Integrating 21st-Century Skills into the General Curriculum: Evidence from Public Schools in Alabama

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Abstract
In the last century, humanity witnessed a drastic change from an agrarian society to a manufacturing culture; now the world is experiencing the same type of change, but with more complexity toward a society based on information. Concerned educators and citizens have acknowledged the future of competitive global economics that the current generation is moving towards. A call has been put forth for policy makers, administrators, and educators to collaborate in designing a curriculum that will prepare students to build the skills required for the new century. The current study expands the view by revealing the voices of students and reporting students' ratings of their own 21st century skills. Students in three public schools in rural Alabama in grades 3-6 rated their abilities and enjoyment in using 21st century skills. Findings can help educators address the gap between the current school curriculum and the needed skills for the 21st century, as well as determine how prepared children in low-resource schools are to face the challenges of the new century.
Keywords: 21st century skills, assessment, standards.

Introduction

Philosophers and educators, such as Plato, Socrates, and Dewey have proposed many aims of education and suggest that the purpose of education is to produce knowledge, enhance understanding of human beings, improve peoples' morals and thinking, and accordingly their actions (Nodding, 2009). The role of education is still a critical matter, therefore; educators and policymakers need to rethink the role of education and educational institutions in P-12 schools, colleges, and universities worldwide. This reconsideration is essential to prepare students with skills that meet the needs for this sophisticated, complex and demanding century.

Dede (2010) posited that 21st century skills have emerged to meet the need of the sophisticated future. Numerous questions stem from this need for education reform. What does the workforce that we are preparing our students for look like? Are students equipped with skills needed by the workforce? These questions and concerns come from a number of stakeholders, some of whom were the CEOs of Microsoft, Intel, and Cisco -the three leading companies in technology. In 2008, these leaders expressed their concerns and raised questions whether the new graduates from schools and universities are ready to work in the digital age (Griffi & Care, 2015).

These legitimate concerns provide the basis for the need to improve curriculum appropriate for the 21st century. According to Wisniewski (2010), 20th century skills focus on knowledge, comprehension and application, while 21st century skills require a new set of skills for students to thrive. Kay and Greenhill, (2011) and Luterbach and Brown (2011) suggest that the need to teach the core subjects of reading, writing, math, history and geography is well established. Now however, educators, curriculum specialists, and policymakers must move forward to focus their attention on teaching skills that will better prepare students for 21st century needs, which include flexibility, adaptability, and innovation.

Trilling and Fadel (2009) suggest that 21st century skills are needed to help everyone learn, work, and live. We live in a society that is rapidly changing, but the education system does not always reflect and easily adapt to those changes. This is due in part to the difficulty associated with curriculum change. Barriers to change include educators who embrace academic traditions that resist instructional change, burnt-out teachers with no desire to improve their knowledge, lack of scientific educational studies that examine new teaching research-driven strategies, and regulations that prevent enthusiastic teachers as well as researchers from bringing new ideology into schools (Symonds, Schwartz, & Ferguson,2011).

Adapting and changing curriculum encourages teachers to be aware of their changing role in modern society. As noted by Adam and Tulasiewicz (1995), the role of the teacher has been transformed. In the past, teachers were the main source of information and now they must serve as facilitators, guides, mentors, and coordinators. Even higher education has been influenced by the changes. In his book, *Can Colleges and Universities Survive in the Information Age?* Duderstadt (1999) argued that the role of professors and faculty members is not to teach but

instead to design viable learning environments and experiences. To adapt to the changing needs, teachers must also use innovative teaching and assessment approaches (Griffi & Care, 2015).

Effective teaching goes beyond presenting information or lecturing. Students must be involved in the process to enhance their knowledge and skills. Education reform has become a necessity and must address many areas including standards, professional development for educators, learning objectives, assessments, and teaching instruction (Kay & Greenhill, 2011). Similarly, Templeton, Huffman, and Johnson (2011) posit the education system is responsible for preparing productive citizens, who must help their country face the challenges of today's economy. Education today is undergoing a serious crisis; it is facing challenges that unless addressed, will cause it to be incompatible with the needs of the 21st century.

This paper introduces and discusses the need for teaching 21st century skills, integration of 21st century skills into the curriculum, and recommendations for curriculum changes in light of middle school students' perceptions of their own 21st century skills

Integration of 21st Century Skills

Integrating 21st skills into the curriculum is an essential step to provide students with the content and knowledge they need to be competitive in the current society. General curriculum needs to be shifted from teaching memorization of basic facts to analyzing and engaging in a higher level of thinking. The concept of 21st skills goes beyond learning math, reading, arts, science, and history only. It is a set of new skills that students need to have for the future workforce such as collaboration and teamwork, communication, critical thinking, and problem solving.

The Partnership for 21st century (2007) developed a complete framework consisting of four main components that should be considered when integrating 21st century skills into any curriculum. Mastery of primary subjects-math, reading, arts, science, geography, history, government and civics- with 21st century skills themes including -global awareness, financial and business literacy, civic literacy, is the first component in the framework. The second component is learning and innovation skills which include creativity, critical thinking, problem solving, communication, and collaboration. The third component is technology, media, and information literacy. The last component is life and career skills in which students learn how to acquire social and emotional capabilities, such as self-direction, adaptability, and productivity to prosper in demanding life and work environment. The Partnership's framework can be utilized by educators to incorporate 21st century skills into the curriculum.

With respect to the implementation of 21st century skills, Bellanca and Brandt (2010) delineated several recommendations to integrate 21st skills in the classroom, some of which include: utilizing interactive teaching methods to encourage students' participation and collaboration, offering multiple opportunities for students to express their knowledge and understating, and supporting classroom debates, research, and experimentation. Likewise, Bell (2010) found that Project-Based Learning (PBL) is an effective teaching approach because it allows students to use their creativity, curiosity, and interests to thoroughly understand the subject matter.

Teaching in the 21st Century

To successfully engage in this century, educational research must continue to evaluate practices in education, meaning research-driven teaching methods are needed to discover new effective instructional methods to replace outdated practices (Norcini & Banda, 2011). Kay and Greenhill (2011) outlined the competencies needed for the 21st century and justified their necessity. Critical thinking, problem solving, global awareness, civic literacy, health literacy, collaboration, decision making creativity, global, and digital economy are identified among the most important skills students need to successfully function in the digital age.

The information age and new work environments require a set of skills that were not needed in the past (Dede, 2010; Luterbach & Brown, 2011; Trilling & Fadel, 2009; Wisniewski, 2010). This finding was supported by a study conducted by Sharma and Sharma (2010) which explored the major concerns of engineering students regarding the skills they need. The authors found that engineering students are typically concerned about their hard skills and how to improve them to meet the needs of the global economy. However, in the current work environment, the importance of soft skills is increasing, which are identified as communication, leadership, collaboration, and interpersonal skills (Sharma, 2010). As such, students should be learning how to develop their interpersonal communications, leadership skills, and how to work effectively in team situations. Dede (2010) suggests that the nature of interpersonal communications, leadership, and collaboration are changing. For example, in addition to collaborating face-to-face, people can collaborate with others across the globe via different communication means such as FaceTime, Zoom, Adobe Connect, Skype, GoToMeeting, and WhatsApp.

21st Century Standards

Education is a complex process that should be constantly assessed, improved, and changed based on the results of on-going assessment and reflection. Making education relevant to students and associating it with their own experiences is one of the goals of education reform (Kay & Greenhill, 2011). Ideally, schools prepare students to

gain critical thinking, problem solving, and decision making skills (Silva, 2009). Unfortunately, this is not always the case. Therefore, the current curriculum needs to be adapted and must integrate new instructional practices (Luterbach & Brown, 2011).

What should students be taught, what do we expect them to learn, and how can they learn it? A change in the education system must be preceded by a change in focus which is often dictated by standards. Kay and Greenhill (2011) believe the current education standards do not adequately prepare students for the future and they outline the limitations of the current educational standards and how they hinder the improvement of school curriculum. These limitations include a lack of focus on creativity, and dealing with technology. The authors also suggest the standards cover details the public is not aware of, and instead should focus on information that provides a better understanding about learning and how to master the critical skills needed now and in the future. The authors also suggest that mastery is measured by standardized tests, which do not provide a clear picture of what students really know.

These limitations underline several challenges educators face with the current standards which can be perceived as restricted and can complicate the learning process. They bind learning to standardized tests, and do not help schools to progress. In addition to inflexibility, standards limit the creativity of teachers as well as learner (Silva, 2009). Teachers feel obligated to dedicate teaching time to cover specific topics on which students will be tested, so students can pass the standardized tests. In response, Kay and Greenhill (2011) suggest alternative areas to be addressed by standards. Specifically, standards should emphasize the importance of 21st century skills, should provide a clear understanding of what knowledge is and how to obtain it, and should have some flexibility in terms of measuring student learning.

The Partnership for 21st century (P21) created guidelines which are strongly recommend for redesigning standards that will meet current, as well as future needs:

- Focus on 21st century skills, content knowledge and expertise.
- Build understanding across and among academic subjects as well as 21st century interdisciplinary themes
- Emphasize deep understanding rather than shallow knowledge
- Engage students with the real world data, tools, and experts they will encounter in college, on the job, and in life--students learn best when actively engaged in solving meaningful problems
- Allow for multiple measures of mastery. (p. 7)

21st Century Assessments

Another area of concern is in the area of assessment. As Kay and Greenhill (2011) and Silva (2009) indicate, traditional assessment tools, including standardized tests, narrow the curriculum, take time that could be used for teaching, often do not give adequate consideration to students from diverse backgrounds, and limit students' creativity. Standardized tests ignore individual differences by expecting that all students can answer the same questions at the same level.

Indeed, researchers have suggested different effective assessment models that can help teachers to assess student learning. Silva (2009) reviewed assessment tools that could be used at the college level to assess adults' knowledge.

The College Work Readiness assessment (CWRA) is one example that offers 90 minute tasks where students have to discuss a real-life dilemma that society is experiencing, and students use libraries of online documents, scientific journals, and magazines to come to a logical and practical solution. Friend and Bursuck (2009) suggest a portfolio assessment model be used with students who are culturally and linguistically diverse to assess student performance and the learning process. Additionally, teachers are encouraged to implement new assessment strategies, such as classroom-based assessments, to monitor the learning progress (Silva, 2009). In teaching, 21st century skills are essential to improve the quality and capacity of education. Many educational practices currently applied in schools are new approaches, but have not been sufficiently researched to determine their effectiveness. Often, educational practice is focused on improving quality without paying enough attention to the usability and efficiency of the educational tool, leading to a decrease in the importance and usefulness of the practice and tool. Adapting to education in the 21st century is challenging due to a lack of educational research to provide the groundwork necessary to establish appropriate educational practice. As Norcini and Banda (2011) suggest, to successfully fill this gap, educational research must step in and become the source of practice in medical school as well as general education.

Method
Data source. As part of a larger study focusing on the development of STEM-related content knowledge, standards, and outcomes associated with space, rocketry, and space shuttle missions, 425 surveys were completed by 3rd-6th graders attending four public schools in rural Alabama randomly selected from the seven schools engaged in grant-sponsored *Adventure to Space Week* activities provided by the staff of the U.S. Space and Rocket Center in

Huntsville, Alabama. The source of the data in this study was part of a program evaluation of *Adventure to Space Week* supported by the Appalachian Regional Commission (ARC). As per the guidelines of the institutional *review board* (IRB), program evaluations are exempt from IRB approval.

Instrument. Students were given a 47-item survey comprised of two fill-in-the-blank questions (demographic: grade and name of school), three open-ended questions ("List as many jobs you can think of that you might want to do when you grow up," "List as many jobs you can think of that use math, science, engineering or technology/computers," and "Is there anything else you want us to know?"), and 42 multiple choice questions regarding how much they like math, science, engineering, technology/computers, and 21st century skills, as well as a rating of how skilled they feel they are in those same areas. For example, students were asked, "How much do you like to work in groups?" and were given the choices, A lot, Some, Not sure, Not much, and Not at all. They were also asked, "How good are you at working in groups?" and asked to rate their skills as Very good, Pretty good, Not sure, Not very good, or Not good at all.

Procedures. Hard copies of the survey were distributed and completed two weeks after the completion of Space Week. The results reported here are taken from the post-Space Week survey. Data from all surveys were manually entered into Qualtrics, an online survey software, for aggregation and analysis. All qualitative responses were exported from Qualtrics and imported into Atlas.ti for coding and analysis, leading to identification and reporting of common themes.

Findings

The post-Space Week survey was completed by 425 students in grades three through six. The distribution of student respondents to the post-Space Week survey by grade and by school is provided in Table 1. Due to tornado damage and resultant school closings, one school was unable to complete the post-Space Week survey. The number of respondents differs by question, as some students elected not to answer all questions.

Table 1

Distribution of Student Participants by Grade and School (Post-Space Week Survey)

Grade	Frequency	Percent (%)
3rd	99	23.3
4th	146	34.4
5th	136	32.1
6th	43	10.1
School		
A	68	16
G	288	67.9
S	68	16.0

The majority of students reported liking math and science content "a lot, or some". Overall, students reported enjoying doing science experiments in class and indicated that experiments help them understand science. With regard to methods used to present mathematics content, students reported enjoying: solving math problems, using math in projects, memorizing math facts, and solving math word problems. Finally, students reported that they enjoy using computers or other technology "a lot."

Students were asked to list as many jobs they could think of that they might want to do when they grow up. Students listed a total of 1308 jobs with each student generating a list between one to nine jobs, with three being the most common number of potential jobs listed. Table 2 provides a summary of the top 15 jobs mentioned most often by students (by percent).

Table 2
Jobs Mentioned Most Frequently

Job	Percent of Total
Medical	16%
Professional Sports	12.9%
Educator	12.6%
Police/Firefighter	9.3%
Legal	6%
Retail/Fast Food	4.9%
Cosmetology	5.6%
Scientist/Engineer	5.1%
Music	2.7%
Military	2%
Computers/Technology	2%
Astronaut	2.3%
Chef/Baker	2%
Artist	2%
Driver	1.6%

In order to provide insights into students' perceptions of their abilities as related to 21st century skills, students were asked to rate how good they were at: using their creativity, solving problems, working in groups, and communicating with others. In addition, students were asked to rate how much they liked: using their creativity, solving problems, working in groups, and communicating with others. The results are presented in Tables 3 through 10.

Table 3
Self-Perceptions of Creativity

Response	N (414)	%
Very good	196	47%
Pretty good	174	42%
Not sure	24	6%
Not very good	13	3%
Not good at all	7	2%

Table 4
Like Using Creativity

Response	N(410)	%
A lot	280	68%
Some	89	22%
Not sure	22	5%
Not much	9	2%
Not at all	10	2%

Table 5
Self-Perceptions of Problem-Solving Ability

Response	N(413)	%
Very good	151	37%
Pretty good	181	44%
Not sure	43	10%
Not very good	29	7%
Not good at all	9	2%

Table 6
Like Solving Problems

Response	N(410)	%
A lot	183	45%
Some	159	39%
Not sure	32	8%
Not much	24	6%
Not at all	12	3%

Table 7
Self-Perceptions of Collaboration Skills

Response	N(411)	%
Very good	252	61%
Pretty good	106	26%
Not sure	21	5%
Not very good	21	5%
Not good at all	11	3%

Table 8
Like Collaborating (Working in Groups)

Response	N(412)	%
A lot	265	64%
Some	86	21%
Not sure	15	4%
Not much	26	6%
Not at all	20	5%

Table 9
Self-Perceptions of Communication Skills

Response	N(413)	
Very good	245	59%
Pretty good	115	28%
Not sure	20	5%
Not very good	22	5%
Not good at all	11	3%

Table 10
Like Communicating with Others

Response	N(411)	%
A lot	265	64%
Some	98	24%
Not sure	23	6%
Not much	14	3%
Not at all	11	3%

Interestingly, although students liked and perceived themselves as being quite skilled at using 21st century skills, the reported use of these skills in content area courses that could and or should be activity-based, was relatively limited, even following an intervention designed to promote the use of activity-based pedagogy in

content area classrooms. See Table 11 for a summary of students' reported use of activity-based methodology in content area classrooms.

Table 11

Use of Activity-Based Methodology in Class

Activity		Frequency		
A lot/Some	Not much/Not at all	Not sure		
Hands on projects in science		77.4%	14.3%	8.3%
Solve real-life problems in science		60.5%	19.9%	19.7%
Hands on projects in math		64.9%	19%	16.1%
Solve real-life problems in math		70.3%	15.8%	13.2%

Discussion

These results provide students' perceptions of their use of 21st century skills. Most students reported enjoying hands-on activities, the use of technology, collaboration, and creativity in school. However, the results support the need to make learning engaging, relevant, and effective. The findings of the study are consistent with the reviewed literature in terms of the apparent absence of 21st century skills utilized in classroom activities as well as addressed across the curriculum.

To address the gap identified by these findings, we echo the call of numerous researchers who suggest incorporating new teaching methods. For example, educators should employ interactive teaching strategies to increase students' participation and collaboration, encourage students' creativity and problem solving skills with real world tasks, offer multiple opportunities for students to express their knowledge and understating through different means, and support classroom debates, research, and experimentation (Bell, 2010; Brandt, 2010; Norcini & Banda, 2011).

Based on the collected data, several strategies teachers can implement in the classroom when preparing students for success in the 21st century include: (1) giving students an opportunity to express their creativity and express themselves through their work, (2) informing students about the significant shift in society and its impact on their future performance, (3) allowing students to be part of the learning process and teaching them how to assess and continue to develop their skills, and (4) supporting effective communication among students to prepare them for future success as leaders.

Recommendations for educational leaders include: (1) giving students a voice in the school system by making them part of the decision making process; (2) providing funding and resources that can help students develop math and science concepts using hands-on, relevant, real-life, practical approaches; (3) supporting the use of technology across the curriculum; and (4) providing workshops and training for teachers to improve their instructional methods.

Further investigation in such a topic with a different population of learners will provide solid evidence and more information about the necessity of utilizing creative teaching methods to enable students to develop and practice 21st-century skills. Examining teachers' perspective will shed light on their own beliefs and willingness to integrate the 21st-century skills into the general curriculum. Finally, the outcomes of the empirical studies will assist stakeholders in making decisions to provide more findings that can support the integration of 21st-century skills into the general curriculum.

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