Using an Intelligent Tutoring System as a Textbook Supplement for Personalized Learning

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Abstract: Intelligent Tutoring System (ITS) programs are new technologies that may help to personalize learning paths to meet the needs of students with varying cognitive abilities. The purpose of this descriptive case study was to explore how educators describe the web-based ITS program, CompassLearning, in relation to the varying cognitive needs of students. The results of this study may guide instructional leaders to support learning beyond textbooks to the educational staff with the assistance of teacher leaders by promoting an atmosphere of blended learning. The theoretical framework of the study was utilized to find emerging themes as possible solutions to the specific problem—textbooks may not meet the varying cognitive needs of students at a school district in rural Michigan. Research questions bounded by propositions guided the development of questions for the focus group discussion and follow-up interview protocols. The data gathered from focus group discussion and individual interview questions answered by seven participants were transcribed, uploaded into NVivo10, and guided by propositions for thematic analysis. Codes were grouped corresponding to each interview question using NVivo10 to support data triangulation of the following: focus group discussion, individual interview, narrative information, and a document. Seven themes emerged from the data analyses: textbooks alone insufficient, web-based, ITS programs promote personalized learning, CompassLearning supplements textbooks, motivational theories, learning style inventories, response to interventions, and instructional adjustments. A recommendation for future multi-case study research with different school demographics and alternate web-based ITS platforms is suggested.

Keywords: CompassLearning, Web-based Programs, e-Learning, Blended Learning, Personalized Learning, Motivational Theories, Learning Style Inventories, Response to Interventions, Instructional Adjustments

Introduction

CompassLearning Odyssey is a computerized instructional program that provides differential instruction for math, science, history, English, and other subjects. Differentiated instruction may allow students with varying cognitive levels to learn using a web-based program. Students with varying cognitive styles have unique learning strategies (Chen 2010; Riding and Rayner 2012). CompassLearning is a web-based Intelligent Tutoring System (ITS) program that benefits students with different learning styles; a team of curriculum and assessment experts and a team of designers, writers, and engineers work together to develop creative lessons (Edgenuity 2017). The program personalizes the educational experience by creating learning pathways for every student based on what he or she has learned and what he or she needs to learn (Edgenuity 2017). The personalized learning experience goes beyond the traditional use of textbooks by helping students with exceptionalities understand and retain material while textbooks serve as curricular guides (Childre, Sands, and Pope 2009; Emory 2014). A program that supports personalized learning to support cognitive conditions may allow students to enjoy school and to learn (Willingham 2009; Olsen et al. 2014). CompassLearning as a supplemental program in the classroom may help students to perceive learning to be more fun and rewarding.

The curricular structure of textbooks is often driven by the needs of large states (e.g., California or Texas). Such textbooks may not align with smaller states’ standards and may not provide the adaptations necessary to meet the varying cognitive needs of students. For example, Texas is the largest consumer of textbooks with 5.2 million K–12 students (OESE 2016);
teachers in other states may use textbooks influenced by Texas’ curricular standards (Mangan 2010; Darder 2012). Textbook publishers save printing costs by developing a textbook that can adapt to the curricular needs of multiple states. Textbook publishers include more topics than necessary for any specific grade level to meet the demands of many states, which increases the possibility of large textbooks lacking depth of coverage in some area (Reys and Lappan 2007; Darder 2012). The lack of curricular depth is a downfall for several subjects (e.g. algebra, language, etc.) that require new concepts to build upon previously mastered concepts—similar to building blocks. Vertical articulation of curricula may be limited due, in part, to ineffective learning transitions from the prior grade-level textbook to the current grade-level textbook.

**Problem**

The general problem is the curricular structure (e.g., detail, organization, comprehension) of textbooks can make meeting the varying cognitive needs of students difficult. The curricular structure of textbooks lacks detail in alignment with specific state standards since textbooks are mass produced to align with the standards of large states like California or Texas. Thus such textbooks may lack adaptation to a diverse group of learners at a rural school district in Michigan (Kimmons 2015). The lack of adaptation to a diverse group of learners is a research problem, which may be solved by the supplement of CompassLearning using research questions aligned to the problem of the study. The main research question and two sub-research questions support the framework of the qualitative descriptive study for developing the focus group and supplemental interview protocols. Research Question 1 was the main research question that guided the study: What themes emerge related to using CompassLearning as a supplement to textbooks meeting the varying cognitive needs of students in a Rural School District (RSD)? Research Questions 2 and 3 were the sub-questions as follows: How do educational stakeholders perceive the effect of CompassLearning as a supplement to traditional textbooks in a RSD via their experiences? What theories or models do teachers in a RSD rely upon for the support of CompassLearning as a supplement to traditional textbooks in meeting the varying cognitive needs of students?

There is a need for support of blended instruction to meet the diverse group of learners. The term “blended learning” refers to formal learning programs through which students acquire knowledge to some extent through online instruction coupled with other forms of instruction in a traditional school setting under the guidance of a teacher or facilitator (Christensen Institute 2017; Gemin et al 2015). Blended learning differs, in part, from online schools because face-to-face instruction is part of the instructional process. Blended learning and online schools share similar learning methodologies as both use online learning programs, which may share similar theories or models embedded into the learning programs.

**Theories, Models, and Strategies**

Theories or models are an important contribution to the educational field, especially in the area of curriculum and instruction. Educators, through college courses and professional development, use theories or models to facilitate and support learning in the classroom. Constructivism, various motivational theories, learning styles, response to interventions, instructional adjustments, and other theories or models are part of the interview and focus interview questions used to gather data from seven study participants. An important cognitive theory in education, which may support web-based learning, is Bandura’s social cognitive theory, which suggests motivation has an influence on a person’s behavior (Kolodziej 2015). Two common constructivist principles are Piaget’s theory of cognitive constructivism and Vygotsky’s theory of social constructivism. Both theories promote inquiry as a method of instruction as well as support discovery and collaboration in an environment of learning (Henson 2015). Using a learning style inventory with students may assist the teacher in recognizing how students learn related to environmental, emotional, sociological, and physical elements in the classroom as well as providing insight regarding students’ cognitive abilities and right or left hemispheric learning
preferences (Pritchard 2014). A teacher may use the response to intervention (RTI) model or another strategy to make an instructional adjustment to meet the cognitive needs of a student. An instructional adjustment is similar to a prescription in the medical field, where the appropriate learning strategies or instructional/curricular theories are utilized to maximize the academic achievement of a student. The reauthorized IDEA of 2004, which was renamed as the Individuals with Disabilities Education Improvement Act, introduced the response to intervention (RTI) model (Burns and Gibbons 2012). The RTI model is a tiered-intervention model that is implemented to improve the learning outcomes of students with disabilities. These theories, models, and strategies are the theoretical frameworks of the web-based programming, known specifically as intelligent tutoring systems (ITS).

Intelligent Tutoring Systems

Intelligent tutoring systems (ITS) are environments for learning assisted by computer (Steenbergen-Hu and Cooper 2014). ITS platforms are versatile, intuitive, and learner-paced simulations utilizing computational models that grew in popularity as part of the learning sciences, cognitive sciences, computational phonetics, computerized reasoning, mathematics, and associated fields (Graesser, Conley, and Olney 2012; Steenbergen-Hu and Cooper 2014). The outer loop (learning tasks) and inner loop (task steps) of ITS are various types of tasks based on assessment and feedback adjusted to student responses at each step and level (Steenbergen-Hu and Cooper 2014; VanLehn 2011). ITS platforms differ from computer-assisted instruction (CAI), computer-based training (CBT), and eLearning; ITS platforms are advanced systems allowing infinite interactions with students (Steenbergen-Hu and Cooper 2014). CompassLearning is characterized as an ITS (Edgenuity 2017).

Methods

The purpose of this qualitative descriptive case study was to explore how educators perceive CompassLearning in relation to the varying cognitive needs of their students. Open-ended questions were used to gather the experiences and perceptions of seven educators at multiple school sites within a rural school district (RSD) in Michigan to generate themes reflecting the use of CompassLearning as a supplemental educational tool in addition to and support of textbooks in the secondary classroom. Specifically, how do educational stakeholders perceive the effect of CompassLearning as a supplement to traditional textbooks at RSD via their experiences? In addition, what theories or models do teachers at RSD rely upon for support of CompassLearning as a supplement to traditional textbooks in meeting the varying cognitive needs of students? The research questions were bounded by propositions, which guided the researchers on increasing validity and addressed a moderating variable of how effectively teachers use textbooks. The following propositions are statements based on the literature: personalized learning goes beyond the traditional use of textbooks by helping students with exceptionalities better understand and retain curricular material when textbooks serve as curricular guides (Childre, Sands, and Pope 2009; Emory 2014), and the program personalized learning by creating learning paths for every student based on what he or she has learned and what he or she needs to learn (Edgenuity 2017). The narrative perspective developed from participants’ responses is a strength of the descriptive case study design used in this study. The delimitation of the study was within the controls of conducting research (Simon 2011) with seven participants. A limitation to the study was the size of the rural school district and the district’s demographics. The study was limited to five schools. The potential harm to internal validity may have included the demographics of the school district; a lack of diversity may exist at each school compared to the student population on a national level. The percentage of Caucasian students was above the state average for all schools except the alternative high school, which had a higher percentage of African American students than the state average (OESE 2016). Additionally, perceptions of how teachers and other staff
assist students academically, using cultural learning theories and strategies, may differ depending on the cultural composition of the student population.

**Setting, Population, and Sample**

The study took place at the lower peninsula of Michigan in a community on the periphery of the auto industry cities of Flint, Saginaw, and Bay City. Farming is another main source of jobs for the geographical area, and the student population was approximately 1,208 students. The study population excluded students as participants and included educational stakeholders with experience or knowledge using CompassLearning and traditional textbooks. The sample size was seven educational stakeholders and represented specific groups: teachers, special education teachers, and paraeducators.

The sample frame consisted of a purposeful (non-probability) sampling, where the participants were required to have knowledge of CompassLearning as well as understand appropriate CompassLearning use in the classroom. Excluding students from the study was necessary because they are a protected class; students were either under the age of eighteen or had a special education designation. The sample size (seven participants) was limited by the case study design, where the themes developed from data supplied by the educational staff participants may not be generalizable to the general population.

**Pilot Study**

In order to assess the objectiveness of focus group discussion and individual interview questions, a pilot study was conducted with six volunteers who were not members of the sample group. Evaluating the face validity of the questions before the focus group and interviews began reduced potential bias. The interviewing the interviewer method (Chenail 2011) was used to assess researcher bias and revise problematic wording. The pilot study validated the questions for the focus group discussion as well as the individual follow-up interviews.

**Materials and Instruments**

The focus group discussion contained two parts (see Table 1). Both parts were predicated by a proposition based upon the literature. Participants were instructed that they could agree or disagree with the proposition as well as the statements made by other focus group participants.

<table>
<thead>
<tr>
<th>Table 1: Focus Group Discussion Questions</th>
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<tr>
<td><strong>Part 1</strong></td>
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<td><strong>Proposition:</strong> Personalized learning goes beyond the traditional use of textbooks by helping students with exceptionalities to understand better and retain curricular material when textbooks serve as curricular guides (Childre, Sands, and Pope 2009).</td>
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<td><strong>Question 1:</strong> Describe how you feel about textbooks being sufficient as the only learning tool if the teacher is effective with using this tool.</td>
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<td><strong>Question 2:</strong> What are your thoughts on having intelligent tutoring systems as personalized learning tools?</td>
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<tr>
<td><strong>Part 2</strong></td>
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<td><strong>Proposition:</strong> The intelligent tutoring system CompassLearning personalizes learning by creating learning paths for every child based on what he or she has learned and what he or she needs to learn (Edgenuity 2017).</td>
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<td><strong>Question 1:</strong> What are your perceptions on the effectiveness of learning with the intelligent tutoring system CompassLearning as a supplement to textbooks?</td>
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<td><strong>Question 1 follow-up:</strong> What about textbooks alone?</td>
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<td><strong>Question 2:</strong> Explain in detail about any of the following models or theories you may use to assist with the supplement of the intelligent tutoring system CompassLearning: cognitive theories, constructivist theories, motivational theories, learning styles, instructional/curricular theories, response to interventions, instructional adjustments, or others.</td>
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<tr>
<td><strong>Question 2 follow-up:</strong> What documents or artifacts can you donate to the study of these models or theories?</td>
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The individual, follow-up interview questions (see Table 2) were used to garner additional data regarding the use of the intelligent tutoring system CompassLearning as a supplement to textbooks to meet the needs of diverse learners, which provided both thick description and triangulation.

<table>
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<th>Table 2: Individual Follow-up Interview Questions</th>
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<tr>
<td>1. How would you describe your experiences using the intelligent tutoring system CompassLearning as a supplement to textbooks in your classroom?</td>
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<tr>
<td>2. What are your perceptions on the effectiveness of learning using the intelligent tutoring system CompassLearning as a supplement to textbooks? How about textbooks alone?</td>
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<tr>
<td>3. If you prefer using CompassLearning as a supplement to textbooks (Question 2), describe your experiences regarding how this type of learning meets the varying cognitive abilities of students.</td>
</tr>
<tr>
<td>4. Explain in detail how any of the following models or theories are used to assist with supplementing textbooks with CompassLearning: cognitive theories, constructivist theories, motivational theories, learning styles, instructional/curricular theories, response to interventions, instructional adjustments, or others.</td>
</tr>
<tr>
<td>5. If you do use any of the models or theories (Question 4), describe your specific experiences regarding how they may help or hinder the supplemental use of CompassLearning.</td>
</tr>
<tr>
<td>6. What are your thoughts on having a passive approach where student learning is based on CompassLearning alone without the support of models or theories?</td>
</tr>
<tr>
<td>7. What additional experiences or perceptions do you have regarding CompassLearning as a supplement to textbooks?</td>
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Data Collection

The data collection process began with a letter of introduction emailed to all stakeholders of the RSD. The introduction stated an interest in recruiting six to twelve participants who facilitated or had facilitated the ITS, CompassLearning. Eight stakeholders responded to the email, of which only seven were able to attend the focus group interview as participants. Third party cookies were deleted using the deleting browsing history option in all open browsers before retrieving email correspondence to protect the confidentiality of the participants. In the emailed correspondence, participants were assured that their participation was voluntary, and their part in the focus interview would take approximately one hour with a possible supplemental, follow-up interview for up to an hour. Upon arrival at the focus interview, each participant signed an informed consent form acknowledging the risks, data confidentiality and security procedures, coding process, and how to withdraw from participation if desired.

Analysis

The raw data from the focus group and supplemental interview questions were analyzed to develop common themes of the participants’ experiences. The process began by transcribing the answers to the open-ended questions followed by coding the answers to begin thematic analysis using NVivo10. A tape recorder was used to verify the answers or raw data written during the focus interview discussion and follow-up interview.

The propositions helped guide the boundaries of the analysis. The propositions guided the researchers on increasing validity and addressing the possibility of moderating variables during coding of the raw data. A codebook using NVivo10 was used to group codes to each interview question shared by the focus interview and individual, supplemental interview protocols, to support triangulation of the data. The codebook reinforced the confidentiality of participants by referring to each one as P1, P2, P3, P4, P5, P6, and P7 (see Table 3).
Findings

The focus group discussion and individual follow-up interview questions were aligned to the primary research question—[RQ] What themes emerge related to using CompassLearning as a supplement to textbooks meeting the varying cognitive needs of students at RDS?—as well as the two sub-questions—[SQ 1] How do educational stakeholders perceived the effect of CompassLearning as a supplement to traditional textbooks at RSD via their experiences? and [SQ 2] What theories or models do teachers at RSD rely upon for the support of CompassLearning as a supplement to traditional textbooks in meeting the varying cognitive needs of students?

The following themes emerged as responses to the primary research question and sub-questions:

- Theme 1: Textbooks Alone Insufficient [RQ; SQ 1]
- Theme 2: Web-Based Programs Promote Personalized Learning [RQ; SQ 1]
- Theme 3: CompassLearning Supplements Textbooks [RQ; SQ 1]
- Theme 4: Motivational Theories [RQ; SQ 2]
- Theme 5: Learning Style Inventories [RQ; SQ 2]
- Theme 6: Response to Interventions [RQ; SQ 2]
- Theme 7: Instructional Adjustments [RQ; SQ 2]

The propositions guided the focus group discussion questions based on the literature, which helped establish the emergence of themes related to the main research question. Theme 1 and 2 emerged with the boundaries of the first proposition. Themes 3 through 7 developed with the boundaries of the second proposition. The themes were compared and contrasted with literature.

**Theme 1: Textbooks Alone Insufficient**

The first theme established textbooks alone as insufficient for addressing the instructional needs of students with varying learning styles; this theme was supported by 100 percent (n = 7) of the participants. This theme helped support the first proposition that personalized learning goes beyond the traditional use of textbooks by helping students with exceptionalities to understand better and retain curricular material when textbooks serve as curricular guides (Childre, Sands, and Pope 2009; Emory 2014). Theme 1 eliminated the possibility of textbooks alone as an educational tool effectively put in place by a teacher as the moderating variable. The elimination of the moderating variable corresponds to the use of Northwest Evaluation Association (NWEA) assessments. The NWEA assessments may not accurately measure the academic growth from CompassLearning because of the inclusion of other formats of learning (e.g., other web-based programs, textbooks); the other formats of learning represent moderating variables, which are a limitation of the study.

**Theme 2: Web-Based Programs Promote Personalized Learning**

Seventy-one percent (n = 5) of the participants discussed how web-based programs promoted personalized learning for Theme 2, which supported the first proposition. The participants’
discussion focused on web-based programs addressing the gaps of learning for students and meeting their various learning style preferences or cognitive needs. Web-based or technology-based lessons may be helpful outside the classroom to help close the educational gaps. Technology-based lessons taking place outside of the classroom allow for a higher amount of focus on classroom content (Kolb 2011; Lemley, Schumacher, and Vesey 2014).

Web-based learning used only as a supplement was a sub-theme discussed by 43 percent (n = 3) of the participants. The participants agreed that web-based learning should not be the only type of learning taking place and should be used as an additional resource. Clariana’s (2009) quasi-experimental study supported web-based learning as an additional resource for learning and not the only learning tool in the classroom along with the following four learning activities: laptop-directed instruction, seatwork, teacher-directed instruction, and collaboration with peers and small groups.

**Theme 3: CompassLearning Supplements Textbooks**

All participants supported CompassLearning as a supplement to textbooks. Twenty-nine percent (n = 2) of the participants discussed CompassLearning supporting math and special education specifically. A few participants suggested classroom exclusion for special educational students to work on CompassLearning. Regular educational students may tease or bully special educational students working on lower-level CompassLearning lessons (e.g., cartoon-animated learning games) in the classroom. Low learning achievement may be a possible result of poorly implementing a new teaching strategy or program and addressing how the strategy or program fits the students’ needs (Tupa and McFadden 2009; Fullan 2013). Special education students encountering teasing or bullying in the classroom may want to work outside of class (e.g., exclusion) on CompassLearning program. The CompassLearning program may be more effective for meeting the needs of students’ learning in an exclusive learning environment.

**Theme 4: Motivational Theories**

The models or theories represented by Themes 4 through 7 emerged from the responses to the questions developed and guided by the theoretical framework. The framework was developed to incorporate the information needed to assist with the delivery of differentiated instruction to students with varying learning styles, which was the focus of the second proposition. A set of theories using the research questions and a problem statement guides the theoretical framework development, which assists with the analysis and discussion of data for the conclusions (Simon 2011).

Motivational theories were used by 43 percent (n = 3) of the participants to prompt students using CompassLearning as a supplement to textbooks. According to Bandura’s social cognitive theory in the literature discussion, motivation is a factor that influences a person’s behavior (Kolodziej 2015). An example of a motivating factor discussed by a participant was to award a star for each student to encourage attaining an 80 percent or higher on quizzes while working independently. The participant stated, “When using the motivational theories, we have a program that we use called the star program. If they [the students] receive ten stars every Monday, they receive a bag of chips.” Students earn a star for every 80 percent or higher on a quiz when they complete a quiz independently without any help.

The negation of motivational theory use (teacher application of motivational theory) would be allowing CompassLearning to do all the instructional interaction with the students without the teacher present. Without teacher involvement, students working online may be less likely or less inclined to finish assignments (Mentzer, Cryan, and Teclehaimano 2007; Platt, Raile, and Yu 2014). The teacher would not be there to award a star and praise the student who earned an 80 percent or higher on a quiz. A passive approach by the teacher not motivating the students to learn using web-based programs on computers or laptops may not work. Clariana’s (2009) quasi-
experimental study investigated a teacher who did not take a passive approach, which in return, resulted in success in the intervention group using laptops.

**Theme 5: Learning Style Inventories**

Learning style inventories (LSI) were discussed among 29 percent (n = 2) of the participants for the facilitation of CompassLearning as a supplement to textbooks. An LSI of the student may assist the teacher in recognizing how the student learns relative to environmental, emotional, sociological, physical elements; cognitive abilities; and right or left hemispheric learners (Pritchard 2014). CompassLearning displays animated lessons, which appeal to both visual learners and right hemispheric learners who prefer making connections to charts, networks, pictures, outlines, and courses of events (Magana and Marzano 2013; Shaffiei et al. 2014). A non-visual learner completing a geometric lesson on transformations and reflections may need a teacher’s help with the visual steps of the problems. Without having a student complete an LSI, the teacher may not know whether the student is a visual or non-visual learner. Thus, the teacher may have difficulties recognizing beforehand which students could struggle on the transformations and reflections lesson.

**Theme 6: Response to Interventions**

Fifty-seven percent (n = 4) of the participants said they used Response to Interventions (RTI) with CompassLearning. All three of the special educational participants used RTI. The RTI model was introduced by the reauthorization of Individuals with Disabilities Education Improvement Act of 2004 (Castro-Villarreal, Rodriguez, and Moore 2014). The RTI model is a tiered-intervention model, which is intended to help improve the learning outcomes of students with disabilities.

In addition to the participants who use RTI, the CompassLearning program is a researched-based program utilizing the integration of RTI. Tier I (Benchmark), Tier II (Strategic), and Tier III (Intensive) are the levels of interventions of the RTI model, which are the focus of the CompassLearning program (Edgenuity 2017). Tier I represents students needing minor help, who are at the normal benchmark levels. Students performing at lower grade-level expectations are at Tier II. Tier III is for students who are educationally at-risk and require intensive learning support.

**Theme 7: Instructional Adjustments**

Twenty-nine percent (n = 2) of the participants utilized instructional adjustments (IA) for adapting CompassLearning lessons. An IA would occur, for example, when a teacher resets a Pythagorean Theorem lesson, so the student is able to review the lesson again. IA may work along with RTI and LSI, when the teacher implements Tier II by tutoring the student on the Pythagorean Theorem or another lesson; the teacher uses the LSI of the student to apply the right supplemental instructional strategy.

Unlike the Intelligent Tutoring System (ITS) program, CompassLearning, instructional adjustments may not be possible with some web-based programs. One disadvantage may be the lack of a real teacher to adjust the instruction to meet the needs of students using a pre-scripted web-based course, whereas with and ITS, the educators may adjust the material (Carr 2014). The massive open online course (MOOC) is one example of a pre-scripted online course for an independent learner. As described in the literature, MOOCs are free online courses offered by universities to K–12 schools, similar to content provided by CompassLearning and Edgenuity (Horn 2014).
Limitations

The limitations to this descriptive case study included: the study design, the school district demographics, and participation of stakeholders. The case study design limits the participation to a smaller sample of participants. Thus, the challenge for a case study design is meeting the generalization criterion, as a validation of social science (Thomas 2011; Bardone and Lind 2016). A case study implemented at a rural school district (RSD) may not be generalized to schools across the United States due to factors including demographics, percentage of special educational students and at-risk students, and other factors. This RSD may have more dependent students, who may lack either external or internal motivation to learn, compared to an affluent private school with a large population of independent learners. The differences might influence the list of themes or models, in which motivational theories may not be on the list if the case study took place at the affluent private school. The participation of stakeholders was limited to a paraeducator, high school teachers, and special education teachers. Thus, a limitation was the willingness of participation, which relied on responses to a letter of introduction emailed to all stakeholders of the school district. Stakeholders not participating were administrators, parents, and others (e.g., school counselors, community members).

Future Recommendations

This descriptive case study examined experiences of seven participants who facilitated the Intelligent Tutoring System (ITS), CompassLearning, as a supplement to textbooks. The study was small in size allowing for thorough descriptive responses of these participants supporting the development of seven themes. As discussed in the limitations of the study, the study may not be wholly generalizable to other schools due to the nature of the setting, population, and sample. The study may need to be replicated at different types of schools as a larger multi-case study.

Instead of using CompassLearning as a web-based learning, ITS tool supplemental to textbooks, future researchers may want to examine other web-based, ITS programs in relation to their populations. Studies on CompassLearning and other web-based ITS programs may be time-sensitive because of continuous technological advances. Future studies may be necessary on new web-based, ITS programs as well as other new technologies, which promote academic learning. Further studies could help determine whether or not these new programs and technologies promote learning through the mastery of specific academic outcomes.

Conclusion

The data collected in this study included responses from seven participants with experience using the web-based ITS, CompassLearning, as a supplement to textbooks. Questions of how and why were the core of the focus group discussion and individual, follow-up interview protocols, which were aligned to the main research question and two sub-research questions. The questions addressed the problem related to the curricular structure of textbooks and their difficulty in meeting the varying cognitive needs of students. A qualitative, descriptive case study was designed to find a solution to the problem after no solution was identified in the review of literature. A methodological framework was developed with support of propositions to guide the boundaries of the research questions. A theoretical framework was utilized to support the data analyses resulting in the development of seven themes: textbooks alone insufficient, web-based ITS programs promote personalized learning, CompassLearning supplements textbooks, motivational theories, learning style inventories, response to interventions, and instructional adjustments. At a time when the acquisition of new textbooks and the maintenance as well as the obsolescence of new technologies must be incorporated into strategic plans, it is essential for educators, administrators, and legislators to understand the relationship between the two and their relative effectiveness. Future studies are warranted to determine whether or not new technologies
integrated in classrooms promote academic learning and address the varying cognitive needs of students.

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