The Perceptions of High School Honor Students on the Academic Skills Needed to Succeed in College Science Classes

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The Perceptions of High School Honor Students on the Academic Skills Needed to Succeed in College Science Classes

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Abstract

High school honor graduates at a rural high school in the Southeastern United States of America have not been as prepared for college science classes. At the research site, which is located in one rural high school, honor graduates have been experiencing difficulties with their freshman college science classes although these students were honors students in their high school science classes. The purpose of this study was to understand the perceptions of high school honor students on the academic skills needed to succeed in college science classes. This qualitative case study was grounded in the brain-based theory of Caine and Caine. Twenty high school honor students participated in semi-structured face-to-face interviews and one theme emerged from the interview transcripts. The findings revealed that the most important academic skills for success in college science classes were problem solving, critical thinking, and how to study effectively skills. The implications of these findings for high school honor

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3 Research Paper Pertains to K-12 School Districts and the Institute of Higher Education
students are that the focus of the high school curricula should on the development of critical thinking, problem solving, and study skills.

Keywords:
school district, high school honor graduates, high school, science classes, college level, freshman college science classes, preparation of high school honor graduates, entering college, teachers and administrators, effectively prepare honor students for college science classes

Introduction

Higher education is crucial for a progressive nation (Ji, 2009; Lee & Ready, 2009). Higher education institutions in the United States of American need students who have acquired the necessary academic skills in high schools. Students entering college require academic skills (Attewell, Lavin, Domina, & Levey, 2006; Pascopella, 2005; Planty, Provasnik, & Daniel, 2007).

Problem Statement

At the research site, which is located in the Southeastern United States of America, high school honor graduates have been having difficulties with their freshman college science classes although these students were honors students in their high school science classes. Educational stakeholders at the research site needed research-based findings on understanding the perceptions of high school honor students on the academic skills needed to succeed in college science classes.

Nature of the Study

The researchers conducted a qualitative case study with a sample of 20 participants selected based on these criteria: (a) high school honor graduates from the research site, (b) college science students, and (c) at least 18 years old. The participants were from one high school within a school district having two elementary schools, one middle school, and one high school where these schools serve the entire county. Twenty former honor graduates who had attended college upon their graduation were invited to participate in the study, and 20 agreed to participate in this study.
Data were collected from the participants from only the high school that had an enrollment of about 1,000 students when this study was conducted. The population at the research site consisted of about 60% economically disadvantaged students. The student body was 61% White, 36% African American, and 1% each Asian, Hispanic, and multiracial (State Department of Education, 2008). Of these, about 60% qualified for the free or reduced lunch program (National Center for Education Statistics, 2008). The county had a population of about 20,000 people in 2008 where about 70% of adults had at least a high school diploma and 12% had at least a bachelor’s degree. About 71% of all county households earned less than $50,000 annually (Standard & Poor’s, 2008). At the participating research site, 53 teachers teach Grades 9-12 classes.

Research Question

What are the perceptions of high school honor students on the academic skills needed to succeed in college science classes?

Purpose of the Study

The purpose of this study was to understand the perceptions of high school honor students on the academic skills needed to succeed in college science classes and identify the academic skills high school honor graduates need to succeed in college science classes. The findings may help high school teachers and administrators, researchers, and other education stakeholders to help students develop certain academic skills needed to succeed in college science classes.

Conceptual Framework

According to Caine and Caine’s (1995) brain-based learning model, academic challenge leads to higher-level learning. High school teachers need to provide a learning environment for students to develop academic skills by applying the brain-based learning model in their teaching in order for students to innately search for meaning. High school students can apply the brain-based learning model by continually challenging themselves in their learning. When challenge does not exist
in the high school science curriculum, students may not be as successful academically in their college science classes (Lujan & DeCarlo).

**Definition of Terms**

*Academic preparedness:* Academic preparedness refers to the degree of ability to do college level work sufficiently. Students who are sufficiently prepared academically possess sufficient academic skills to be successful in college (Perrin, 2004).

*Rigorous curriculum:* A curriculum is rigorous when academic work is challenging, demanding, and holds students to high expectations (Wraga, 2010). Curriculum is designed to expose learners to difficult and challenging concepts and emphasizes depth of instruction to breadth of instruction (Andrew, 2008).

**Assumptions, Limitations, Delimitations, and Scope**

For the purpose of this study, the researchers assumed that the development of academic skills promotes growth, which leads to a higher level of preparedness of honor students for college science classes. The researchers also assumed that better prepared high school students perform better academically in college science classes.

The weakness of the study was that the researchers relied on the participants’ honesty in their responses during the face-to-face interviews. The study was limited to high school honor students from one high school within one school district and the implementation of a challenging science curriculum. The study was bounded by one high school. The findings may apply to the research site.

The scope of this study was specific to the high school honor students at the research site who were the focus of the study. The sample size limited the opportunity to generalize the findings to the larger and like school student populations in other school districts or states. The researchers interviewed 20 high school honor students. The timeframe for the study was limited to 10 weeks during the 2009-2010 academic year. The researchers had no authoritative position over the participants and therefore they were not concerned with the possibility of coercion. The participants were selected from aforementioned predetermined criteria.
Significance of Study

The study was significant in several ways. The findings generated new knowledge for high school teachers. The findings expanded the knowledge about the academic skills considered most essential for students entering college science classes. The findings may shed further light on high school honor students’ academic skills needed to succeed in college science classes.

The findings may help county administrators at the high school level to prepare students, teachers, building administrators, and policymakers to institute effective academic programs for science classes. The findings may guide education leaders’ efforts to hire highly qualified high school science teachers who help honor students developed the academic skills needed to succeed in college science classes.

The findings might help parents recognize their roles in helping their honor children develop the academic skills needed to succeed in college science classes. Local institutes of higher education, teacher organizations, school districts, and community members might benefit from having an awareness of the academic skills of honor students with regard to high school and college science curriculum.

Literature Review

Less than half of high school graduates feel being prepared for work or post secondary education (National Center for Educational Statistics, 2008) and that two-thirds feel being inadequately prepared for a 4-year college (Culpepper, Basile, Ferguson, Lanning, & Perkins, 2010; Hardy, 2006). Lack of academic preparation has negatively impacted students’ success rates in college (Steinberg & Almeida, 2008).

College remediation rates have increased across the United States of America (Attewell et al., 2006; Bettinger & Long, 2005). College students need remedial courses (Kirst, 1998). College freshmen spend less than a year in remediation (National Science Foundation, 2006). Remediation rates suggest a profound disjuncture between K-12 education and postsecondary institutions (Kirst, 1998). College costs have increased (Kennamer, Katsinas, Hardy, & Roessleer, 2010) and 49 of the 50 states received a failing grade in college affordability (Hebel, 2008, 2009, 2010). Colleges and universities spent around $16.6 billion
annually for remedial education (Hussey & Allen, 2006). Costs of remediation have been a contributing factor in the high costs of college.

Student accountability is probably one of the most crucial aspects of a quality education (Fisher & Frey, 2008). Lack of accountability has been documented in education (Hussey & Allen, 2006; Pascopella, 2005). Peer-led labs and peer-teaching have both been shown to raise achievement and motivation among students (Tai & Sadler, 2008; Tribe & Kostka, 2007). Hands on teaching strategies are also effective in improving student achievement (Zan & Geiken, 2010). Inquiry-based science instructional methods are necessary in teaching science where instructional strategies are effective for all levels of students (Sanger, 2007).

The teacher is the most important factor in the success and achievement of a student (Darling-Hammond & Rustique, 2005; Haycock & Chenowith, 2005). The teacher must be able to adapt (Haycock, 2001, 2005, 2010), and provide instruction that is relevant outside of school (Barab & Plucker, 2002). Continuing education workshops have been valuable in helping science teachers adopt a more real world focus in their classrooms (Barak, Carson, & Zoller, 2009). Mahalingam, Schaefer, and Morlino (2008) found that collaborative problem solving in science classes was beneficial. Teachers who are truly caring for students are giving them the most rigorous education possible (Schnee, 2008).

A student’s academic achievement is linked to the rigor of the curriculum (Allen & Robbins, 2008; Barton & Coley, 2010; Pardini, 2007). Loveless (2008) and Seon-Young, Olszewski-Kubiuli, & Peternel (2010) reported that young people are not challenged in school. The rigor and challenge of a student’s high school classes have been found to be the best indicators of how well that student might perform in college (Culpepper et al., 2010; Levesque, Wun, & Green, 2010; Smith, 2006). Ali and Jenkins (2002) found that exposure to a highly rigorous high school curriculum resulted in increases in college graduation rates. Academic rigor in coursework has been found to be most crucial among gifted students (McCollister & Sayler, 2010; Weber, Boswell, & Smith, 2008). Tsai (2007) found that an unchallenging curriculum is a major reason that a gifted student may become an underachiever.

A rigorous curriculum should encourage critical thinking skills through high instructional standards (Payne, Kleine, Purcell, & Carter, 2005). Teachers must have high expectations of their students (Ford,
Smith (2008) found that many students leave honors level classes and programs when they perceive that only the amount of work has increased and they get no net learning benefit from the honors level classes when compared to the regular classes. Culpepper et al. (2010) found higher achievement in college science among students who had taken rigorous coursework in math and science in high school. A rigorous curriculum embraces the deep immersion in the content area specified in Caine and Caine’s brain-based learning model (Washor & Mojkowski, 2007). A rigorous and challenging curriculum is beneficial to students and is needed in schools (Wiggins & McTighe, 2008).

Students learn best when they are interested and motivated, and their achievement level rises (Jones, 2009; Martin & Dowson, 2009; Martin, 2008; Tella, Tella, & Adeniyi, 2009; Winebrenner, 2006). Brain-based learning increases student interest (Wilson, 2004) and when interest is increased, achievement follows (Tella et al., 2009). The academic rigor associated with brain-based theory is required to stimulate students and promote academic growth (McCollister & Sayler, 2010). Brain-based learning has been found to be more effective than traditional methods in increasing student achievement (Ozden & Gultekin, 2008).

A challenging curriculum, such as prescribed in the brain-based learning model, and academic achievement in the post secondary realm are positively correlated (Center for Comprehensive School Reform and Improvement, 2006). The beneficial effects of increasing academic challenge and rigor have been well documented (Colangelo & Assouline, 2005). Brain-based learning, with its emphasis on challenge, has been found to be effective in increasing student achievement (Lujan & DeCarlo, 2006). Challenge and rigor do effect achievement (Kaufman, Robinson, Bellah, Akers, Haase-Wittler, & Martindale, 2008).

Sample and Context of the Study

The study population was high school honor graduates. The research site was a rural high school in the Southeastern United States of America. The participants were selected because they were high school honor graduate from the research site who have completed college science classes and were at least 18 years old. These criteria were employed to ensure that all participants would be able to report relevant and specific information concerning the study inquiry. The participant
pool was limited to those who met the selection criteria within the previous 5 academic years. Those candidates who agreed to participate in the study were invited to participate in face-to-face interviews. The sample consisted of 20 high school honor students of which 11 were males and nine were females. The times and places were chosen for the convenience of each participant. The participants were identified by the type of college they first attended, community college, 4-year university, or technical school, and the time since their high school graduation, either 2 years of less or more than 2 years. All of the participants attended college after high school graduation. Fourteen of the participants attended community college, five attended state universities, and one attended a technical college. Additionally, seven of the participants who had been out of high school for more than 2 years attended a 4-year college program after completing community college. Twelve of the participants took an elective science class during senior high school year, either physics or anatomy and physiology. Eleven of the participants took science classes classified as honors level or gifted classes.

**Research Design**

A case study design was chosen. Through interviews, the participants shared their perceptions of the academic skills needed to succeed in college science classes. The narrative research design was not chosen because the lives of individuals were not studied. The ethnography research design was not chosen because the participants were not members of an intact cultural or ethnic group. The phenomenological research design was not chosen because the participants were not studied for a prolonged engagement. Quantitative research designs were not chosen because the goal of this study was to understand the perceptions of high school honor students on the academic skills needed to succeed in college science classes. As a result, a qualitative case study was chosen and the participants were interviewed in a natural setting at the research site over a 10-week time period.
Ethical Protection of the Participants

The administrator responsible for research at the research site provided the researchers with a list of honor graduates who met the aforementioned selection criteria. Potential research candidates were contacted during their summer break, when they were back in their hometown, to participate in the study. Those candidates who agreed to participate in the study were provided with an informed consent form to sign. Those candidates who signed the consent form, were the participants in the study. The names of the participants were not revealed during and after the study was conducted. Each participant was assigned a unique number such as 10 represented the tenth participant. The names of the teachers of the participants were not collected during the interviews. All interviews were held in a comfortable place. All participants were informed that they could withdraw from the study at any time. The consent and release forms detailed all privacy protection measures.

Data Collection Procedures

The interviews focused on the research topic and were conducted face-to-face, recorded, transcribed, and member checked when completed. Interviews were audio-taped with the participant’s permission. The interviews were 1 hour each in duration. The interview protocol was used during the interviews. The responses of the participants were entered into NVivo 8.0 to manage the interview data. Follow-up interviews were scheduled with the participants after the completion of the scheduled interviews when member checking was needed. Follow-up contacts were made in person in order to give a complete examination of each response collected during the face-to-face interviews.

Data Analysis Procedures

All interviews were transcribed and recorded in color-coded notebooks representing a particular form of data. During the reading and deciphering of the interview transcripts, new or different codes were determined. Analyses for each case and by each research question were conducted. Themes emerged from the interview transcripts. Quality was
assured by member checking and peer debriefing. The findings were distributed the participants for their member checking. Specifically, each interview transcript was shared with the participant of that interview session to allow the participant to confirm that what was recorded was accurate. A researcher experienced on this topic conducting the peer debriefing by reviewing the interview transcripts and findings.

Reliability and Validity

Scholars should replicate the findings of this study. The researchers minimized data collection and analysis errors and researcher biases. The interview protocol was pilot-tested by experts on research, high school and college science classes, science curriculum, and policy development whose feedback was utilized to revise the interview questions. The interview questions were used as data collection instruments and were designed to measure what they were intended to measure. The researchers were the research instrument and as a result, credibility for validity was established through trustworthiness and member checking that contributed to the credibility of the findings by minimizing investigative bias.

Findings

The participants reported that critical thinking, problem solving, and study skills developed in high school better prepared them for college science classes. All of the participants reported that they developed problem-solving skills in high school. Half of the participants reported that they developed critical thinking skills in high school. Half of the participants reported that they developed study skills in high school.
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Table 1

<table>
<thead>
<tr>
<th>Academic Skills</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem-solving</td>
<td>100%</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>50%</td>
</tr>
<tr>
<td>How to Study Effectively</td>
<td>50%</td>
</tr>
</tbody>
</table>

Participants 1, 3, 5, 6, 8, 9, 10, 11, 13, and 14 reported that the high school teachers and administrators could do more to help honor students be better prepared for college science classes. Participant 1 reported, “Good problem-solving skills developed in high school make college courses easier because students were taught how to study effectively.” Participant 3 reported, “High school teachers taught us how to problem solve and how to take tests.” Participant 5 reported, “The teachers had excellent teaching strategies and helped us problem solve and study well.” Participant 6 reported, “At least one high school teacher taught using lecture-centered lessons with the focus on problem solving.” Participant 6 reported, “We mastered how to take notes during each lecture.”

The participants reported that their academic skills needed to succeed in college science classes depend on how well they were prepared after high school. Seven participants felt their academic skills were well developed while six felt their skills were somewhat developed, and seven felt their skills were not developed at all. Eight participants reported that they felt prepared in science courses and not in other academic courses. Ten of the participants indicated that they felt their high school science curriculum was challenging. All participants reported that grades were the overwhelming focus in high school. Sixteen participants reported that teaching should be about understanding the curriculum and not memorizing concepts.

Evidence of Quality

In member checking, the results were presented to the participants to ensure that they accurately reflected the participants’ feelings. No participant suggested any correction or modification after member checking was conducted.
Interview data were found to be consistent. Interviews were audio-taped, transcribed verbatim, and then presented to the participants for their review. This additional review allowed the participants to read their interviews and make comments, if necessary. All participants reviewed their interview transcripts to make sure that the information they shared during the face-to-face interviews were accurate. The participants’ rights were protected during this study.

Theme

The theme that emerged was that the participants who developed critical thinking, problem solving, and study skills were better prepared for college science classes. Theme: Students who developed critical thinking, problem solving, and study skills in high school are better prepared for college.

Discussion, Conclusions, and Recommendations

Results showed that the participants felt their high school science curriculum was a challenging curriculum and beneficial in preparing them for college science classes. In addition, results showed that honor graduates perceived that their high school curriculum affected their preparedness for college science classes; Specifically, those honor students who considered their high school curriculum to have been challenging felt more prepared for college than those honor students who did not consider their high school curriculum to have been challenging.

Interpretations of the findings emerged from the interviews with the participants. Honor students felt that a challenging curriculum in high school science, one that required more work from students, was instrumental in preparing them for college. The findings indicated that the participants were divided into two categories: those who felt prepared and those who were not prepared for their freshman college science classes. The participants who felt that their high school curriculum was challenging were required to work harder. As a result, these participants felt more prepared when they got to their college science classes. The participants who did not feel that their high school curriculum was challenging did not feel required to work harder. As a
result, many of these participants did not feel as prepared as their peers did when they got to their college science classes.

The participants who felt prepared reported that a high quality curriculum required them to work and study harder. These participants reported rigorous and challenging classes were important to them.

Having attended college, the participants were aware of what aspects of their high school education had helped them to become prepared for college. The participants were also aware of the aspects of their high school education that were not beneficial in helping them to become prepared for college. The participants were able to reflect on their recent high school experiences in light of their college experiences meaningfully analyze the practical efficacy of both their high school curriculum and their high school teachers’ teaching strategies.

The findings are supported by the current research that there is a link between academic work with a rigorous curriculum and high achievement in college, and study skill have been shown to be crucial for success in college (Haught, 2008; Huang & Cho, 2009; Manthey, 2005; Jones, 2009). With respect to gifted students, depth of instruction is crucial, and this requires the student to develop and utilize his or her study, problem solving, and critical thinking skills (Ruf, 2005). These findings support the suppositions of the brain-based learning theory as proposed by Caine and Caine (1990, 1995). Caine and Caine advocated that integrating bits of information together into an understanding is better than collecting and displaying random bits of information. This is what the participants were meaning when they referred to teachers’ asking them to think critically and develop study skills. According to St. Jarre (2010), effectively increasing rigor in education requires more emphasis on the teachers’ assigning the students a “heavy work which requires complex thought … adapting preexisting knowledge to new concepts” (p. 80).

Practical Applications of the Findings

Education stakeholders should measure the academic skills of high school honor students by providing evidence that these students have developed higher competencies for success at the next academic level. High school honor students need critical thinking and problem solving skills in order to do well in college science courses. The findings may contribute to the primary objectives of NCLB (2002) to provide
quality education for all children. The findings might help parents recognize their roles in helping their honor children acquire and hone these necessary skills, and assure parents that their children are learning at the honors level for ongoing academic success.

Conclusion

The finding that high school honor students who developed critical thinking, problem solving, and study skills in high school are better prepared for college has made positive contributions to the field of research. Focusing on the honor students’ aforementioned academic skills could assist K-20 education stakeholders with assisting high school honor students succeed in college science classes.

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