SECTION I

Digital Age Best Practices

Digital Age Best Practices represent a distinct set of instructional strategies that contain empirically validated results relating to student academic achievement while promoting the tenets of digital age learning. Each Digital Age Best Practice was selected based on the following criteria:

- Aligns to the National Educational Technology Standards for Students (NETS-S) and 21st Century Skills
- Demonstrates significant results on standardized tests
- Employs existing classroom digital tools and resources
- Provides results that can be generalized to any K–12 classroom
- Allows seamless integration with other "competing" instructional initiatives

The Digital Age Best Practices provide classroom practitioners with a balanced approach to addressing instructional practices that have demonstrated "statistical significance," but of equal importance, have promoted the critical attributes of 21st Century Skills and Themes. A summary of each Digital Age Best Practice follows.

Digital Age Best Practice 1: Bolstering Purposeful Inquiry Through Student Questions

Critical Look-Fors

- Student-generated questions drive the inquiry
- Evidence of one or more teacher-generated focus activities
- Presence of complex thinking processes
- Presence of a student-directed learning environment

Student-directed inquiry represents the process of students guiding their own inquiry through self-generated questions based on the dissonance created between the student and his or her psychological, physical, or digital environment. Creating this dissonance is often a result of the student's exposure to and interaction with an event, a self-generated problem or challenge, or a critical observation. Teachers seeking to promote inquiry often capitalize on some type of focus activity (e.g., staged scenarios, discrepant events, world events, word clouds, engaging video clips) that enables students to connect to the content in an authentic manner and generate purposeful questions about the topic.

Contemporary instructional models including the Universal Design for Learning (UDL), 5E Model (Bybee et al., 2006), Experiential-Based Action Model (Moersch,1994), problem-based learning, and issues-based science capitalize on this approach, providing the classroom teacher with a set of guidelines to transform didactic learning environments into purposeful centers of student inquiry. According to the National Science Education Standards (1996), "When engaging in inquiry, students describe objects and events, ask questions, construct explanations, test those explanations against current scientific knowledge, and communicate their ideas to others. They identify their assumptions, use critical and logical thinking, and consider alternative explanations" (p. 13).

Current meta-analytical research findings confirm positive gains on student academic achievement when comparing student-centered inquiry to conventional instruction (Preston, 2008; Schroeder et al., 2007). Independent studies by Anderson (2002) and Kessner (2008) documented similar findings. In research studies that address the usefulness of *project-based learning*, an instructional methodology grounded in student inquiry and authentic problem solving, Geier et al. (2008) and Mergendoller, Maxwell, and Bellisimo (2007) demonstrated that project-based learning was more effective than traditional instruction in increasing academic achievement on annual state-administered assessment tests as well as teaching specific content areas, such as science and economics.

The evidence suggests that the role of student inquiry using a student-centered learning model has strong merit as a Digital Age Best Practice. As with any best practice, whether digitally based or conventional, the fidelity of implementation ultimately determines the magnitude of the effect on student achievement.

Digital Age Best Practice 2: Promoting Shared Expertise With Networked Collaboration

Critical Look-Fors

- Students able to articulate a common group goal
- Evidence of student problem solving and/or issues resolution
- Individual and group accountability structures in place
- Employment of digital tools and resources (e.g., blogs, wikis, online threaded discussion forums) to promote collaboration

Structured social networking, a cornerstone of digital age learning, is not to be confused with students randomly accessing and updating their Twitter or Facebook account. As a Digital Age Best Practice, structured networked collaboration supports the concept of connectivism, whereby learning is viewed as a process of creating connections among information sources and developing networks. A network, in this context, may be a community of learners (e.g., a classroom), a digital environment, or a social structure where ideas are shared with others, thereby "cross-pollinating" the learning environment (Siemens, 2005).

When defining networked collaboration, a distinction needs to be made between cooperative and collaborative learning. Though both cooperative and collaborative learning involve students working in groups toward the completion of a task as well as sharing and comparing procedures and conclusions, cooperative learning tends to be more teacher centered than collaborative learning. Collaborative learning involves the empowerment of students for the purpose of finding solutions to problems and making inferences and drawing conclusions even though they may be different from the teacher's perspective.

The positive impact of cooperative learning on student academic achievement is well documented in the research literature (Dotson, 2001; Johnson & Johnson, 1999; Slavin, 1991). According to Slavin (1995), "Cooperative learning has its greatest effects on student learning when groups are recognized or rewarded based on individual learning of their members. Research has found greater achievement gains for cooperative methods using group goals and individual accountability than for those that do not" (p. 41). In a meta-analysis investigating the impact of teaching strategies on science achievement scores, the presence of a collaborative learning environment was cited as significant in terms of its link to improved student achievement (Schroeder et al., 2007).

As a Digital Age Best Practice, collaborative learning involves student participation in a learning community for the purpose of clarifying, assimilating, or generating new concepts or ideas. Collaborative learning retains the benefits of the cooperative learning structure but promotes higher-order thinking processes, purposeful problem solving and decision making, and issues resolution. The impact of structured collaborative networking on student academic achievement is less documented than cooperative learning given the relative infancy of this instructional approach. Baker, Gearhart, and Herman (1994) found that technology-enriched collaborative learning environments seem to result in new experiences for students that require higher-level reasoning and problem solving—two variables often linked to improved student achievement.

Studies conducted by Wade (1994) and Teele (2006) reported similar findings involving groups of elementary and middle school students, respectively. Students exposed to a collaborative learning environment achieved higher posttest scores in literacy and mathematics when compared to their control group counterparts. Although the available research on networked collaboration is modest compared to cooperative learning, we considered its potential in light of the empirical data supporting group learning configurations in general.

Digital Age Best Practice 3: Personalizing and Globalizing Content by Making Authentic Connections

Authentic contextual bridges provide the foundation for students to connect what they are learning in class to the real world. Herrington, Oliver, and Reeves (2002) identified ten characteristics of authentic learning that can be adapted to any subject area (Figure C).

As a Digital Age Best Practice, creating authentic contextual bridges can be accomplished by integrating one or more 21st Century Themes as articulated by the Partnership for the 21st Century (2013). These themes include global awareness; financial, economic, business entrepreneurial literacy; civic literacy; health literacy; and environmental literacy. Encasing these themes within a well-conceived and standards-aligned performance task can elevate the rigor and relevance associated with any content area.

Critical Look-Fors

- Learning connected to one or more 21st Century Themes
- Outcomes require sustained investigation
- Emphasis on multiple interpretations and outcomes
- Learning possesses an interdisciplinary perspective

Figure C Ten Characteristics of Authentic Learning

1. **Real-World Relevance.** Authentic activities match the real-world tasks of professionals in practice as nearly as possible. Learning rises to the level of authenticity when it asks students to work actively with abstract concepts, facts, and formulae inside a realistic—and highly social—context mimicking "the ordinary practices of the [disciplinary] culture."
2. **Ill-Defined Problem.** Challenges cannot be solved easily by the application of an existing algorithm; instead, authentic activities are relatively undefined and open to multiple interpretations, requiring students to identify for themselves the tasks and subtasks needed to complete the major task.
3. **Sustained Investigation.** Problems cannot be solved in a matter of minutes or even hours. Instead, authentic activities comprise complex tasks to be investigated by students over a sustained period of time, requiring significant investment of time and intellectual resources.
4. **Multiple Sources and Perspectives.** Learners are not given a list of resources. Authentic activities provide the opportunity for students to examine the task from a variety of theoretical and practical perspectives, using a variety of resources, and requires students to distinguish relevant from irrelevant information in the process.
5. **Collaboration.** Success is not achievable by an individual learner working alone. Authentic activities make collaboration integral to the task, both within the course and in the real world.

(Continued)

Figure C (Continued)

6. **Reflection (Metacognition).** Authentic activities enable learners to make choices and reflect on their learning, both individually and as a team or community.
7. **Interdisciplinary Perspective.** Relevance is not confined to a single domain or subject matter specialization. Instead, authentic activities have consequences that extend beyond a particular discipline, encouraging students to adopt diverse roles and think in interdisciplinary terms.
8. **Integrated Assessment.** Assessment is not merely summative in authentic activities but is woven seamlessly into the major task in a manner that reflects real-world evaluation processes.
9. **Polished Products.** Conclusions are not merely exercises or substeps in preparation for something else. Authentic activities culminate in the creation of a whole product, valuable in its own right.
10. **Multiple Interpretations and Outcomes.** Rather than yielding a single correct answer obtained by the application of rules and procedures, authentic activities allow for diverse interpretations and competing solutions.

Source: Herrington, Oliver, and Reeves (2003)

A clear delineation needs to be made between authentic performance tasks and authentic assessments. Authentic performance tasks become authentic assessments when scoring criteria is developed and shared with students. The goal is for students to internalize the criteria, establish milestones, and be able to monitor their own progress. According to Mueller (2005), "Authentic assessment is a form of assessment in which students are asked to perform real-world tasks that demonstrate meaningful application of essential knowledge and skills" (p. 2).

Research on various forms of authentic learning, such as students making authentic connections and integrated-curriculum programs, lend support to its inclusion as a Digital Age Best Practice. In a meta-analysis conducted by Hartzler (2000), "students in integrated curricular programs consistently out-performed students in traditional classes on national standardized tests, on statewide testing programs, and on program-developed assessment." Meissner (1999, Conclusion) investigated the impact of problem-posing instruction on mathematical problem solving among seventh-grade students and found a statistically significant difference between those students who received some type of problem-posing instruction and those who did not. Problem-posing instruction employs authentic, personally meaningful learning experiences as the basis for students to make sense out of their world by building connections between previous and new knowledge.

Though research provides empirical support for both *making authentic connections* and *student-directed inquiry* as separate Digital Age Best Practices, their combined effect in the classroom can provide the foundation for even more powerful learning.

Digital Age Best Practice 4: Accelerating Individual Growth Through Vertical and Horizontal Differentiation

In a differentiated classroom, the content, process, and product of learning are adjusted based on the readiness level, interests, and learning profile of the students. In a differentiated learning environment, the teacher

- addresses student differences both horizontally and vertically,
- adjusts the elements of the curriculum to match student needs,
- ensures that students participate in respectful work, and
- collaborates with students in the learning process.

Critical Look-Fors

- Adjustments to the content, process, and/or product based on learner readiness, profile, and interests are documented
- Presence of learning centers/ stations
- Digital tools and resources adjusted to the needs of the learner
- Multiple LoTi levels simultaneously employed in the classroom

An abundance of research findings (Kegerise, 2007; Luster, 2008; Slemmer, 2002) have found positive links between differentiated instruction and student achievement. Its inclusion as a Digital Age Best Practice has more to do with the complexity and diversity of students entering classrooms across the United States than with its alignment to the characteristics of the "defined" digital age learner (e.g., digital native). How do you promote the tenets of differentiation in school settings with multiple dominant languages, a large variance in socioeconomic levels, and distinct cultural differences? Here lies the challenge.

In a digital age differentiated classroom, the existing digital resources are used strategically by the teacher to adjust instruction either horizontally (e.g., student interests, learning modalities) or vertically (e.g., student reading levels). Instruction is delivered at multiple LoTi (Levels of Teaching Innovation) levels based on individual student or group learning profiles. LoTi is a framework conceptualized by Moersch (1995) that describes different levels of teaching practices with graduated levels of authenticity, complex thinking, student-centeredness, and technology use as one moves from a lower to a higher level of teaching innovation.

Accommodating the needs of today's digital natives requires multiple skill sets. The educator must be well versed in both specific strategies to differentiate instruction (e.g., tiered instruction, personal agendas, anchor activities, learning contracts, compacted curriculum, flexible grouping) and the available digital tools and resources that promote differentiation (e.g., wikis, blogs, interactive applets, simulations).

Digital Age Best Practice 5: Anchoring Student Learning With Digital Age Tools and Resources

Critical Look-Fors

- Emphasis on content and process skills; not the digital tools
- Digital tools used at a LoTi 3 and higher
- Digital tools used in conjunction with clear, measureable achievement goals
- Use of digital tools is purposeful and intentional

For years, the term digital age tools and resources or its earlier alias, technology, have been the standard-bearer for 21st Century Skills. Yet, used in isolation, its effects on student achievement have been criticized (Wenglinsky, 1998). As noted by Papanastasiou, Zemblyas, and Vrasidas (2003), "It is not computer use itself that has a positive or negative effect on the science achievement of students, but the way in which computers are used" (p. 325). According to Perez-Prado and Thirunarayanan (2002) and Moersch (2009), higher student achievement gains were found in classrooms using technology in conjunction with inquiry-based teaching that emphasized collaborative learning methods, critical thinking, and problem-solving skills.

Roschelle, Pea, Hoadley, Gordin, and Means (2000) noted that technology can enhance both what and how children learn when used in conjunction with (1) active engagement, (2) participation in groups, (3) frequent interaction and feedback, and (4) connections to real-world contexts. Results of more than seven hundred empirical research studies, a statewide study, a national sample of fourth and eighth graders, and analysis of newer educational technologies demonstrate that students show positive gains in achievement on researcher-constructed instruments, national tests, and standardized tests when they participate in

- computer-assisted instruction,
- integrated learning systems technology,
- simulations that teach higher-order thinking,
- collaborative networked technologies, or
- design and programming technologies (Schacter, 1999).

These findings corroborate a meta-analysis conducted by Sandy-Hanson (2006) that indicated that students who are taught with technology outperform their peers who are taught with traditional methods of instruction. These findings also suggest digital age tool use is most telling when implemented in conjunction with the other Digital Age Best Practices. In the LoTi (Levels of Teaching Innovation) framework, the occurrence of digital tool use with complex thinking strategies (investigation, decision making) and collaborative problem solving is first encountered at a LoTi 3 (Figure 8.0).

As Archer (1998) reminds us, "What matters most are not the machines and the wiring themselves, but what teachers and students do with them . . . a constructivist approach toward learning, in which students work in rich environments of information and experience, often in groups, and build their own understandings about them—taps into the computer's greatest strengths" (p. 12).

Digital Age Best Practice 6: Clarifying Student Understanding With Formative Assessments

Formative assessments refer to both informal and formal activities used by teachers and students to provide information about individual and group academic progress for the purpose of adjusting or modifying instruction. Research supports the use of formative assessments as a viable strategy to improve student achievement (Black & Wiliam, 1998b; Fuch & Fuch, 1986; Wininger, 2005).

According to Black and Wiliam (1998a), "such assessment becomes formative when the evidence is actually used to adapt the teaching

Critical Look-Fors

- Follow-up interventions are timely, targeted, and based on student data
- Adequate wait time given for student responses
- Framed questions apply directly to content understanding
- Digital tools and resources (e.g., blogs, wikis, discussion forums) used for student feedback

work to meet the needs" (p. 2). Formal assessments provide more structure and greater reliability (e.g., common assessments, benchmark tests, performance tasks); informal assessments require less structure but are more frequent, transparent, and in many cases, student centered (e.g., teacher observations, minute papers, peer reviews, questions and answers, self-reflection, student journals, pair shares).

The inclusion of formative assessments as a Digital Age Best Practice is based on the reflective nature of the formative assessment process to promote personal progress. Shepard (2000) links formative or classroom assessment with the constructivist movement, which suggests that learning is an active process, building on previous knowledge, experience, skills, and interests.

The critical attributes of the formative assessment process are also linked to specific 21st Century Skills that address the importance of being flexible, adapting to change, and becoming self-directed learners; for example, incorporate feedback effectively; deal positively with praise, setbacks, and criticism; demonstrate commitment to learning as a lifelong process; and reflect critically on past experiences in order to inform future progress (Partnership for 21st Century Skills, 2011). According to Stiggins and Chappuis (2008), "It is the practice of assessment for learning that wields the proven power to help a whole new generation of students take responsibility for their own learning, become lifelong learners, and achieve at much higher levels" ("Taking Responsibility," para. 1).

Digital Age Best Practice 7: Implementing Student-Centered Learning Environments

In a student-directed learning environment, students are vested with more options and input into the teaching/learning dynamic than its conventional instructional counterpart, teacher-centered instruction. Gibbs (1992) describes student-centered learning as giving "students greater autonomy and control over choice of subject matter, learning methods, and pace of study" (p. 23) to make decisions governing their own learning.

> **Critical Look-Fors**
>
> - Students talk exceeds teacher talk
> - Emphasis on individual or small group learning
> - Teacher/student negotiate learning opportunities
> - Use of varied instructional materials/strategies

The easiest way to think about student-centered learning is to visualize any learning experience as being divided into three components: content, process, and product. Content represents what students need to know or do; the process represents how the students will learn the content; and lastly, the product represents what the student(s) will need to produce to demonstrate their mastery of the content. In a student-centered learning environment, students are given options, input, or control into one or more of these components.

Consider the content/process/product wheel within a student-centered learning environment addressing the causes of the American Revolutionary War. In this scenario, students are given opportunity to provide input, make choices, or control the overall focus of their own learning. For example, students may be presented with choices relating to the content (e.g., investigate the economic issues impacting the U.S. colonies or the political discontent with autocratic rule), process (e.g., participate in learning stations, use an options list, participate in an I-Search investigation, negotiate a learning contract), and/or product (e.g., submit a blog entry, conduct a formal presentation, prepare a voice thread, submit a peer-reviewed article).

In K–12 classrooms, the concept of student-centered learning may also appear in the guise of problem-based or project-based learning. Both are derivatives of a constructivist learning model that emphasizes guided student engagement in discovery learning. Each seeks to present students with a complex problem or challenge requiring student identification of and engagement in the knowledge and skills necessary to successfully solve the problem or address the challenge (Laitsch, 2007).

Problem-based learning represents students actively engaged in a purposeful investigation surrounding an ill-structured problem. According to Barrows (2002), the use of ill-structured problems prompts students to "generate not just multiple thoughts about the causes of the problem, but multiple thoughts on how to solve it" (pp. 119–122). Thomas (2000) identifies five criteria for defining problem-based learning. Problem-based learning

- is central and not peripheral to the curriculum,
- focuses on questions or problems that "drive" students to encounter (and struggle with) the central concepts and principals of the discipline,

- involves students in a constructive investigation,
- is student driven to some significant degree, and
- represents realistic, not school-like scenarios.

Research indicates that problem-based learning benefits students by increasing their motivation and engagement for a topic, and it produces a positive effect on student content knowledge and the development of collaborative, critical thinking, and problem solving skills (Center of Excellence in Leadership of Learning, 2009).

The impact of a student-centered learning environment on student achievement is well established. Research shows that providing students with choices in learning activities increases students' achievement, engagement, perceived competence, and levels of aspiration (Cordova & Lepper, 1996; Westberg & Archambault, 2004). Current meta-analytical study findings confirm positive gains on student academic achievement when comparing student-centered inquiry to conventional instruction (Smith, 1996). As reported earlier, Geier et al. (2008) and Mergendoller et al. (2007) demonstrated that PBL was more effective than traditional instruction in increasing academic achievement on annual state-administered assessment tests, and it teaches specific content areas, such as science and economics.

Meta-analyses conducted by Dochy et al. (2003) and Walker and Leary (2009) found a positive effect from PBL on the skills of students. In a study on the effects of learner-centered classrooms, Salinas and Garr (2009) found "that minorities in schools and classrooms with higher learner-centered orientations not only have test scores statistically equal of those from their white peers, but also that students in learner-centered environments have higher scores in the non-traditional measures, including tolerance and openness to diversity" (pp. 226–237).

The evidence suggests that the role of student inquiry using a student-centered learning model has strong merit as a Digital Age Best Practice. As mentioned earlier, the fidelity of implementation involving any best practice, whether digitally based or conventional, will ultimately determine the magnitude of its effect on student achievement.

The majority of the Digital Age Best Practices have demonstrated moderate to significant results relating to student academic achievement. These include clarifying student understanding with formative assessments (providing formative assessments), bolstering purposeful inquiry through student questions (self-questioning by students), promoting shared expertise with networked collaboration (cooperative versus individualistic learning), accelerating individual growth through vertical/horizontal differentiation (tactile stimulation programs), and implementing student-centered learning environments (student-centered teaching) (Wiggins, 2012).

Many, if not all, of the Digital Age Best Practices can be integrated seamlessly into any learning experience or curriculum initiative ranging from a single day lesson plan to a new reading program. As with other "research-based best practices," their combined impact on student achievement consistently produces the greatest overall effect size on student achievement. The same is true with the aforementioned Digital Age Best Practices. Their deliberate use in the instructional planning process in isolation, collectively, or in concert with other best practices provides students the best opportunity to maximize their academic success and prepare for their eventual matriculation into a digitally based global environment.

Chapters 1 through 7 will explore each of the Digital Age Best Practices in greater detail, with emphasis on practical application to the classroom. The ensuing chapters will discuss the implementation challenges facing each Digital Age Best Practices' integration into the urban school setting defined by the Atlantic City Board of Education experience. The reader will hopefully note the pivotal role of district level leadership in finding viable solutions to potential implementation barriers stemming from various stakeholders (e.g., teachers, parents, community members). Many of these barriers were overcome by an administrative team that possessed the ***courage*** to stay the course in light of quick-fix options, a ***creative*** spark to finding solutions, a ***cultivating*** mentality to empowering others, a ***communication*** acumen that embraced community members, staff, and students, and lastly, a deep-seated ***commitment*** to purposeful and thoughtful change.