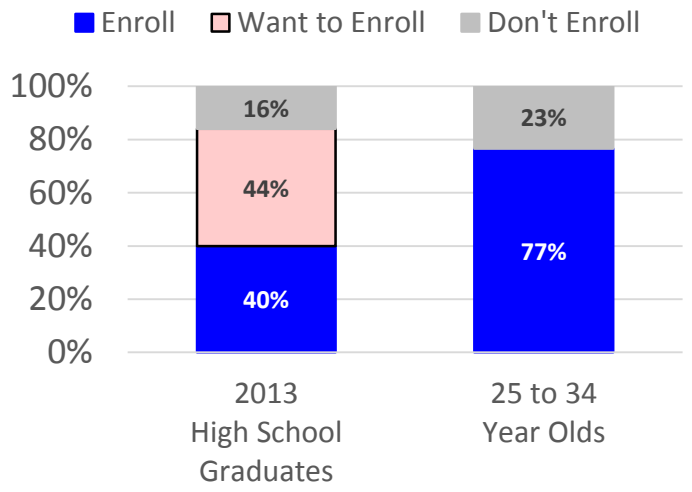
Source: ACT, *The Condition of College & Career Readiness, Utah*
U.S. Census Bureau, *American Community Survey, Utah*

High School Graduates Have High Hopes

Approximately 78% of the 2013 high school graduating class indicated their plan to obtain at least a Bachelor degree. **Figure 3** displays high school hopes relative to actual historical degree attainment. It is partly based on the information the ACT collects from students during testing regarding their future educational plans[11] in addition to actual attainment rates reported by the U.S. Census Bureau for 25 to 34 year olds. The share of students who hope to obtain a degree from college is significantly higher than the actual attainment rates.[12] Nearly five times as many 2013 high school graduates (37%) think they will earn graduate or professional degrees, as the share of 25 to 34 year olds who earn such degrees (8%). Only 26% of 25 to 34 year olds reach a Bachelor degree as their highest level of education compared to the 41% of high school graduates who want a Bachelor degree. Nearly twice as many (11%) 25 to 34 year olds earn an Associate degree compared to recent high school graduates who aim for that degree (6%). High hopes for college degrees combined with poor preparation wastes students' time and money.

"Eventually, students who want to attend college end up enrolling at some point. Gaining access to college does not appear to be a problem for most students in Utah."

Figure 4. High School Enrollment Expectations Compared to Historical College Enrollment



Source: ACT, *The Condition of College & Career Readiness, Utah*
U.S. Census Bureau, *American Community Survey, Utah*

Access to College Not a Limiting Factor

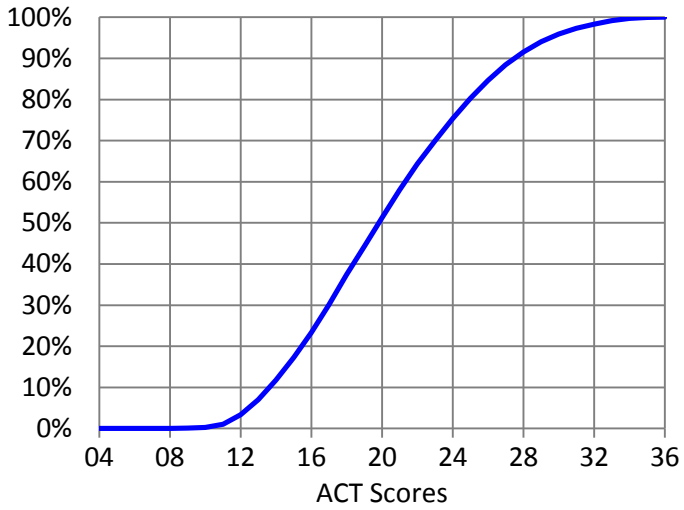
Providing students with access to college has been the principal public policy related to higher education in the United States for the last 50 years.[13] Many now argue that focus should be placed on helping students complete degrees, rather than focusing only on helping students gain access to college. As shown in **Figure 4**, the ACT reports that while 84% of Utah's high school graduating class of 2013 thought they would enroll in college, only 40% actually enrolled the year after high school. However, this large gap may reflect unique cultural factors in Utah, from large shares of high school graduates participating in religious or volunteer service to other factors like financial constraints. As the chart shows, 77% of 25 to 34 year old high school graduates[14] in Utah ultimately enrolled in some form of college education. This suggests that eventually, students who want to attend college end up enrolling at some point. Gaining access to college does not appear to be a problem for most students in Utah. This issue was explored in a recent report[15] from the Utah Foundation.

Comparing Utah's Preparation

One of the measures used in admittance decisions at selective colleges and universities is student ACT scores. Most colleges and universities within the Utah System of Higher Education require students to take the ACT; the test is administered to nearly every graduating high school student. As the previous section indicated, student scores are used as a proxy for the preparedness or ability of students to succeed in college. **Figure 5** shows the range of scores for the 2014 high school graduating class in Utah.[16] Less than 25% of students receive a composite score of 16 or less on the ACT. A composite score on the ACT of 20 is the mid-point. Nearly 80% of the student population scores a 24 or lower. Only 10% of students score at or above a 28. The distribution of ACT scores in Utah is similar to the nation overall. Utah's average composite score ranks[17] 31st in the nation. Understanding this distribution of scores will be helpful throughout this report.

"The distribution of ACT scores in Utah is similar to the nation overall, the average composite score ranks 31st in the nation."

Figure 5. Share of High School Graduates at or below Composite ACT Scores



Source: ACT, *Profile Report - Utah Graduating Class of 2014*

Section 1: Recommendations

While 84% of 2013 high school graduates wanted college degrees, only 25% appear well prepared for success in college. Recently, the trend has been that less than 50% of students who attended more than 4 semesters of college have actually attained an Associate or Bachelor degree. We recommend:

- More accurate communication of the actual requirements for college readiness.
- Guiding more college bound high school students into rigorous college preparation courses.
- Active monitoring by Public Education to improve the readiness of college bound students.
- More realistic assessment and communication by Higher Education to students of their preparedness for college.

Section 2: Performance Measures Related to College Graduation

Findings

We discovered various performance measures are highly correlated with college graduation. These are more timely and actionable measures than graduation rates and could be used to better design a system of performance-based budgeting in Utah's System of Higher Education.

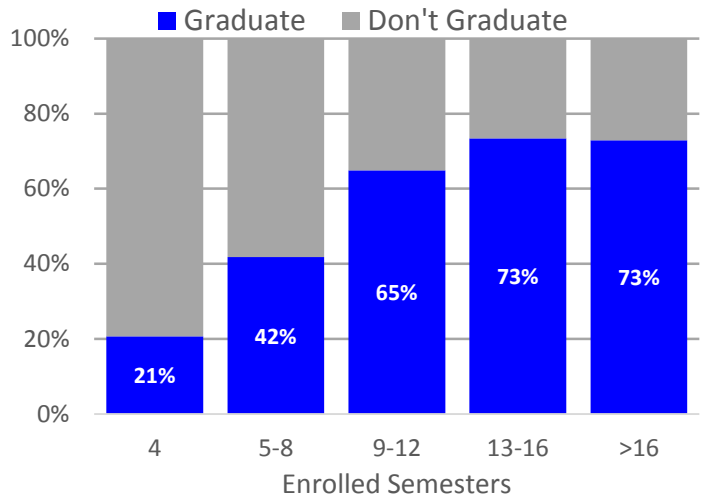
- The level of average course-hour completion rates were an indicator of who would earn a degree. When students completed an average of less than 66% of enrolled credit hours in a semester, their graduation rates were around 10%. Students who completed 95% of enrolled credit had graduation rates near 90%.
- The level of average hours enrolled per semester were an indicator of who would earn a degree. Students averaging 6 or fewer hours of enrollment in a semester had a 10% chance of obtaining a degree, while students averaging more than 12 hours had a 73% chance of obtaining a degree.
- The data showed that the current system of remediation appears to be ineffective. Higher hours of remediation correlate with lower odds of graduating as follows: 54% of students who had no remediation graduated, while 46% of students graduated who had remediation up to 3 hours, but only 20% to 30% of students graduated who had more extensive remediation.

Evidence

Definition of Graduation Rates

Recent efforts to increase the accountability of colleges and universities have focused[18] on increasing the efficiency and percentage of students completing undergraduate degrees. Graduation rates are often calculated by evaluating how many first-time full-time freshmen in a college class earn a degree within four, six, or eight years of attendance. However, this measure excludes nearly half of students who attend college. Therefore, in this report, we have defined a more comprehensive measure of graduation rates that include all degree seeking students. The measure divides Associate and Bachelor degrees by the number of degree seeking students who did not earn degrees plus all the degrees awarded (see supplemental background for more detail). **Figure 6** shows that Utah's graduation rates increase with length of enrollment as expected. The majority of Associate

Figure 6. Graduation Rates by Enrolled Semesters



Source: The Office of the Utah State Auditor, Analysis

Figure 7. Total Degrees Earned

Enrolled Semesters	Degrees Earned 2000-2014						Don't Graduate	
	Associate		Bachelor		All			
	Number of Degrees	%	Number of Degrees	%	Number of Degrees	Graduation Rate	Number of Students	%
4	11,878	65	6,325	35	18,203	21	69,793	79
5 - 8	65,358	61	41,191	39	106,549	42	148,313	58
9 - 12	33,090	32	71,525	68	104,615	65	56,665	35
13 - 16	11,116	21	42,971	79	54,087	73	19,627	27
>16	3,913	20	15,863	80	19,776	73	7,342	27
Totals	125,355	41	177,875	59	303,230	50	301,740	50
Students by Highest Degree	71,336	30	170,021	70	241,357	47	277,596	53

Source: The Office of the Utah State Auditor, Analysis

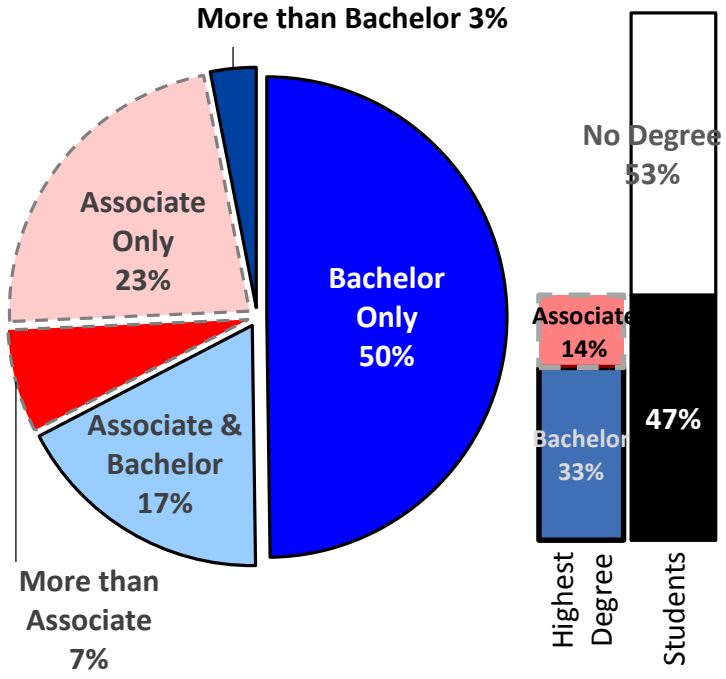
degrees are granted to students with between 5 and 8 enrolled semesters, while most Bachelor degrees are earned between 9 and 12 enrolled semesters.

Figure 7 shows that while 59% of degrees awarded are Bachelor degrees with 41% awarded as Associate degrees, when degrees are restricted to student's highest degree obtained, the split is 70% Bachelor to 30% Associate. Only 47% of students who enrolled earned a degree; while 33% of students received a Bachelor degree as their highest degree attained. The table also shows college graduates take significant amounts of time to earn degrees. These statistics are similar to other reports[19] that show Utah lags behind other states in graduation rates within 6 years for qualifying students. In 2013, Utah ranked 41st with a 47% rate while sixteen states had rates above 60%. The search for meaningful performance measures[20] that are sensitive to time, effort, and the complexity of a network of institutions with different missions and priorities are important considerations when designing measures that may be used for resource allocation to align institutional incentives with successful student outcomes.

"Only 47% of students who enrolled ended up with a degree, while 33% of students received a Bachelor degree as their highest degree attained."

Figure 8 shows the breakdown of students based on the highest degree earned. Of the 47% of students who earned an undergraduate degree, 70% earned a Bachelor degree as their highest degree while 30% earned Associate degrees. Half of the students who earned an Associate degree pursued a Bachelor degree, most of these students were successful (17% of all graduates), but 30% of these students did not reach a Bachelor degree (7% of all graduates). Overall, 10% of graduates enroll in additional courses to seek another degree, but do not earn one. This consolidated view of degree attainment collapses multiple degrees by type to the highest degree earned by a student. A comparison with **Figure 7** shows that many students receive multiple degrees. Performance measures based exclusively on the quirks of narrow definitions of graduation (e.g., first-time full-time freshmen graduating within 6 years) may exclude much of the student population from consideration, and thus alter incentives surrounding performance and budgeting.

Figure 8. Percentage of Students by Highest Undergraduate Degree Earned



So

"Performance measures based exclusively on the quirks of narrow definitions of graduation may exclude much of the student population from consideration."

Measuring graduation rates can be a complicated effort, as the following questions may show:

- What counts as a graduation in the numerator?
- What counts as the potential number of qualifying students in the divisor?
- Does the completion of multiple degrees by a student count numerous times, increasing the graduation rate even though no additional students receive degrees?
- How does a transfer student affect the numerator or the denominator?

Although graduation is often the desired measure of success, it could take 6 years to discover whether an institution's efforts have an impact on the students who graduate. A good performance metric is timely, correlated with future graduation, easily measured, and responds to intervention.

We obtained over 50 million records from the Office of the Commissioner of Higher Education to evaluate the education programs within the Utah System of Higher Education. These records included files related to student history, student course performance, course records, graduation records, and a supplemental ACT score update. We combined these records to evaluate which measures might correlate with graduation rates.

Performance Measure: Enrolled Semesters

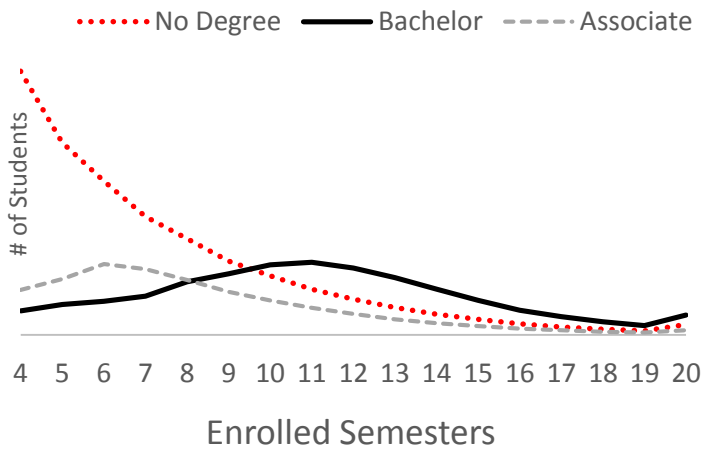
Up to a point, the number of semesters a student attends college is associated with higher rates of graduation. **Figure 9** shows the large numbers of students seeking degrees that spend between 2 and 4 years attending institutions without ever obtaining degrees. Associate degrees earned peaked at 6 semesters of enrollment, while Bachelor degrees peaked at 11 semesters. **Figure 10** shows that only 21% of students attending at least 4 semesters, or the normal completion time for an Associate degree, exit the system with any kind of degree. The graduation rate increases quickly between 4 and 12 semesters, but graduation rates surprisingly plateau near 70% after 12 semesters of attendance.

Gaining a degree takes time. Importantly, enrolled semesters do not count any gaps in enrollment, so this measure does not capture whether a student has a significant gap between enrollments. It is not a measure of the calendar length of time it takes a student to graduate. Students spend more resources and delay higher earning potential the longer it takes to graduate. How long a student takes to graduate will be an important control variable when testing for good performance indicators later in this section.

"Successfully earning credit for courses each semester is highly predictive of graduation."

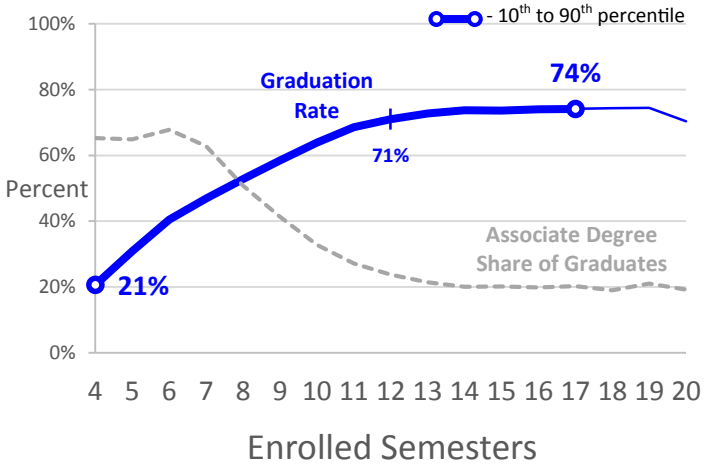
"Graduation rates surprisingly plateau near 70% after 12 semesters.

Figure 9. College Achievement by Enrolled Semesters



Source: The Office of the Utah State Auditor, Analysis

Figure 10. Graduation Rate & Degree Share by Enrolled Semesters



Source: The Office of the Utah State Auditor, Analysis

Performance Measure: Course-Hour Completion

Successfully earning credit for courses each semester is highly predictive of graduation. This measure is defined as the number of credit hours earned at the end of a semester divided by the number of hours enrolled at the beginning of the semester, then averaging these shares for every semester of a student's career. The measure is timely, each semester the performance of a student influences the number. It is also an actionable measure; interventions that change student behavior are incorporated into the number over time. As the measure is an average over a student's entire career, the occasional dropped, failed, or incomplete class has little affect on the average. However, a student who continually fails to earn credit for enrolled courses shows an early indication of the strong likelihood to exit college without a degree. The measure also covers every student seeking a degree, not just a narrow sub-group of students.

Figure 11 shows the stark difference in the likelihood of obtaining a degree by the average course-hour completion rate. The graduation rate is four times as high for students who earn a Bachelor degree and successfully complete at least 85% of their course-hours compared to those students who average course-hour completions less than 85%. Further, those with measures below 66% correspond with a 10% chance of getting any degree. Higher rates of course completion also speed the time to degree attainment for both Associate and Bachelor degrees. Associate degree holders finish a semester or two quicker with increased course-hour completion rates. Bachelor degree holders finish, on average, one to three semesters faster with higher course-hour completion rates.

"The graduation rate is four times as high for students who earn a Bachelor degree and successfully complete at least 85% of their course-hours compared to those students who average course-hour completions less than 85%."

Figure 11. Degrees Granted and Time to Graduate By Average Course-Hour Completion Rate

Average Course-Hour Completion Rate	Degrees Earned 2000-2014					Don't Graduate	
	Associate		Bachelor		All		
	Number of Degrees	Semester Average	Number of Degrees	Semester Average	Graduation Rate	Number of Students	Semester Average
<40%	196	8.3	405	7.3	3%	19,722	6.1
40% to <66%	4,817	9.0	2,451	11.6	10%	63,670	7.2
66% to <85%	28,888	9.0	25,390	12.7	32%	116,972	7.5
85% to <95%	33,626	9.0	54,632	12.0	66%	45,164	8.7
95% to <100%	21,035	8.4	46,213	11.2	87%	10,316	7.9
100%	36,793	7.0	48,784	9.1	65%	45,896	5.9
Totals	125,355	8.3	177,875	11.1	50%	301,740	7.3

Source: The Office of the Utah State Auditor, Analysis

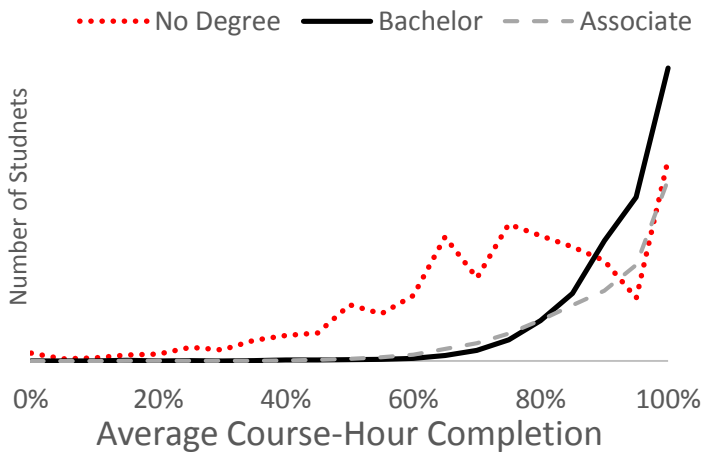
Figure 12 shows that significant numbers of students who fail to complete degrees also have low course-hour completion rates. There are 200,000 students with course-hour completion rates below 85% who have attended a significant number of semesters. It is important to note that transfer students are included in these student counts. Many students who always earn credit in a course in which they enroll are likely transfer students; these depress the graduation rates. This is the principle justification for excluding student populations with less than 4 semesters throughout this analysis—because large amounts of transfer credits and a small number of courses in a student's career were unrepresentative of the broader student population and were eliminated to increase the clarity of the analysis.

Figure 13 shows the near linear fashion in which graduation probability increases when the course completion measure increases beyond 60%. Over 90% of students have average course-hour completion rates above 60%. In fact, as average course-hour completion rates increase graduation rates correspondingly increase in a rapid manner. Students are also more likely to earn more Bachelor degrees as average course-hour completion rates increase.

"As average course-hour completion rates increase graduation rates correspondingly increase in a rapid manner."

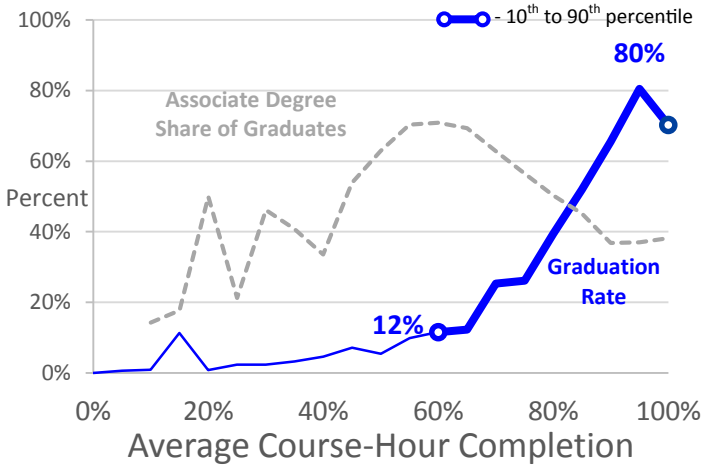
"Significant numbers of students who fail to complete degrees also have low course-hour completion rates."

Figure 12. College Achievement by Average Course-Hour Completion Rate



Source: The Office of the Utah State Auditor Calculations

Figure 13. Graduation Rate & Degree Share by Average Course-Hour Completion Rate



Source: The Office of the Utah State Auditor Calculations

Figure 14. Degrees Granted and Time to Graduate by Average Enrolled Hours per Semester

Average Enrolled Hours per Semester	Degrees Earned 2000-2014					Don't Graduate	
	Associate		Bachelor		All		
	Number of Degrees	Semester Average	Number of Degrees	Semester Average	Graduation Rate	Number of Students	Semester Average
≤3	106	8.9	73	7.5	2%	9,631	7.7
>3 to ≤6	5,221	10.3	2,713	11.5	12%	56,400	6.4
>6 to ≤9	32,984	10.0	19,019	13.3	37%	88,623	7.5
>9 to ≤12	52,846	8.3	78,933	12.1	59%	93,218	7.9
>12 to ≤15	26,594	6.7	65,465	9.8	67%	45,960	6.9
>15	7,604	5.0	11,672	7.5	71%	7,908	5.6
Totals	125,355	8.3	177,875	11.1	50%	301,740	7.3

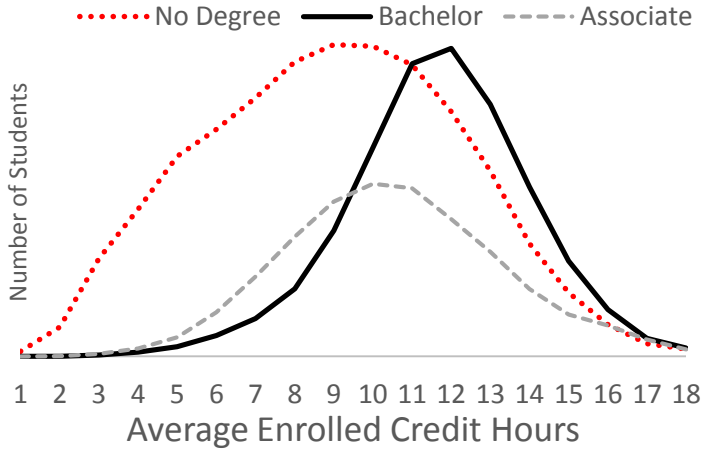
Source: The Office of the Utah State Auditor, Analysis

"Students averaging 15 or more credit hours in a semester earn degrees two years faster than the average graduate."

Performance Measure: Average Enrolled Hours

Figure 14 identifies and clearly segments the student population along what are likely part-time and full-time students. Full-time students are more likely to graduate with a Bachelor degree. Also, as average enrolled hours per semester increases, likelihood to graduate increases, while time to completion decreases. There were over 150,000 students who did not graduate that averaged 9 or less credit hours in a semester. This compares with the 60,000 students that earned degrees with a similar performance metric. Perhaps as expected, those who took more credits on average during a semester completed degrees more quickly. For Associate degree holders, taking 15 or more credit hours meant earning a degree in half the time as students with low enrolled hours per semester, and a year and a half faster than the average student earning the degree. The same held true for Bachelor degree holders. Taking less than 12 credit hours on average meant it took roughly 12 semesters to graduate. Those students who averaged 15 or more credit hours in a semester earned their Bachelor degrees two years faster than the average graduate. This group is also the only group of Bachelor degree holders to graduate in the normal time to completion of 8 semesters.

Figure 15. College Achievement by Average Enrolled Hours per Semester

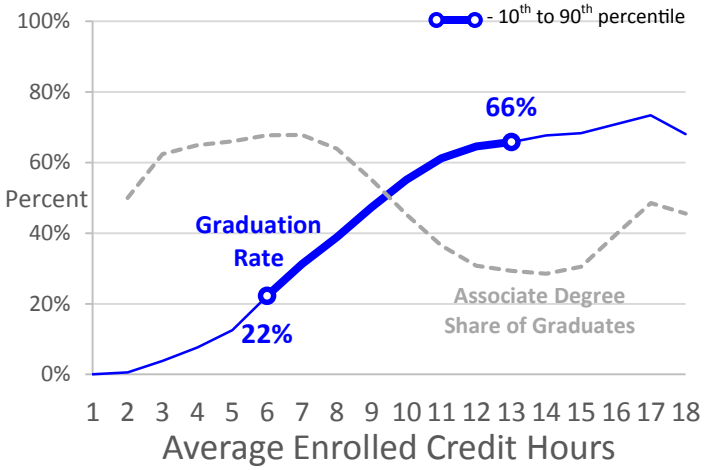


Source: The Office of the Utah State Auditor, Analysis

Figure 15 shows the difference in the distributions of degrees earned by enrolled hours per semester. The center of the distribution for each group shows students without degrees averaged around 9 credit hours per semester, Associate degrees centered around 10 credit hours, and those with Bachelor

degrees around 12 credit hours. There is skew in the group without degrees, which shows that this group has more students with low average enrolled credit hours. Complete College America commissioned an analysis[21] on a national scale of these types of effects that showed similar patterns across 329 institutions.

Figure 16. Graduation Rate & Degree Share by Average Enrolled Hours per Semester



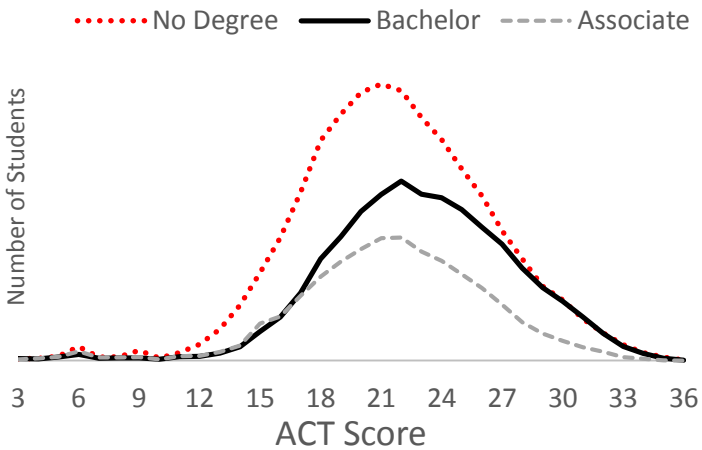
Source: The Office of the Utah State Auditor, Analysis

Figure 16 shows a clear transition between the likelihood of obtaining an Associate degree relative to a Bachelor degree. Across degrees awarded, there were 125,000 Associate degrees (40%) and 178,000 Bachelor degrees (60%). However, for those students averaging 8 or less credit hours, 60% obtained an Associate degree, while averaging more than 12 credit hours meant a 70% chance of earning a Bachelor degree. The probability of graduating with a degree increased quickly for every additional hour a student's average enrollment increased, from a 22% chance of graduating with an average of 6 credit hours to a 60%-70% chance of graduating with an average above 12 credit hours. The bulk of the student population averages 6 to 12 credit hours per semester, less than 10% of students are above or below each of those marks.

Performance Measure: ACT Scores

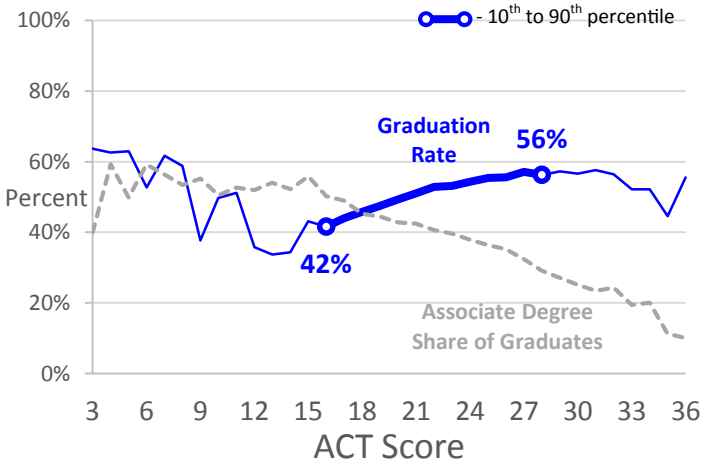
The ACT is designed to measure college readiness, although we recognize that there are many non-academic factors that may drive degree attainment. **Figure 17** shows the distribution of students' ACT scores among those with and without degrees. There is little visual difference in these distributions, though those without degrees are shifted slightly to lower scores. **Figure 18** indicates that graduation rates are well bounded

Figure 17. College Achievement by ACT Scores



Source: The Office of the Utah State Auditor, Analysis

Figure 18. Graduation Rate & Degree Share by ACT Scores



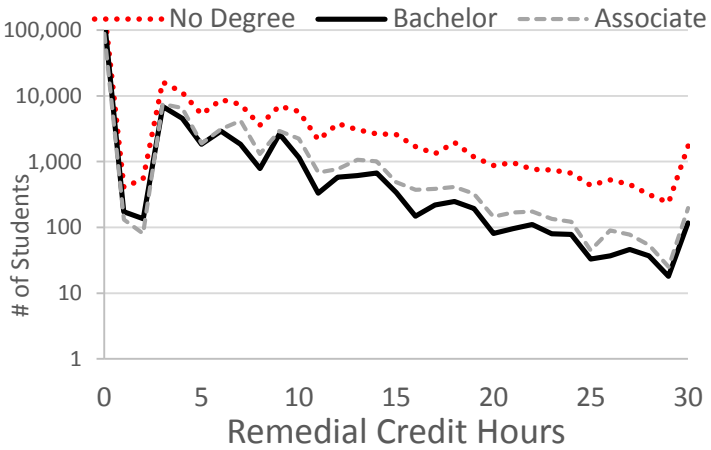
Source: The Office of the Utah State Auditor, Analysis

between 40% and 60% along the entire spectrum of scores. However, as ACT scores increase, the likelihood of earning an Associate degree falls from over 50% to less than 20% and the likelihood of earning a Bachelor degree increases.

Performance Measure: Remediation Hours

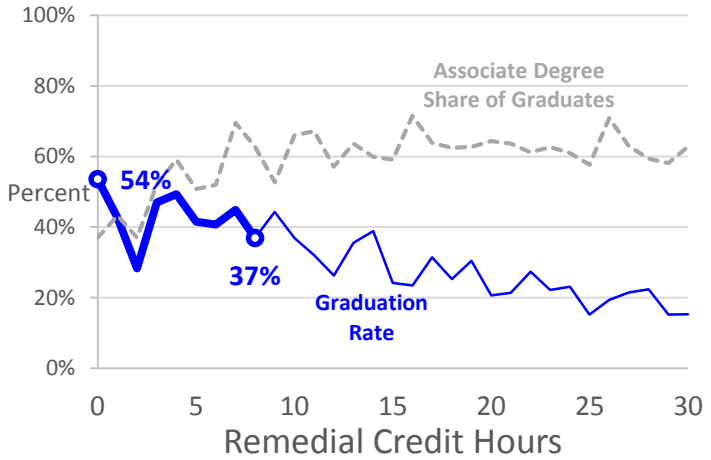
We discovered that the current system of remediation efforts in the system of higher education correspond inversely with graduation. Unexpectedly, for the data we analyzed, the more effort spent on remediation the lower the likelihood of graduation was, leading us to question the effectiveness of the current system of remediation. **Figure 19** shows on a log scale, the number of students with various amounts of remediation.

Figure 19. College Achievement by Total Remedial Credit Hours



Source: The Office of the Utah State Auditor, Analysis

Figure 20. Graduation Rate & Degree Share by Total Remedial Credit Hours



Source: The Office of the Utah State Auditor, Analysis

Nearly 75% of students performed no remedial coursework, another 13% of students have 6 or less hours of remedial coursework, while the remaining 13% (nearly 80,000 students) attended more extensive remedial coursework. As the chart shows, the group with extensive remedial coursework without degrees outnumber those with degrees nearly 10 to 1. **Figure 20** also shows that the graduation rate decreases with additional remediation. Arizona State University recently redesigned[22] their system of remediation around new data collection systems and performance[23] measures. These efforts have dramatically increased graduation rates from under 30% on-time graduation to 50% on-time graduation (within 4 years).

"Unexpectedly, for the data we analyzed, the more effort spent on remediation the lower the likelihood of graduation was, leading us to question the effectiveness of the current system of remediation."

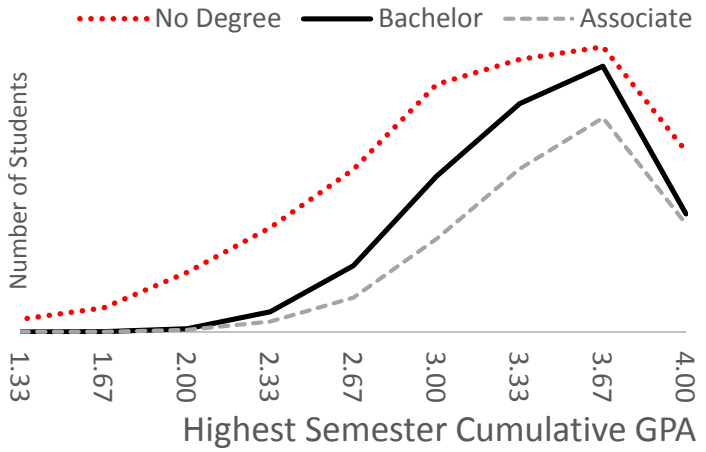
Performance Measure: GPA

Unsurprisingly, success while attending college as measured by a student's highest semester cumulative GPA is associated with higher graduation rates. **Figure 21** shows the distributions of GPA by those with and without degrees. However, those without degrees outnumber those with degrees at every GPA, so these effects may be more muted than one might expect. **Figure 22** shows that GPA is relatively ineffective at predicting what type of degree is earned. However, the chart shows that graduation rates increase as GPA rises from near 10% with a C average to near 50% with a B average (also the share of the general student population earning degrees), while nearly 60% with an A– graduated. That grades are not more predictive of graduation, also points to non-academic factors that may impact degree attainment.

Performance Measures: Other Factors

There are likely important factors not being collected that impact student graduation rates. Studying the adequacy of current evaluation systems could point to additional academic or non-academic performance measures that would be good candidates for improving performance-based budgeting. Continuing to collect subject-specific ACT sub-score information may also provide a valuable data resource.

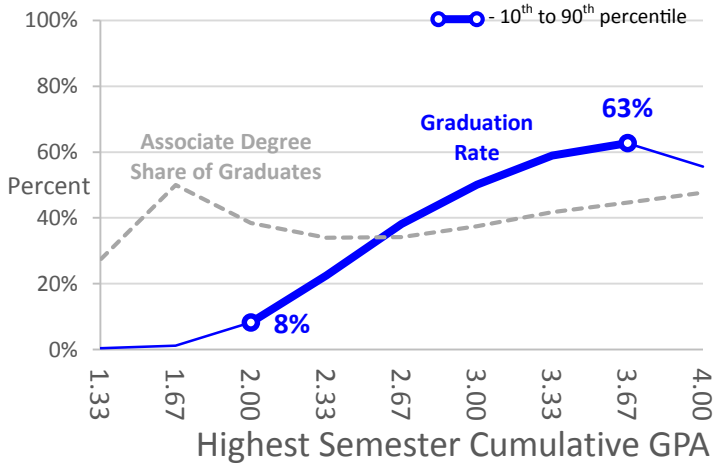
Figure 21. College Achievement by Highest Semester Cumulative GPA



Source: The Office of the Utah State Auditor, Analysis

"There are likely important factors not being collected that impact student graduation rates."

Figure 22. Graduation Rate & Degree Share by Highest Semester Cumulative GPA



Source: The Office of the Utah State Auditor, Analysis

Performance Measures: Combined Model

While isolating variables of interest and describing how they affect graduation rates is interesting, it does not capture how the variables interact with each other or cumulatively on graduation rates. Models properly separate the effects that performance measures may have on graduation rates, while also extracting the noise from how the variables themselves interact. To this end, we modeled graduation rates across the previously described variables using both a logit model and a linear regression model. The models are similar, so for ease of explanation, only the results of the linear regression model are presented.

Figure 23 shows the results of the models across graduation in general, and those for Associate and Bachelor degree attainment. While controlling for (i.e., not changing) the number of enrolled semesters and highest semester cumulative GPA, an additional 3 credit hours in average enrolled credit hours per semester for a Bachelor degree was associated with a 14% increase in the probability of any degree being earned. A 10-point increase in the average course-hour completion rate pointed to a 10% increase in the chance of graduation. Number of enrolled semesters mattered more for earning Bachelor degrees than Associate degrees. Highest semester cumulative GPA showed an effect relative to an Associate degree, but not a Bachelor degree. Increasing ACT scores was associated with less chance of getting an Associate degree but not a Bachelor degree. While credit hours of student remediation did not impact earning an Associate degree, it hurt the likelihood for earning a Bachelor degree. The models had less success predicting who received Associate degrees, but with a correlation coefficient (R^2) of 0.49 had more explanatory power for Bachelor degrees. These are good performance metrics that could improve performance-based management in higher education and align institutional incentives with student success.

Figure 23. Measures Predictive of Graduation

	Linear Regression Models:		
Variables	**Bachelor**	**Associate**	**All**
Number of Enrolled Semesters	4.6%	0.7%	3.3%
Average Hours Enrolled in a Semester	4.5%	1.8%	3.8%
Average Course-Hour Completion Rate	1.0%	0.9%	1.2%
ACT Score	0.1%	-0.6%	-0.2%
Highest Semester Cumulative GPA	-0.5%	3.0%	1.6%
Student Hours of Remedial Courses	-0.9%	-0.1%	-0.6%
	R^2= 0.49	R^2= 0.19	R^2= 0.39

Source: The Office of the Utah State Auditor, Analysis

Section 2 - Recommendations

Based on this analysis and the policy interest surrounding performance management. We recommend:

- Integrating and using timely performance metrics, such as average course-hour completion rates and average credit hours enrolled per semester, that correlate with improved graduation rates.
- Clearly communicating to students the factors that lead to increased college graduation, specifically full-time class loads (more than 12 hours) and high (at least 85%) course-hour completion rates.
- Redesigning the system of remediation by:
  - Improving entering student preparedness to avoid remediation.
  - Establishing limited, targeted, and focused remediation courses that improve graduation rates.
  - Setting clear entry level requirements to help students know how to better prepare for college and avoid wasting students' time and resources.
  - Directing students to cost effective (free or low cost) resources to improve college readiness, including online offerings, tutorials, and other tools.
- Continuing to collect and analyze relevant data to develop best practices that improve student education and increase graduation rates.

Section 3: Earning STEM Degrees Requires High Preparation

Findings

Apart from general graduation rates, we also analyzed attained degrees by subject, and found the following:

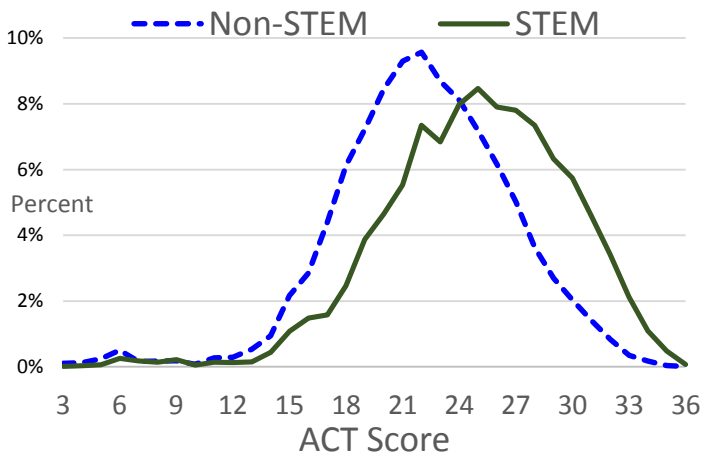
- ACT scores above 27 (nearly the 90th percentile) rapidly increase the likelihood of graduates earning Science, Technology, Engineering, and Math (STEM) degrees. A student with a score over 30 (above the 95th percentile) is three times more likely to obtain a STEM degree than the average graduate.
- 20% of undergraduates with ACT scores below 20 (the median) intend to pursue a STEM degree at some point, but three-quarters of these students do not persist and earn degrees in non-STEM fields.
- The performance metrics relevant to general graduation did not successfully predict STEM graduation. Some measures were less impactful, others lost any predictive power, and ACT scores became predictive.
- Some degrees attract better prepared students based on ACT scores.

Evidence

High School Preparation Affects STEM Graduation

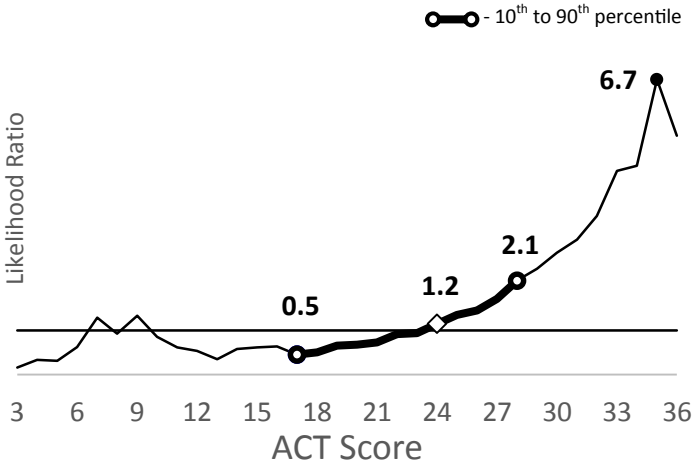
Figure 24 shows the difference in the undergraduate populations between STEM and non-STEM degrees by ACT score. The chart shows a clear difference between the center of the distribution, with STEM graduates having significantly higher ACT scores. Another way of comparing these populations is found in **Figure 25** that describes the likelihood ratio of earning a STEM degree relative to the average graduate by ACT score. The

Figure 24. Distribution of Non-STEM and STEM Graduates by ACT Score



Source: The Office of the Utah State Auditor Calculations

Figure 25. Relative Likelihood of Graduating with a STEM Degree by ACT Score



Source: The Office of the Utah State Auditor, Analysis

"Students with higher ACT scores are more likely to earn STEM degrees."

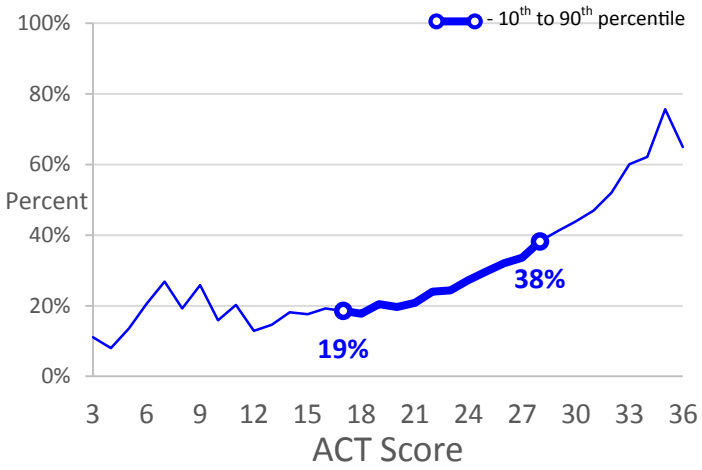
differences are stark. Students with scores under 24 (75% of graduating high school seniors as shown in **Figure 7**) had only half the chance of obtaining a STEM degree. The higher the ACT score, the more likely a student was to earn a STEM degree. Students with ACT scores over 27 are twice as likely to earn a STEM degree. Students with ACT Scores over 30 (95th percentile) are over three times more likely to earn a STEM degree than other graduates.

During the analysis, we also investigated how many students declared a STEM major at some point during their college career. This is represented in the data by coding student records according to the Classification of Instructional Programs (CIP) from the U.S. Department of Education's National Center for Education Statistics.[24] The CIP represents "a taxonomic scheme that supports the accurate tracking and reporting of fields of study and program completions activity." While there are other definitions of STEM, the definition used in this report is defined by the National Science Foundation.[25] **Figure 26** shows that nearly 20% of students with ACT scores below 20 (the median) declare a major that is STEM related at some point in their college career. As ACT scores rise, the percentage of students declaring a STEM major rises to 40% of those with ACT scores of 27, and moves to nearly 80% with the highest ACT scores. Thus, ACT score predicts how likely a student is to try a STEM major.

The rates at which students persist in any STEM field are particularly low, especially when separated by ACT scores. **Figure 27** shows that for students with ACT scores below 20, only 20% to 40% persist to a STEM degree. As ACT scores increase, the attrition rate declines to where roughly 50% of STEM

"Students with ACT Scores over 30 (95th percentile) are over three times more likely to earn a STEM degree than other graduates."

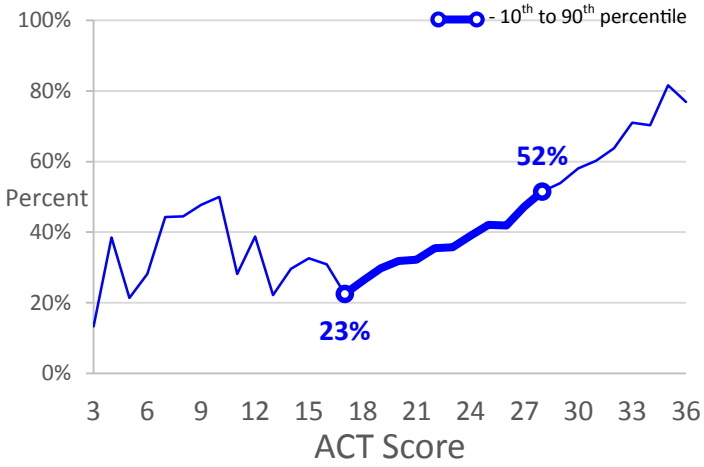
Figure 26. Share of Graduates Declaring Intent to Pursue a STEM Major



Source: The Office of the Utah State Auditor, Analysis

"Only 10% of degrees are associated with STEM."

Figure 27. Share of Interested Graduates that Succeed in Earning a STEM Degree



Source: The Office of the Utah State Auditor, Analysis

Figure 28. Hourly Earnings by Educational Attainment by STEM Field

	Average hourly earnings	
Educational Attainment	**Non-STEM**	**STEM**
High School or Less	$15.55	$24.82
Some College or Associate	$19.02	$26.63
Bachelor Degree	$28.27	$35.81
Graduate Degree	$36.22	$40.69

Source: Economics and Statistics Administration, CPS survey

students with scores around 27 will earn a STEM degree, while 60% to 80% of students with ACT scores above 30 will remain in a STEM field until graduation.

The business community has expressed concern[26] over the number and quality of STEM graduates. The Economics and Statistics Administration release statistics regarding the number, wages, and unemployment rates in STEM fields in the United States. There is significant job growth in STEM fields, nearly double that of non-STEM occupations. STEM workers also command a 26% wage premium. **Figure 28** shows the average hourly earning by educational attainment and STEM field. In non-STEM fields, in 2010, full-time workers with a Bachelor degree earned $28.27 on average per hour while those with a high school diploma or less only earned $15.55. Those with some college but no degree averaged earnings of $19.02 per hour. However, in STEM fields, full-time workers with a Bachelor degree earned $35.81, nearly the same wage as a non-STEM worker with a graduate degree; and those with some college or an Associate degree earned $26.63, 94% of the wage of those who obtained a Bachelor degree but worked outside a STEM field. While the increased earning potential in attaining a Bachelor degree is clear, earning any degree that led to employment in a STEM-related field also increased earning potential.

STEM Graduates are Different

The second section outlined the importance of the modeled effects of various performance metrics. When applied to STEM degrees, **Figure 29** shows how the models changed. STEM degrees represent about 10% of all degrees. The models that predicted graduation, in general, could not predict which students would earn a STEM degree. The coefficients for average hours enrolled in a semester were cut by a third, while impact of the average course-hour completion rate fell by more than half. However, ACT score became relevant for STEM Bachelor degrees. This may reflect a sorting effect in which the ACT score may reflective native student ability to persist to graduation and high levels of preparation needed in STEM education. The effect of remedial hours remained similar to the prior model with negative coefficients, meaning an extra 10 hours of remediation, all else being equal, pointed to a 9% decline in the odds of earning a STEM degree.

Figure 29. Measures Predictive of STEM Degrees

All Degrees: 303,230		
STEM Degrees: 30,844 (10.2% of all)	**Bachelor Degree**	
Variables	**Non-STEM**	**STEM**
Number of Enrolled Semesters	4.5%	1.9%
Average Hours Enrolled in a Semester	4.3%	1.5%
Average Course-Hour Completion Rate	1.0%	0.4%
ACT Score	-0.1%	**1.6%**
Highest Semester Cumulative GPA	-0.5%	-0.4%
Student Hours of Remedial Courses	-0.9%	-0.4%
	R^2= 0.46	R^2= 0.07

Source: The Office of the Utah State Auditor, Analysis

"The models that predicted graduation in general could not predict STEM degrees."

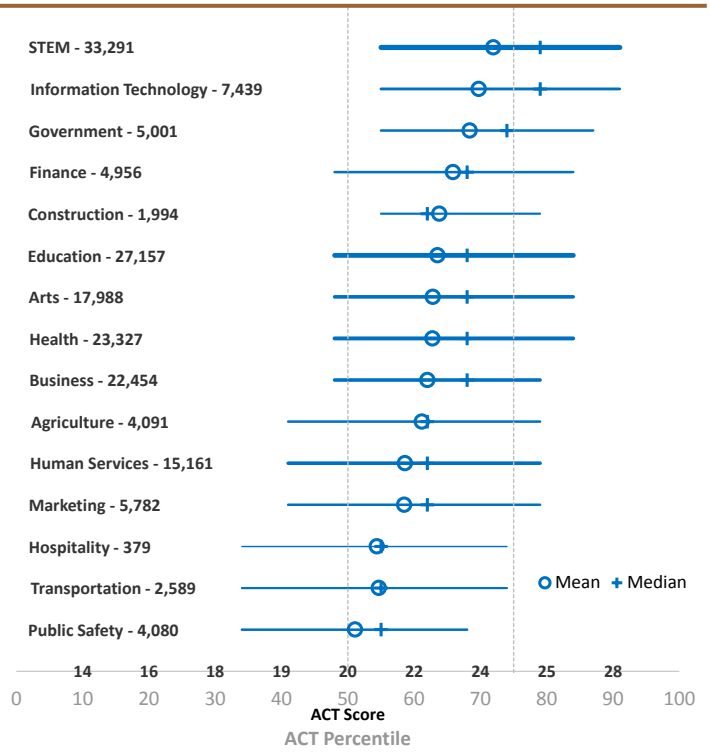
High Performing Students Were Attracted to Certain Degrees

In our analysis, we compared the ACT score distributions of many fields of study, from broad clusters to more narrow majors as defined by CIP coding. **Figure 30** shows that the highest graduate ACT score distributions were in a STEM cluster relative to other major fields of study. In this chart and the following, the thickness of the lines represents the number of graduates. The length of the lines represents the distance between the graduates in the 25th percentile and 75th percentile of the ACT score distribution. The mean and median are also presented.

Figure 31 shows the distributions of the largest 15 majors ranked from highest to lowest mean ACT score. For degrees with the highest ACT scores, nearly 75% of graduates have ACT scores higher than 50% of graduates in fields like Business, Sociology, or Elementary Education.

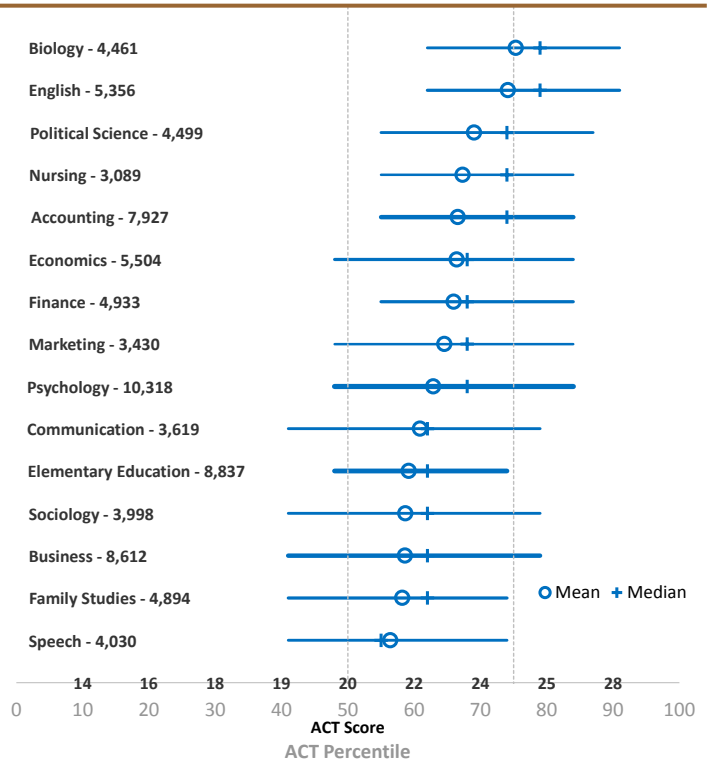
Figure 32 expands the list to the largest 80 majors with similar rankings. Ten of the top twelve majors are STEM related, with five related to engineering; English and Linguistics were the two non-STEM majors in the top 12. In the example of the top ranking majors, Medical Engineering, Mathematics, Physics, Chemistry, Chemical Engineering, all had over 75% of the graduates in their majors with ACT scores above the top 25% of all Utah high school graduates.

Figure 30. Undergraduate ACT Distribution by 15 Largest Clusters of Study



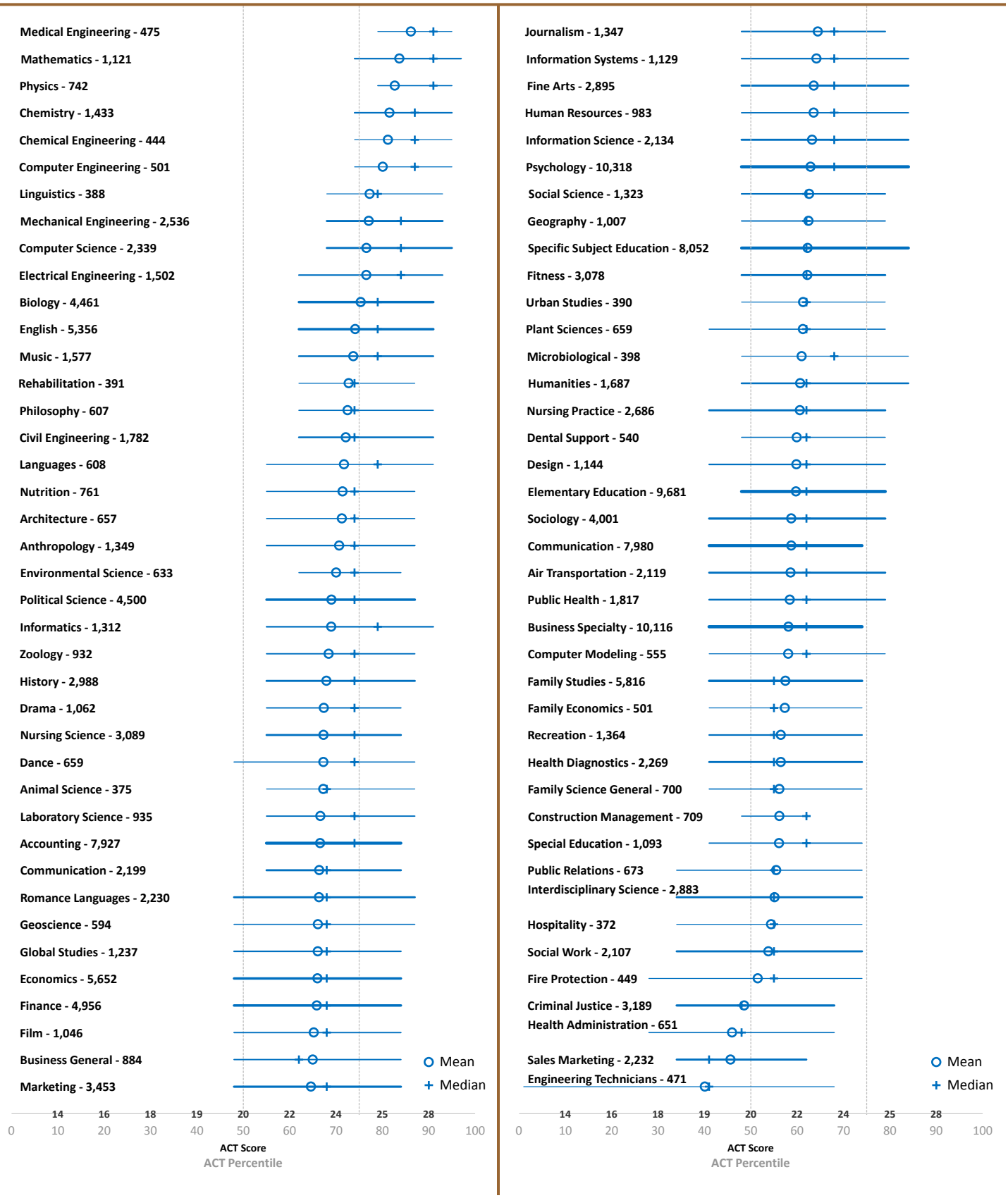
Source: The Office of the Utah State Auditor Calculations

Figure 31. Undergraduate ACT Distribution by 15 Largest Majors



Source: The Office of the Utah State Auditor Calculations

Figure 32. Undergraduate ACT Distribution by the 80 Largest Fields of Study



Source: The Office of the Utah State Auditor Calculations

Section 3: Recommendations

STEM graduates had a different range and concentration of performance metrics. We recommend:

- Informing students that earning a STEM degree depends on a rigorous high school education.
- The business community should focus on increasing interest in STEM careers for elementary students as well as prepared high school students (e.g., ACT scores above 27) and provide encouragement throughout college.
- The State Board of Education and public schools statewide should work to eliminate bias against Science and Math courses.
- The Utah System of Higher Education should work to eliminate barriers to successfully complete STEM degrees for high performing students.

Conclusion

The State of Utah lacks meaningful performance monitoring systems to align institutional incentives with the goal of preparing college bound students to successfully earn college degrees. This report points to practical measures that could be adopted to increase student success and performance within Utah's systems of education.

Prepare College Bound Students for College

Most of Utah's high school graduates who are interested in earning college degrees are not adequately prepared for the rigors of earning a college degree. All college bound students should take the recommended high school courses to prepare for college. However, too many of these high school students either fail to take the necessary classes or take the recommended courses and are still unprepared. Recommended courses should be rigorous enough to properly prepare a larger share of college bound students for initial success in college. Students, parents, and educators should focus on elevating student preparedness to meet expectations for college bound students.

Accurately Communicate College Readiness and Progress

High school graduates have expectations surrounding success in college that are unrealistic compared to historical college degree attainment. A large share of students believe they are prepared to earn college degrees who are not actually prepared. More effort should be made by those within the systems of public and higher education to clearly communicate to students the standards for college readiness. Also, degree seeking students enrolled in college should be told of the behaviors and conditions under which most students succeed in earning degrees. These students should be accurately apprised of how their individual progress compares to the benchmarks that lead to successful completion of college degrees.

Utilize New and Better Performance Measures to Increase College Graduation Rates

There are several timely measures of student performance that correlate with success in earning college degrees. Students with high average enrolled credit hours per semester are more likely to earn a degree. Students who earn credit for most of the courses in which they enroll are also more likely to earn degrees. Students with higher attainment in these performance measures are also more likely to earn a Bachelor degree. The states who have adopted and deployed appropriate performance systems in college institutions have realized better student performance. For example, Arizona State University has moved the share of students that graduate on-time from under a third to half since 2002, with a goal to increase on-time graduation rates to two-thirds by the end of 2015.

Increasing Success: Students Need to Prepare and Perform in Order to Graduate

Students make decisions that impact their preparation before and performance during college. While students don't always make decisions that help them earn college degrees, ensuring institutions have incentive to focus on student success by providing them with accurate information and clear expectations will increase the number of students who complete degrees. During secondary school (grades 7-12), students should be advised of how to prepare for the rigors of college. Before enrolling in college, students should be informed that:

- Full-time students (greater than 12 credit hours per semester) are much more likely to earn degrees, especially Bachelor degrees.
- Students who consistently pass their classes (over 85% of average course-hours complete) more often earn degrees; they are also more likely to earn a Bachelor degree.

Students who focus on these efforts reduce the time it takes to graduate. This can save significant time and money.

Expanding the STEM Talent Pool

Those who desire to increase the number and quality of STEM graduates should know that high school graduates who are well prepared are much more likely to earn such degrees. Business leaders should work to build interest early in a student's life, in both elementary and secondary school. There should also be a concerted effort to remove bias against Math and Science subjects within public education. The Utah System of Higher Education, in addition to each college and university, should identify opportunities to help prepared and interested college students to persist in STEM subjects and not abandon the pursuit of these high value degrees.

Supplementary Background

Data and Methodology

The Office of the Utah State Auditor obtained data[27] from the Office of the Commission of Higher Education to undertake an evaluation of the preparedness and support of students as they progressed within Utah's System of Higher Education. This data contained over 50 million records from 11 institutions spanning the years 1999 through 2015.

Four files contained course data, graduation data, student history data, and student course performance data. These data show by institution, the performance of all the students enrolled in higher education over a period of time. Every degree and certificate awarded students is documented by type along with final GPA, institutional and transfer hours, and graduation dates. The progress of each student is documented by semester with student demographic information, declared major, class, cumulative credit hours, ACT score and sub-score, AP and CLEP hours, and cumulative GPA. Student course performance contains every class a student registers for across all institutions, whether credit is earned or not, and the grade in the course.

Due to the recent collection of ACT data by USHE (composite score in 2009, sub scores in 2011), the University of Utah provided more comprehensive ACT scores and sub-scores for their student populations. This improved coverage for the missing time periods. Most institutions report ACT scores for roughly 50% of their student populations. Some schools have better coverage (Snow at around 66%) and other schools have less reporting (Salt Lake Community College roughly 25%).

In order to analyze these data, observations were collapsed to a student by degree level of analysis. For students without degrees, data was combined into a single record per student. For students with a degree, a collapsed record was formed for each degree or additional pursuit of a degree for the student (e.g., if a student earned an Associate degree and then sought a Bachelor degree that student would have two records, each reflecting the varied career of the student). A record preserved the analytically useful information in each attempt to earn a degree, including: the number of institutions attended, the number of declared majors, the highest semester cumulative GPA, the number of semesters enrolled, the span, gaps, and timing of each student's career, as well as the average course-hour completion rates. Subsequent analysis was restricted to degree-seeking undergraduates who had enrolled in at least 4 semesters.

Figure A. Summary of Data

Files	Records
Courses	2,409,469
Graduation	412,504
Student History	10,818,428
Student Course Performance	38,106,537
Supplemental ACT	421,752

Source: The Office of the Utah State Auditor

Supplementary Background

Data and Methodology

Graduation Rate

The graduation rate was calculated by adding all Associate and Bachelor degrees granted in the numerator with the denominator composed of any degrees counted in the numerator, plus any students who enrolled as degree-seeking students without obtaining a degree. The population was restricted to those who enrolled in 4 or more semesters across Utah's colleges and universities.

ACT Scores

Nearly all graduating high school seniors take the ACT. However, prospective students are not always required to remit their ACT scores to a Utah Institution of Higher Learning to be admitted as a student.

Student Enrollment

Enrollment was not counted according to a calendar because the measure ignores gaps between enrollment. A student who attends two consecutive semesters, then takes a year break before enrolling in two more semesters is indistinguishable from the student who enrolls in four consecutive semesters on this measure. As such, gaps in a student's college career are not captured by this measure.

Average Course-Hour Completion Rate

The average course-hour completion rate calculates the percentage of credit a student earns in a semester relative to the number of credit hours for which they enrolled across the student's career. The sum of the hours that earned credit are divided by the total number of credit hours enrolled at the beginning of the semester. Each semester is equally weighted and an average is computed across each semester of a student's career.

Highest Semester Cumulative GPA

The highest semester cumulative GPA is calculated by assessing the career-to-date GPA for a student at the end of each semester. The maximum value of this career GPA at any point during the student's career is then used as this measure. For example, if a student obtained over the course of 4 semesters, semester GPAs of 3.0, 4.0, 4.0, 3.0 then the cumulative GPA for the student would be 3.0, 3.5, 3.66, 3.5. The highest semester cumulative GPA was reached in the third enrolled semester at 3.66 and this statistic would be used for the student in this analysis.

Supplementary Background

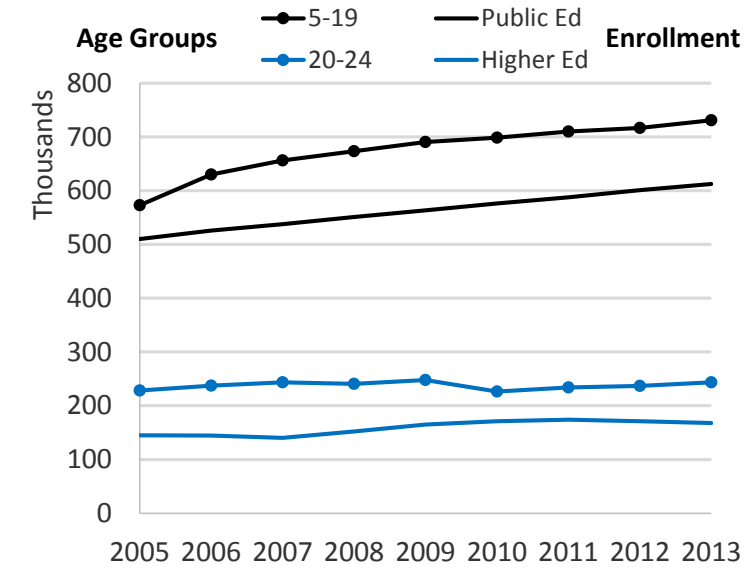
Public Finance Related to Utah Education

Tremendous resources are used in educating the people of Utah. The Census Bureau reported that Utah spends over $4 billion on Public Education and nearly $4 billion on Higher Education.[28] When combined with private education spending of nearly $2 billion,[29] the people of Utah spend roughly $10 billion each year on education. This represents 7.4% of the state's economy and educates over 600,000 students in Public Education[30] and roughly 200,000 students in Higher Education,[31] and employs about 150,000 people.[32] There are over 1,000 schools for Public Education[33] with 20 public or private university, college, and technical college campuses that grant around 50,000 degrees or certificates each year.[34]

Figure B shows that over the last decade, public education enrollment has steadily increased each year, adding about 20% more students to the Public Education System. In the recent past 10,000 additional students (beyond those who graduate) arrive to be taught each year. This trend is driven by the demographics of the grandchildren of the baby boom.[35] This demographic demand should shrink to half of recent experience by 2017 and the student flows should balance by 2020. The lull in growth for public education will correspond with the leading edge of children beginning to enroll in higher education.

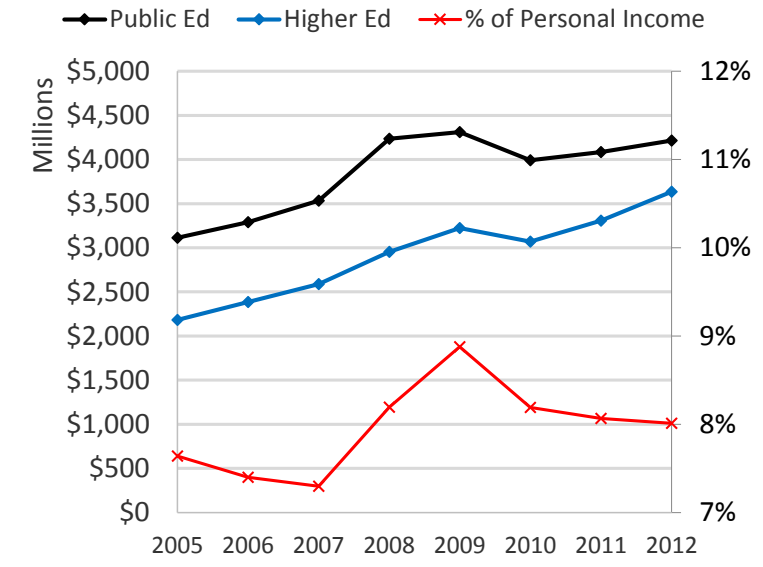
Figure C shows the growth in spending for Utah's systems of education to nearly $8 billion dollars. The chart shows education spending as a share of Utah Personal Income, this percentage increased in 2009 due to federal transfers amid the Great Recession and Utah's effort to prioritize education funding. Since the recession, funding has increased roughly in line with economic growth.

Figure B. Age Group Population and Enrollment



Source: U.S. Census Bureau, USOE, USHE

Figure C. State and Local Education Expenditure



Source: U.S. Census Bureau, State and Local Expenditure

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Agency Response

UTAH SYSTEM OF HIGHER EDUCATION
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April 22, 2015

David Stringfellow, MPP
Chief Economist
Office of the State Auditor
P.O Box 142310
Salt Lake City, Utah 84114-2310

Dear Mr. Stringfellow,

The State Auditor's Analysis Report No. AR 15-01, *Steps to Improve College Graduation Rates - College Preparation and Student Success* provides an independent analysis of data maintained by the Office of the Commissioner of Higher Education for the Utah System of Higher Education (USHE) (comprised of the eight public higher education institutions in Utah). The USHE data warehouse has been maintained by the Office of the Commissioner for over fifteen years and provides the foundational data for key reporting, including the annual USHE Data Book. The findings of the Analysis Report not only reinforce the objectives of current initiatives established by the State Board of Regents within USHE, but provide additional independent validation of the quality of the data collected by USHE over the years. These data help the Board of Regents, institution presidents and other higher education leaders better understand the complex nature of the issues they are continually addressing in an effort to remain efficient and cost-effective, while helping to drive innovation and growth in Utah's economy. Suggestions for analyses not previously utilized by USHE that are presented in the report are well worth additional consideration. Thank you for taking the initiative to look into these important issues.

Key findings of the Auditor's Analysis Report demonstrate the importance of college preparation in high school. Quite simply, successful college preparation while in high school significantly impacts a student's ability to enroll in college, maintain timely progress and graduate. Key strategies and programs of the Board of Regents and USHE institutions that encourage planning and preparation in high school that lead to timely graduation from college include:

Regents' Scholarship and Utah Scholars

Established in 2008, the Regents' Scholarship encourages Utah high school students to take a college prep curriculum above and beyond the Utah high school graduation requirements. This merit-based scholarship provides a clear college preparation path for high school students as well as influences the types of courses offered by Utah's public high schools.

2,328 students were awarded the Regents' Scholarship in 2014. USHE data indicates that students who receive the scholarship are more likely to be successful in college: on average, recipients earn a higher GPA and complete their degree more quickly than those who do not receive the scholarship.

The Regents' Scholarship is funded by the Legislature and administered by the State Board of Regents. Applicants and awards for the Regents' Scholarship have grown annually by at least 20%.

Utah Scholars is the outreach effort associated with the Regents' scholarship. While any Utah high school graduate can apply for the scholarship, Utah Scholars focuses on reaching underserved middle school students. The program coincides with the time 8th graders register for their 9th grade classes – and uses in-classroom presentation by volunteers who encourage students to take a rigorous course of study in grades 9-12 that goes beyond the requirements for high school graduation. This program, administered by the Office of the Commissioner, touches every 8th grader in 16 Utah school districts.

High School Math Recommendations

In March 2014 the Board of Regents approved Recommendations for High School Mathematics Preparation to clarify what is expected of Utah high school students to successfully prepare for college. Those recommendations are as follows:

- Each year in high school, students should take the most rigorous Mathematics course for which they qualify. Utah high school and college data is clear that a student who successfully completes math the final year of high school is twice as likely to complete their college math requirement.
- All students should successfully complete high school Secondary Math I, II and III, or Secondary Math Honors I, II and III.
- Students who intend to pursue a college degree should complete one or more mathematics course(s) beyond the high school math required for graduation.

USHE Completion Strategy

In 2013, the Board of Regents launched a multi-year strategy to improve rates of student completion by adopting specific system-wide initiatives, working with USHE institutions on their implementation. USHE institutions are required to provide annual updates to the Board of Regents toward their goals in support of the following objectives:

1. *Establish 15 credit hours per semester as the normal full-time course load for students.* Each institution has set a target based on the percent of students it has taking 15 credits/semester or 30 credits/year.
2. *Maintain plateau tuition at seven institutions, and work to inform students at all institutions so they understand the financial benefits of taking 15 instead of 12 hours per semester (or 30 hours per year including summers).*
3. *Create standardized semester-by-semester degree program maps with specific recommended courses, and actively promote them to current and potential students.* Institutions have assessed how complete these degree maps are, and have set a target date for 100% completion by the end of 2015.
4. *Encourage students to enroll in an appropriate math course in their first year in college; transition students from developmental to credit-bearing math within three semesters; and market Math 1030/1040/1050 as a preferred concurrent enrollment option for high school students who qualify to take these courses.* Institutions have set goals to increase the number of students successfully completing the general college math requirement and decrease the number of semesters students spend in Math 1010 or lower.

5. *Expand feasibility of reverse transfer/stackable credentials.* Institutions that grant certificates have set a goal to increase the number of certificates that are contained within an associate degree, and associate degrees that can be embedded within a bachelor's degree. Associate degree-granting institutions have also set a target for associate degrees awarded to students and for increasing reverse transfer.

The Analysis Report confirms:

1) Better-prepared students are more likely to succeed in college.
2) Time is the enemy to college graduation. Studies show that students who take at least 15 credits per semester will earn better grades, save money and graduate sooner.
3) Students who are the most academically and financially prepared are more likely to enroll in challenging majors.
4) Math education plays a significant role in college and STEM completion.

We are hopeful this report further informs state leaders of the complex issues related to college preparation and successful degree completion. As the provider of postsecondary education for over 80% of Utah high school graduates who go on to college, our USHE institutions are committed to providing students a high quality, affordable college education. Proof of this commitment is demonstrated by the fact that a USHE four-year degree, on average, is the third least expensive to obtain in the country. With the state's continued support, we are hopeful that we can continue to keep college accessible and affordable for all Utah high school graduates and that the programs we have implemented will lead to an increased number of students who successfully complete a high quality certificate or degree.

Sincerely,

David L. Buhler
Commissioner of Higher Education
Utah System of Higher Education