7-2006

# Student Transition to College

Doug Glasshoff
*Brainard, Nebraska*

# Student Transition to College

Doug Glasshoff
Brainard, Nebraska

A report on an action research project submitted in partial fulfillment of the requirements for participation in the Math in the Middle Institute.
University of Nebraska-Lincoln

July 2006

# Student Transition to College

## ABSTRACT

*In this action research study of recent graduates from my district, I investigated their level of readiness for college-level mathematics courses. I discovered that the students have a wide variety of experiences in college. There are many factors that determine success in college mathematics courses. These factors include size of college, private or public, university or community college. Other factors include students' choice of major, maturity level, and work ethic. As a result of this research, I plan to raise the individual expectations in my classroom. It is our duty as high school educators to prepare the students for a wide variety of experiences in college. We cannot control where the students attend college or what they study. High schools need to prepare the students for all possibilities and ensure that they have a solid knowledge of the baseline mathematics skills.*

This research project takes a look at the level of mathematical retention by past graduates of my small rural school district. I am interested in their level of preparation as they enter college level courses. At a small school, we cannot offer the same course load as larger school districts. Are our students behind these students when entering college? Are there things that I can be doing differently in my classroom to better prepare them for college? Many of our students take a rigorous class schedule, including algebra, geometry, algebra II and pre-calculus, along with chemistry and physics, but many still seemed unprepared for college expectations. I am interested in knowing if there is a lack of retention on materials they have previously learned.

This is an action research project; I am studying my current students and past students who have already graduated from the district. I have taught in this school district for five years. This was my first school after graduating college. I also coach three sports and am the district assessment coordinator. Because of these different roles outside the classroom, I have a different perspective than a traditional classroom teacher. As a coach, I have the opportunity to relate to the students outside of the classroom setting. As the district assessment coordinator, I analyze all standardized test scores, district data, and state standards. These roles outside the classroom influence me as a teacher in two ways: (1) I am more aware of student achievements and deficiencies, and (2) because of the close relationships, students are more open and honest with me and are more willing to come to me for assistance.

## PROBLEM OF PRACTICE

I needed to know if students are adequately prepared for their required mathematics courses in college after graduating from our district. This problem originated from discussions over the summer with recent graduates and problems they had in their college courses, particularly their mathematics courses. Not all students experienced difficulties, but some

demonstrated frustrations over what their professors assumed they already knew or could remember without review. My experience this fall with the student I discussed in Journal #1, made me more interested in researching this topic:

> …a student in college calculus asked for my assistance because he was struggling with his professor. This was a great student of mine in high school, always on task and working hard at his studies. I was surprised to hear him tell me of his struggles. He told me the first day the professor reviewed a small amount of advanced algebra and trigonometry and told the class they were responsible for review on their own. The professor also assumed that all of his students had been exposed to calculus in high school. This is a course we do not offer because of a limited number of students and teachers available. He went on to tell me that he was expected to know material all year that he had never seen before. I was clearly frustrated and I wonder if other students were experiencing similar situations as they entered college level mathematics. (Teacher Journal Entry)

I wanted to know if other students are experiencing these same frustrations or if this was an isolated incident. Was this the same for everybody at his college, or was it just his professor?

The problem of practice that this addressed is with the curriculum of our school. Is the curriculum preparing students to be successful in college? Does the curriculum need to be changed to address the many different requirements that students may encounter in college? Are my methods of teaching and assessing preparing them for college professors and their assessment process?

My goal for my math students is to acquire the experience and knowledge to be successful in college. As the primary mathematics teacher at our high school, it falls for the most part on my shoulders to properly prepare the students for whatever they encounter after they graduate. The ideal situation would be to cover calculus with all students so they could be prepared no matter what major they choose in college. On average, only half of the students in my school district take pre-calculus. The district requires three years of math and many choose not to take the fourth year for various reasons. If I could teach every student about statistics and trigonometry, then the student would be prepared no matter what life throws their way. There is,

however, a definite mismatch between ideal curriculum and reality. The ideal curriculum would have all students taking all math classes. The reality is that most students don't need the fourth year of math and changing the requirements would be met with great resistance.

Currently I teach through the book, covering everything in the book from the beginning to as far as I can make it each year. This usually results in about the same spot each year. For example, the topic of quadratic equations is usually left for the second year of algebra. I do not get the chance to teach them about the quadratic formula and all of its benefits: solving, discriminant, roots, etc. With the results of this survey, maybe I can narrow my focus on some topics and cover other topics in more detail. For example, I cover a lot of review material in the second year of algebra that we actually covered in great detail in the first year of algebra. We cover graphing of a line, solving single variable equations, and functions in the first and second year in great detail. My primary goal is that all students graduate with the necessary skills needed to be successful in the area they choose. I do not want them to limit themselves because of mathematics requirements in their desired major. I would like them to feel prepared to conquer all obstacles they encounter in college.

I need to know if students are prepared to see if changes need to be made beginning in Algebra I. I can move some topics I mentioned above from course two to course one of Algebra. This will free up more time for topics in Algebra II. Then I can move some course topics, such as statistics, from Pre-Calculus to Algebra II which would allow more of the needed time in Pre-Calculus. With more time in Pre-Calculus, I could cover derivatives and prepare them more adequately for their first semester of Calculus in college. As the teacher of all of these courses, it is possible to make these changes. However, I would like to know by collecting data from recent graduates what topics need to be covered and which topics need to be moved.

My goal is to develop a system to improve the transition from high school mathematics to the required college courses in our school system. I will provide a model in mathematics through this project. Then other departments in my school can do the same sort of discovery in their subject areas. There is more than likely the same sort of need to align English or Science to what graduates are experiencing in college courses. I believe the goal of our school states that we are to prepare students for life after walking across the stage on graduation. My question is, how do we know if we have succeeded?

I received in the mail a booklet that lists all the mathematics requirements of the colleges in the state of Nebraska for all different majors. It is amazing how each college requires a different amount of math even for the same field of study across the state of Nebraska. This booklet had a preface by Dr. Jim Lewis from the University of Nebraska-Lincoln, which tells me this is an important topic worth knowing about and learning more about. In the preface, Dr. Lewis writes:

> This publication provides students and school officials with a convenient reference to the mathematics requirements associated with the academic programs offered at Nebraska colleges and universities. The goal of this publication is to ease the transition from high school to college level mathematics and to emphasize the significance of mathematics in certain fields of work and study. (CSMCE, 2005)

How are we to prepare students for what is important mathematical knowledge when colleges have different requirements across the state? It is important that we all have the same goals in mind when preparing young adults to enter the work force. In a standards driven time, are we preparing them for all possibilities or narrowing our approach too much to just address these state standards?

## LITERATURE REVIEW

Concerns about the transition for students entering college has been an issue studied frequently. It is a topic of concern for both high schools and colleges alike. This transition is a

difficult one because all states have different curriculum requirements. This is especially challenging in the field of mathematics. In college math courses, there is a certain level of understanding that students must have prior to being successful. The National Council of Teachers of Mathematics [NCTM] found evidence from a variety of sources that makes it clear that many students are not learning the mathematics they need or are expected to learn. The reasons for this deficiency are many: in some instances, students have not had the opportunity to learn important mathematics (NCTM, 2000).

Standards can play a central role in the transition to college. The standards have a potential norming effect on educational programs across institutional boundaries (Conley, 2003). With the introduction of these standards across the nation, states and local school districts have adopted these or similar standards. In the past, most school districts taught the material they deemed important to student learning. This could vary widely from between districts and states. Now, most states have a common set of standards and all districts are striving to teach these standards. This levels the playing ground for students' transition to college. With a common set of standards, every student has the same opportunities to learn mathematics.

Interestingly, higher education faculty have not been consulted systematically on their views of needed knowledge and skills as states have rushed to develop content standards and assessments (Conley, 2002). It appears that most state assessments are not well aligned to the knowledge and skills for university success in mathematics (Conley, 2003). The goal of enhancing student learning is central to the secondary-to-postsecondary transition effort; it must be achieved through collaboration (Bragg, 1999).

High school graduation requirements in states throughout the United States were reviewed by Achieve, The Education Trust and the Thomas B. Fordham Foundation, to better

understand how well they align with what students need to be successful in college or the workplace. It was found that no state requires its graduates to take the courses that reflect the real-world demands of work and postsecondary education. Recommendations include the following: (1) requiring all students to take a common college and work-preparatory curriculum in math and English; (2) giving attention to content, not just course titles; (3) aligning academic standards in high school with the knowledge and skills required for college and workplace success; (4) working with postsecondary officials and employers to define the knowledge and skills necessary for graduates to successfully perform in college and the workplace; (5) providing clear guidance on essential courses and allowing flexibility for instructional approaches. States should encourage all students to pursue accelerated options for earning postsecondary credit while in high school (Achieve, 2005).

In a many cases, students are not enrolled in enough rigorous courses to prepare them for future study. One survey conducted by High Schools That Work [HSTW] found that 50 percent of their students enrolled in courses aimed at preparing them for some form of further study, yet 75 percent of these students say they plan to attend some form of postsecondary education. This means making the senior year count, eliminating low-level academic courses, and having more students complete the recommended default curriculum. Schools need to inform parents and students about the actions they need to take in the senior year so that students are better prepared for postsecondary studies. It is important to have every student complete a challenging academic core. The 13 rural high schools in this study, with the greatest proportion of students completing the recommended academic core, had significantly more students with mean achievement scores at the proficient or higher levels. This was measured by the National Assessment Educational Progress [NAEP] exams (Bottoms & Feagin, 2003). It is also important for students to have a

direction for their futures in mind as they progress from high school into college. A study found a strong association between achievement gains and career guidance: schools in which students talked more often with their teachers and counselors about the high school program increased their average scores. The reverse was also true – schools with students spending less time talking with their teachers and counselors showed decreases in test scores (Bradby & Dykman, 2003). When the students had education goals in mind and a direction for their academic courses, they were more likely to be successful. It is important for not only counselors, but also core teachers to encourage their students to take a rigorous course schedule: algebra, geometry, advanced algebra and trigonometry, and calculus. This needs to be done throughout their academic careers, including the senior year.

Preparing for college and the workplace requires taking the right courses. This is particularly true when it comes to mathematics, where data show a strong correlation between taking higher level courses in high school and achieving success in college (Achieve, 2005). The level of college students' high school curriculum was strongly related to their persistence in postsecondary education. This was true both for maintaining enrollment at their initial institution and, if they transferred, staying on track to a Bachelor's degree. The difference between levels of academic curricula was especially notable with respect to staying on track to a bachelor's degree. Findings demonstrate a consistent advantage in college achievement experienced by students who completed rigorous high school curricula, and to a lesser extent, by those competing mid-level curricula, over their peers completing core curricula or lower-level classes (Horn & Kojaku, 2001). Students need to challenge themselves in high school by taking rigorous courses. This will better prepare them for achieving success in college. The level of mathematics courses

taken in high school is a significant predictor of students' post secondary enrollment and of attaining a college degree (Adleman, 1999).

Throughout my research on literature on this topic, I found numerous articles that discussed how students need to take core classes in high school to properly prepare them for college. However, I struggled to find an answer to my question of retention. What about those students who took the rigorous courses and were unable to retain the information for future use? The data all points to the idea that taking the course will make you successful. There seems to be a gap in the literature that addresses the topic of retention or students who take the courses but cannot retain the information when needed in college. The students showed mastery on the subject at one point in time; why can't they recall the information after only a few short years?

This action research project is intended to examine two areas. The first will be to survey past graduates to obtain data on transitions to postsecondary studies. I will examine any gaps in curriculum and expectations from our district to the college level. Surveys will be conducted of college mathematics professors from both 2-year and 4-year colleges in the area. This will gather perceptions of student preparation from college professors' perspectives.

The second will be to determine if retention is a factor for difficulties in past graduates. I will be examining those students who took the college preparatory course work at our district but were unable to retain the information for their postsecondary studies. I will be conducting daily reviews in my current courses to study the effect on their retention of knowledge on a long-term basis. My goal is to develop a system to improve the transition from high school mathematics to the required college courses in our school system. Other departments in my school can do the same type of discovery in their subject areas. More than likely, there is the same sort of need to

align English or science to what graduates are experiencing in college courses. This research can benefit teachers in all subject areas.

## PURPOSE STATEMENT/RESEARCH QUESTIONS

The purpose of this study was to see if there was a gap in curriculum and retention problems as students transition from high school to college level math courses. Data collection took place during the spring semester 2006 in the researcher's classroom. The study attempted to answer the following research questions:

- What gaps are there in curriculum as students transition to local colleges?
- How does consistent daily review in my classroom raise the retention level of the curriculum in my current classroom?

## METHOD

The data collected came from graduates of the district in the form of a questionnaire (Appendix A). The questionnaire was developed in the fall semester, with intentions of distributing the questionnaires to the graduates in early March. After receiving proper consent, the forms were finally sent on April 24, 2006. There were a total of 51 surveys sent out to graduates of the classes of 2004 and 2005. I received 15 completed surveys and consent forms in the mail. The questionnaires consisted of student data, such as major, college, mathematics courses taken in both high school and college, and GPA. There were 14 questions about the graduates' experiences in college mathematics courses.

Other data collected came from a survey of college professors (Appendix B). The list consisted of professors from both universities and community colleges that had direct contact with freshman level mathematics courses. I contacted four colleges, three professors from each college. The professors were contacted by e-mail on April 25, 2006. I received five positive responses from professors agreeing to participate in the survey. Those who responded positively

were mailed a survey and consent forms. Those who received a survey were reminded by e-mail on May 9, 2006 to complete the survey. I received all five surveys back in the mail. The professors represented at least one from every school that I contacted. The surveys found out information on the professor's background and courses taught. The survey was intended to get their professional opinion, based on personal experiences, on student preparation for college level mathematics.

Another form of data included a weekly journal in my classroom to add a third type of data (Appendix C). The journal was written every Sunday evening about experiences from the previous week. The journal discussed topics from my current classroom of students and also personal contact with graduates. The journal was kept beginning the week of February 6, 2006 and concluded the week of May 1, 2006.

The data from the graduate surveys was incomplete and hard to get useful data. There could be many reasons for this. The surveys were sent out at the end of the school year during dead week and finals week: a time that is typically swamped for college students. I received a low percentage of the surveys back. Once again this could have to do with timing again. It may be beneficial to go from a scale to open-ended questions. The data is also hard to get useful information from because it depends so much on where the student is attending college, the major chosen, and even the professor of the course. With more surveys returned, the data may have been more useful.

## ANALYSIS

My first assertion is that daily review has helped my students in their performances by raising the retention level of previous material learned in my classroom. The students are able to recall material more efficiently without as much guidance from me. This in turn helps them in

taking tests and quizzes. The daily review assignments in class are raising the retention of the students in my classroom. The class is traditionally a lower achieving group of students. I begin teaching a topic and the students are better prepared because they remember previous material more readily. The students need less time to recall old material during a new lesson with daily review assignments. The prior knowledge is greater because of the review assignments. Students need the review to recall the information. Without the review, the material seems to get lost somewhere along the way. The following response came from a professor at a local 4-year college with 41 years of experience:

> The typical freshman is weak in basic skills, does not know how to study math, and have exposure to algebra and pre-calculus with little retention of the material. (Professor Survey)

The majority of all students who graduate form high school and attend college have taken two years of algebra. Yet, I received this quote from a different college professor also at a local 4-year college with 30 years of experience, when asked about student preparation:

> It would be helpful if students came to college being strong in algebraic skills. We can easily teach them the calculus at college, but it is harder when we constantly have to review algebra. (Professor Survey)

Another response from a professor also confirmed that students are not prepared for the math skills at the college level. This response came from a professor at a local community college with 13 years of experience:

> While they all have to pass a placement test or meet prerequisite courses to enter certain courses, many have significant gaps in their math skills. For example, it isn't uncommon for students in applied calculus not to be able to solve a quadratic equation. (Professor Survey)

The students have most certainly learned this material somewhere in their previous education, but, when taking this higher level math class, are unable to recall the material. The material needs to be reviewed in order for the students to put the material

into long-term memory. The daily review assignments greatly raise the retention level of my current students. The review assignments will not only help them for the current class, but also will help them put the information into long-term memory. The review assignments help them determine what material will be important for future use. Typically, if it is in a review assignment, it will be used again in a future section. The review assignments are at the end of most sections and consist of eight to fifteen questions. The following came from journal entry during the week of February 20th:

> I have observed a better understanding of my students when they have to apply previous material to solve a problem that we are currently covering. They better understand the concept because they don't have to relearn the previous materials. I am currently doing this in my Algebra II classroom. This is traditionally a lower scoring class by nature. I am excited to see them being able to recall information from past chapters more efficiently. I am so pleased with the evidence that I am going to extend this practice to both of my Algebra I classes and both of my Geometry classes. I hope that I can continue to see growth in all these classrooms. (Teacher Journal Entry)

The following came from a journal entry during the week of March 8th:

> We covered a lesson on the intersection of a line and a conic section. The first part of the lesson requires the student to graph both the line and the conic section. This lesson follows directly after the lessons on conic sections. However; the students usually struggle most with the graphing of a line, even though they learned it in the previous chapter. I usually end up spending the first 10 to 15 minutes of the lesson reviewing the graphing of a line. This year, I was able to go directly into the lesson after just one example. The review lessons I have been assigning covered that concept. The students were able to remember the material with just that one example. This has never happened before. (Teacher Journal Entry)

This raised level of retention in my classroom came as a result of the review lessons. The review lessons come from the book and are at the end of each section. The materials contained in the reviews are intended to be materials the students will use in the near future.

My second assertion is that the students' success in college greatly depends on their choices of college and major. There seems to be a great variation of experiences in college level mathematics courses depending greatly on where the student attended college. The field of study that the graduate has chosen also plays a major factor on the experience in mathematics in

college. After speaking to a number of graduates, the amount of retention of mathematics needed greatly depended on what college they attended and the major chosen by the graduate. Data collected from my post graduate survey supports this assertion. The questions were on a scale of one to five, with one being strongly disagree and five being strongly agree with the statement. If you notice from the data, many have a range of three, if not four. Also the standard deviations of the data are around one on most of the questions. This is quite large for a scale of only one to five. All the students came from the same high school and experienced, for the most part, the same opportunities. Twelve of the fifteen who returned surveys took pre-calculus, the highest level of math offered at our school.

**Pre-Calculus**

| | | Frequency | Percent |
|---|---|---|---|
| Valid | 12th Grade | 12 | 80.0 |
| | Never | 3 | 20.0 |
| | Total | 15 | 100.0 |

**Descriptive Statistics**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| 1) My mathematics courses in high school fully prepared me for my college coursework | 15 | 2 | 5 | 3.73 | 1.100 |
| 2) I had been taught all materials that I was expected to know for my college mathematics course | 15 | 2 | 5 | 3.47 | 1.125 |
| 3) The professors adequately reviewed all materials from past courses that I was expected to know | 15 | 2 | 5 | 3.67 | .900 |
| 4) While in my mathematics course, I knew I had been taught the materials before, but I just couldn't remember them | 15 | 1 | 5 | 3.13 | 1.407 |
| 5) Once the professor explained what to do, the correct operations returned to me | 15 | 2 | 5 | 3.80 | .862 |
| 6) Compared to other students in my math course, I was more prepared for the materials | 14 | 2 | 5 | 3.14 | 1.027 |
| 7) The professor's way of solving problems was different from what I was taught in high school | 14 | 1 | 4 | 2.71 | 1.069 |
| 8) It would have been beneficial for me to have been offered a Calculus course in high school | 15 | 2 | 5 | 4.00 | 1.195 |

| | | | | | |
|---|---|---|---|---|---|
| 9) I spend the majority of my time trying to recall how to solve math problems, rather than actually working on them | 15 | 1 | 4 | 2.33 | 1.047 |
| 10) The professors expected me to know things I had never been taught | 14 | 1 | 5 | 2.57 | 1.158 |
| 11) Other students in the class had an easier time remembering mathematical concepts | 14 | 1 | 4 | 2.71 | .994 |
| 12) It was a difficult adjustment because the professors expected more than what was expected of me in my high school math courses | 14 | 1 | 5 | 3.07 | 1.269 |
| 13) The college math course required prior knowledge of the use of a graphing calculator | 14 | 1 | 5 | 3.00 | 1.468 |
| 14) It would have been beneficial for me to have more experience with a graphing calculator | 15 | 1 | 5 | 2.87 | 1.302 |

The above data shows that there is not a trend in the answers to the questions. The highest average on a question was a 4 about offering a calculus class in high school. The answers to the questions were all over the place and showed that it greatly depends on the students' personal experiences as to their feelings of mathematical preparation. The following came from a journal entry during the week of April 17:

> A student I spoke with is currently finishing his second semester at UNL. He was one of my students who took all four years of math knowing he wanted to attend a four year college. However, he was not planning on needing math for college and sort of slid by on as little as he could in the class. Then midway through the first semester, he changed his major to electrical engineering. This of course requires him to take many credit hours of math. He told me he had been struggling a bit with Calculus 106, but that he has managed to maintain a B throughout the semester going into the final. At this point, he felt confident in his math skills and being able to do well in future classes. He informed me that others in his graduating class were not faring so well in their respective classes and that one of the guys had to get at least an 85 on the final just to pass Algebra 101. Not likely on such a difficult comprehensive exam. It sounds like he will be taking the class over again next semester if he can't do well on the final. This was a student that also took Pre-Calculus in high school. He did acceptable in the class, and I expected him to perform at a higher level. (Teacher Journal Entry)

Is it the mathematics that is getting them or the adjustment to a more independent life with little rules? More than likely it is a combination of both. The following quote came from a college professor when asked about what high schools can do to better prepare students for college level courses:

> Give students more responsibility for their own learning. Some of our students come here with the idea that attending class and trying is enough to earn a passing grade. (Professor Survey)

## INTERPRETATION

All this data tells me that more review in my classroom would be beneficial for my students. From the journal entries, I can tell that the daily review problems had a positive impact on my classroom. It will be interesting to see if these differences will be carried over the summer as those same students transition from Algebra II to Pre-Calculus, and then into college the following year. Because this will be a long process, it is difficult to see all the benefits from the daily review assignments. Many of the effects may show up a few years down the road when the student needs to recall the data for college courses. I am currently pleased with the results of the review assignments and will continue to do them in my classroom setting.

Even with all this data and information of the importance of basic math and algebra skills of students who enter college math courses, it is difficult to say that all students in the school district need algebra. A significant percentage of students do not attend college, but choose to enter the working world directly after high school. We need to be careful in saying that all students need to experience calculus to be successful in life. This makes it difficult for high schools because of the wide range of students we need to prepare for the wide range of possibilities of where life can take them after graduation. This is why it is important for high schools to make the curriculum available and offer all students the opportunity to experience the highest level of mathematics available.

With the low response of students returning the surveys, it is difficult to say that the data represents all past graduates for our school district. With a greater number of responses, I could have been more confident to have a better representation of a typical post-graduate experience. There are also other factors that could have accounted for the raised level of retention in my

classroom this past semester besides the review problems. The increase in retention may have been because of my participation in Math in the Middle graduate studies. As a teacher, I now have better understanding of the math and pedagogy that came about because of my participation in the program. My students may have better understood the mathematics because my teaching techniques have been altered as a result of the program.

The professor questionnaires were very informative even with a low response rate of 5 out of 12 e-mails sent. A common trend that showed in all the responses was that a college professor wants the incoming freshmen to have basic algebra skills down. They can teach the calculus if the baseline skills are there. This reminds me of what I would tell an elementary teacher if they asked what students needs to know for algebra. I would tell the teacher that as long as a student knows basic operations, I can teach them algebra in high school. The focus in my classroom needs to be on students learning the material well enough to recall and use it at later date. The focus should not be on the number of topics covered and trying to get as a much as possible. However, the students need to master the topic before moving on to the next.

As a result of this research, I plan to raise the individual expectations in my classroom. It is our duty as high school educators to prepare the students for a wide variety of experiences in college. We cannot control where the students attend college or what they study. High schools need to prepare the students for all possibilities and ensure that they have a solid knowledge of baseline mathematical skills.

## REFERENCES

Achieve, Inc, Washington, D.C. (2004*). The expectations gap: A 50-state review of high school graduation requirements.* (ERIC Document Reproduction Service No. ED484793)

Adelman, C. (1999). *Answers in the tool box. Academic intensity, attendance patterns, and bachelor's degree attainment.* (ERIC Document Reproduction Service No. ED431363)

Bottoms, D. & Feagin, C. (2003). *Improving achievement is about focus and completing the right courses. Research Brief.* (ERIC Document Reproduction Service No. ED479508)

Bradby, D. & Dykman, A. (2003). *Effects of "High schools that work" practices on student achievement. Research Brief.* (ERIC Document Reproduction Service No. ED479784)

Bragg, D. D. (July, 1999). Enhancing linkages to postsecondary education: Helping youths make a successful transition to college. *Centerpoint, n5*.

The Center for Science, Mathematics and Computer Education (Summer 2005) *Mathematical requirements associated with academic programs at Nebraska post-secondary institutions.* University of Nebraska, Lincoln, NE: CSMCE

Conley, D. T. (April, 2003). *What is the alignment between knowledge and skill for university success and state academic content standards?* Paper presented at the Annual Meeting of the American Educational Research Association, Chicago, IL.

Conley, D. T. & Bodone, F. (April, 2002). *University expectations for student success: Implications for system alignment and state standard and assessment policies*. Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA.

Conley, D. T. & Brown, R. S. (April, 2003). *Comparing state high school assessments to standards for success in entry-level university courses.* Paper presented at the Annual Meeting of the American Educational Research Association, Chicago, IL.

Horn, L. & Kojaku, L. K. (April, 2001). *High school academic curriculum and the persistence path through college*. (ERIC Document Reproduction Service No. ED456694)

National Council of Teachers of Mathematics. (2000). *Principles and Standards for School Mathematics*. Reston, VA: NCTM