Current Issues in Emerging eLearning

Volume 4 | Issue 1 Article 1

March 2017

Educational Apps in the Blended Learning Classroom: Bringing Inquiry-Based Learning into the Mix

Todd S. Cherner
Portland State University, tcherner@unc.edu

Alex Fegely
Coastal Carolina University

EDUCATIONAL APPS IN THE BLENDED LEARNING CLASSROOM: BRINGING INQUIRY-BASED LEARNING INTO THE MIX

Todd Cherner, Ph.D.
Portland State University

Alex Fegely, M.Ed.
Coastal Carolina University

During the annual back-to-school meeting, Mrs. Bell sat listening to Mr. King, the high school principal. With the grade-level curriculum specialist at his side, Mr. King discussed the big change happening at the school.

> *"Students now have tablets and so do you. Our expectation is that this technology will prepare our students for college and career success."*

As he continued, Mrs. Bell listened while feeling a mix of excitement and hesitancy. She thought back over her five years in the classroom, remembering how so much of what was new then has already changed so quickly.

> *"How am I going to decide on the best ways to use these tablets for student learning?" she wondered to herself.*

As she mulled over this question, Mrs. Bell looked around the room and exchanged glances with her colleagues. They all sat there with similar expressions on their faces and thoughts in their heads.

The opening vignette is intended to be representative of the changes happening in schools, and how teachers internalize these changes. Teaching and learning in the modern age is very different, compared to the educational circumstances only a few years prior. These changes include trading paper-and-pencil materials and texts for tablets and educational apps. With the popular mantras of "College- and Career-Ready" and "21st Century Learning" behind them, school leaders are transitioning learning into a 1:1 technology model, which equips all students and teachers with a tablet device (Greaves & Hayes, 2008). This transition has made public education into a technology marketplace worth over eight billion dollars annually (Richards & Stebbins, 2014), and it has led to the development of new instructional models, such as blended learning and flipped classrooms (Kehrwald & McCallum, 2015; Mazur, Brown, & Jacobson, 2015). While teachers may realize students need to be prepared for the technological demands placed on them currently and in the future, these teachers need support for creating learning opportunities in their classrooms. The purpose of this paper is to put forward an original framework for creating app-based lessons. The framework builds on both blended learning techniques and the inquiry-based learning model.

This framework was created in response to the demands placed on pre-service teachers who were completing their internship in a public high school. Both authors are teacher educators who prepare their students to intern and potentially find employment in a 1:1 school district, where all students and teachers are provided a tablet device to use by the district. Through conferences with both in-service and pre-service teachers, the authors were informed that using educational apps was a common challenge in the classroom. To support them, the authors used their knowledge of blending subject-specific content, pedagogical, and instructional technology (Cherner & Smith, 2016; Koehler & Mishra, 2009) to create the framework that will be presented.

BLENDED LEARNING AND INQUIRY-BASED LEARNING

With the rise of instructional technology, the term *blended learning* has become very popular. Friesen (2012) traces the term's original use to an Atlanta-based company that offered software trainings and certifications for business people. In their usage, the company presented blended learning as the act of combining both synchronous and asynchronous learning activities to online classes. In her work, Driscoll (2003) reviewed different definitions that were available at the time, and she found that they all focused on the "combining" or "mixing" of technology with more traditional instruction to achieve an end goal. Though its etymology is rooted in the business world, the term has been adopted by educators and has evolved into an instructional approach.

Though blended learning means different things to different people, Garrison and Vaughan (2008) explain that blended learning involves "replacing aspects of face-to-face learning with appropriate online experiences, such as labs, simulations, tutorials, and assessments. Blended learning represents a new approach and mix of classroom and online activities consistent with the goals of specific courses or programs" (p. 6). So and Brush (2008) further explain the approach as a combination of instructional strategies that utilize face-to-face and digital tools, both synchronous and asynchronous. Given the range of instructional technologies and ways these technologies can be integrated into the classroom, there is not just one way to implement blended learning (Johnson & Marsh, 2013; Taradi, Taradi, Radić, & Pokrajac, 2005). Instead, there are four commonly used blended learning models[1], and each model has benefits and drawbacks (Smyth, Houghton, Cooney, & Casey, 2012; Vaughn, 2007). A commonality, however, is that each model includes opportunities to use educational apps in multiple ways. Cherner, Dix, and Lee (2014) explain a classification system they developed that groups instructional apps by three functions. The first classification comprises "skill-based" apps that use repetition and recall to teach foundational knowledge (e.g., learning vocabulary terms using digital flashcards or answering multiplication questions to advance in a video game). The second classifications includes "content-based" apps that only provide students access to knowledge (e.g., searching YouTube for a video or viewing a digital collection of art). Cherner, Dix and Lee (2014) explain the third classification as "creation-based" apps that allow students to create an artifact that demonstrates their learning (e.g., a multimedia presentation about a research project or a video documentary explaining a topic). The diverse and flexible uses of apps make combining apps from across the three classifications an ideal, though potentially complex,

[1] For a full discussion of the blended learning models, please see Staker and Horn (2012)

blended learning strategy. The authors propose that teachers use the inquiry-based learning model as a guide when beginning to incorporate apps into instruction.

INQUIRY-BASED LEARNING MODEL

In his seminal article, "Overview of problem-based learning: definitions and distinctions," Savery (2006) traces inquiry-based learning back to John Dewey. Savery describes inquiry-based learning as "a student-centered, active learning approach focused on questioning, critical thinking, and problem solving. Inquiry-based learning activities begin with a question followed by investigating solutions, creating new knowledge as information is gathered and understood, discussing discoveries and experiences, and reflecting on new-found knowledge" (p. 16). Inquiry-based learning first was used commonly in the science classroom, but it has since expanded to other content areas (Lacina, 2007; Shriner, Clark, Nail, Schelle, & Libler, 2010).

Hmelo-Silver (2004) outlines the typical cycle used to construct inquiry-based learning lessons. In the cycle, students are first presented a problem statement, which sets the stage for the learning. Example problem statements are:

1. How has the English language changed over time?
2. Which types of triangles appear most frequently in man-made objects?;
3. How has imperialism impacted developing nations?; and,
4. How do organisms develop?

After teachers ensure students comprehend a given problem statement, students work to identify key facts, theories, and other ideas they already know that directly relate to the problem statement. In response to the problem statement, students then put forward a hypothesis that draws on their background knowledge. The hypothesis should connect back to the facts, theories, and ideas students already have identified as connecting to the problem in some way. Students may be uncertain regarding the accuracy of their hypotheses. Hmelo-Silver (2004) refers to these uncertainties as productive "knowledge deficiencies" that drive students to collect additional data and experiment with their hypotheses. Students then take this new information and use it to rework their hypotheses after which they reframe results in a more formalized response to the problem statement.

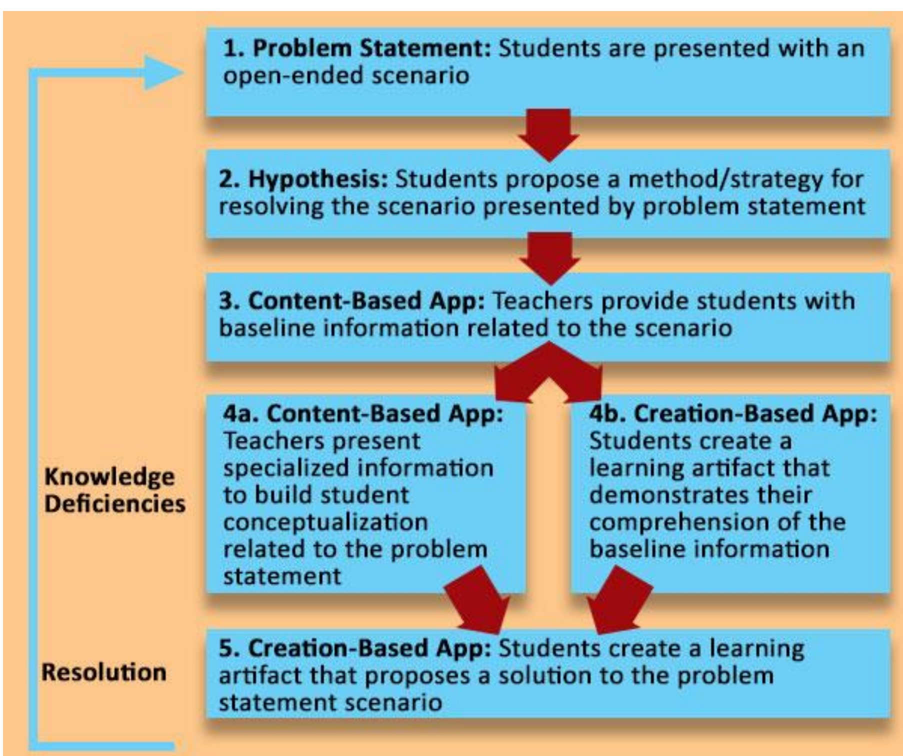
In a prior era, teachers crafted inquiry-based learning lessons in a format known as a WebQuest (Lacina, 2007). Stoks (2002) describe WebQuests as "an inquiry-oriented activity in which some or all of the information that learners interact with comes from resources on the internet" (p. 57). When engaged in a WebQuest, students visit a variety of websites and complete different learning activities. Often a WebQuests takes the form of an Internet-based scavenger hunt. In recent years, WebQuests have become far less popular. Stanley (2014) suggests that the decline in the popularity of WebQuests is due to the rise of Web 2.0 tools – tools such as search engines, social media platforms, crowdsourcing websites, collaborative tools, and file sharing services among others. Although Web 2.0 technologies may have caused WebQuests to lose relevancy and decline, these technologies hold promise as supports for effective teaching practices that enable students to pursue new inquiry formats. The authors suggest that teachers strive to continue the tradition of WebQuests by combining this older Internet inquiry form with the use of Web 2.0 tools to create newly relevant inquiry-based lessons.

USING APPS TO CREATE INQUIRY-BASED LEARNING LESSONS

To design an inquiry-based lesson, teachers need to first develop a problem statement. The problem statement sets the tone for the lesson, because students will respond to the problem statement at the conclusion of the lesson. Similar to essential questions, a key characteristic of a problem statement is that it is open-ended, so it ensures there is no one single “correct” hypothesis or solution involved (Branch, 2003; Lent, 2009); rather, students can respond to the problem statement in multiple ways. Teachers will need to present the problem statement to students and ensure they have a deep understanding of it, so their responses are aligned to it. Students then propose and record a hypothesis, which will serve as their baseline response to the problem statement prior to any instruction. At this point, teachers can direct students to a series of apps that provide them access to information and the opportunity to construct a response to the problem statement.

When using apps to design inquiry-based learning lessons, it is essential that teachers deeply comprehend the functionalities and purposes of each app (Cherner et al., 2014). This understanding allows teachers to make judicious selections of content-based apps that students can use effectively when researching or experimenting with information related to the problem statement. Similarly, deep knowledge of apps enables teachers to make judicious selections among creation-based apps students can use when documenting their learning. Knowledge about the functions and purposes of apps empowers teachers to design effective app-based lessons for their students. Beyond deep knowledge of the available apps, a lesson plan model for blending apps into lessons will utilize the apps’ instructional promise, as shown in Figure 1.

Figure 1. A Visual Map for Creating App-Based Lessons



The first step of the proposed lesson design model requires teachers to develop an appropriate problem statement for their lesson. It is essential that the problem statement establishes an open-ended scenario that enables students to develop a myriad of potential solutions to it. As teachers introduce the problem statement, they can explain the relevancy of the problem statement by explaining how it relates to students' lives. By making relevant connections to the problem statement for students, it will likely increase their motivation for engaging the lesson's line of inquiry and completing the learning tasks (Harackiewicz & Hulleman, 2010; Nicholoson, 2012).

In Step 2, students will draft their solution to the problem statement as a hypothesis. Teachers can modify the requirements for this hypothesis, but it is suggested teachers guide students to formulate hypotheses that clearly identify a potential solution and to include a rationale regarding why that solution has the potential to be successful. This rationale will lead students into the next steps that further their understanding of the problem statement and evaluating their hypothesis using apps.

Step 3 presents students with a content-based app, which is intended to provide them with additional information related to the problem statement. Depending on the content area and problem statement, this information may take the form of text, videos, audio, diagrams, maps, or images. Students will use this information to further support their hypothesis or to begin to rethink their hypothesis and to identify alternative hypotheses. At this point, teachers have a choice to make in regards to Step 4.

Step 4 is pivotal in this framework because it provides teachers with two options. Teachers must select the option that is most appropriate for their students and lesson, and the options additionally offer teachers an opportunity to differentiate their instruction based on their students' needs. The purpose of these options are to make students aware of any "knowledge deficiencies" they may have in relation to their hypothesis, and these two options are referred to in the framework as Path A and Path B.

If teachers follow Path A, they will guide students to use an additional content-based app to gather advanced data that builds on the information provided in Step 3. These data can be used to:

(a) Present additional perspectives related to the problem statement
(b) Demonstrate solutions that failed to remedy the problem statement
(c) Elaborate further on the significance of the problem statement.

Path A is appropriate for providing students with advanced background knowledge that pertains to the topic of study. For example, if the lesson's topic focuses on terraforming Mars, the content-based app used in Step 3 would explain the term *terraforming* on a general level. To do so, the app may explain what it means to terraform a planet, the process of terraforming a planet, and the history behind the idea of terraforming planets. In this way, Step 3 is used to provide general information about terraforming. With this baseline understanding, teachers would use Step 4's Path A to provide specific information about terraforming Mars. To do so, teachers would use an additional content-based app to present information about Mars, current plans to terraform the planet, and estimated costs and timelines for terraforming Mars. By following Path A, teachers are using Step 3 to provide general information about the topic and then using Step

4’s Path A to provide specific information that directly connects to the problem statement presented in Step 1, which sets the stage for Step 5. The other option before advancing to Step 5 is to follow Step 4’s Path B.

The purpose of Path B is to hold students accountable for understanding the content presented in Step 3 by having them produce a learning artifact using a creation-based app. This artifact may take the form of a piece of writing, an image, or a graphic organizer. The reason to use Path B is to ensure students comprehend the information presented in Step 3 before progressing in the lesson. Returning to the terraforming example, teachers could use Path B to have students describe the terraforming process in their own words, illustrate the terraforming process, or outline an argument declaring if and why they are for or against terraforming another planet. In each instance, students would use a creation-based app to demonstrate their understanding of the content, terraforming in this example, presented in Step 3. A key element when using Path B is that the task students complete using the creation-based app demonstrates their understanding of the content; it is not designed to modify or affirm their hypothesis, which will be addressed in Step 5.

Step 5 is the culminating inquiry component of this framework, and its intent is for students to offer a refined solution to the problem statement. This solution can be based on the students’ original hypothesis or the solution can be based upon an entirely new hypothesis. In both cases, students are to base their refined or new hypothesis on the content-based app in Step 3 along with the additional content-based app from Step 4’s Path A or their deeper understanding of the information using a creation-based app from Step 4’s Path B. To develop their new or refined solution, students will use a creation-based app to make a learning artifact, which again can take the form of a graphic organizer, piece of writing, video, presentation, podcast, or image. It is also important that students have the opportunity to share their artifact with their peers as a whole-class presentation or in small groups, such as a think-pair-share activity. Sharing is essential at this point so that students can receive feedback about their work and can demonstrate their learning to classmates.

The framework’s final component is the arrow shown in Figure 1 that cycles Step 5 back to Step 1. By encouraging students to share their solutions in Step 5 with their peers, students will be able to make modifications or further consider their solutions based on the feedback they receive. The arrow then serves as a symbol for representing that inquiry is a never-ending process and that as one solution is put forward, it opens the possibilities for additional solutions to be developed and new problems be solved (Bains, 1997; Lucero, Valcke, & Schellens, 2013).

In this model, teachers have the responsibility to select and choose the apps for the type of instruction described above. If teachers choose an app without fully understanding its functionalities and purpose, it may result in potential challenges and confusion for students as they attempt to use the app to complete a part of the lesson. Therefore, when selecting apps, it is essential for teachers to understand the purpose and functionality of the apps they choose. The following section offers two examples for how the proposed framework can be used.

APP-BASED LESSON FOR SCIENCE: CREATING CONNECTIONS TO THE PERIODIC ELEMENTS

The purpose of this lesson is for students to analyze the different periodic elements before identifying one and analyzing how it is used in society. The lesson is organized so students first select and view a periodic element at the atomic level before researching it and presenting their findings as a learning artifact.

Problem Statement: How are periodic elements used?

Hypothesis: The teacher will guide students through a K-W-L chart activity (Ogle, 1986) related to the periodic elements using the chart shown in Table 1.

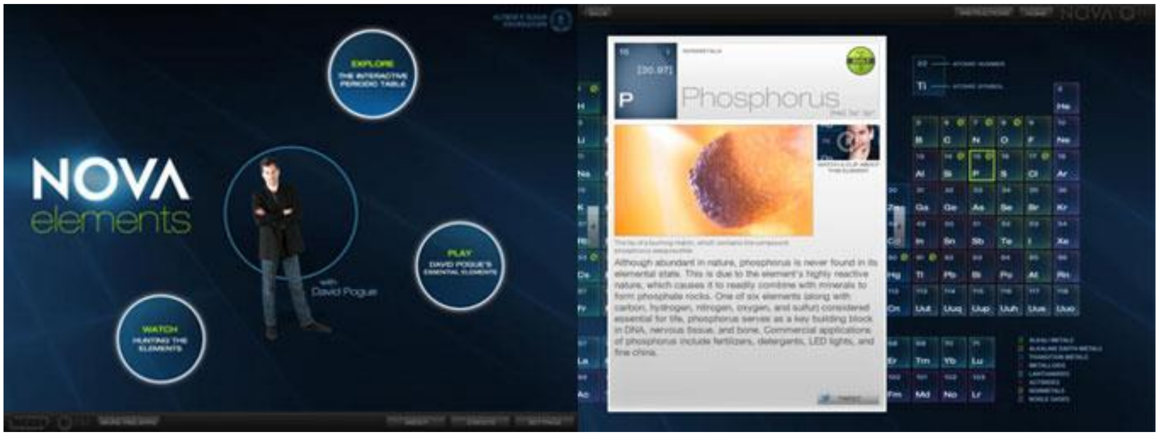
Table 1. Example K-W-L Chart

*What Do You **K**now?*	*What Do You **W**ant to Know?*	*What Did You **L**earn?*
1.	1.	1.
2.	2.	2.
3.	3.	3.

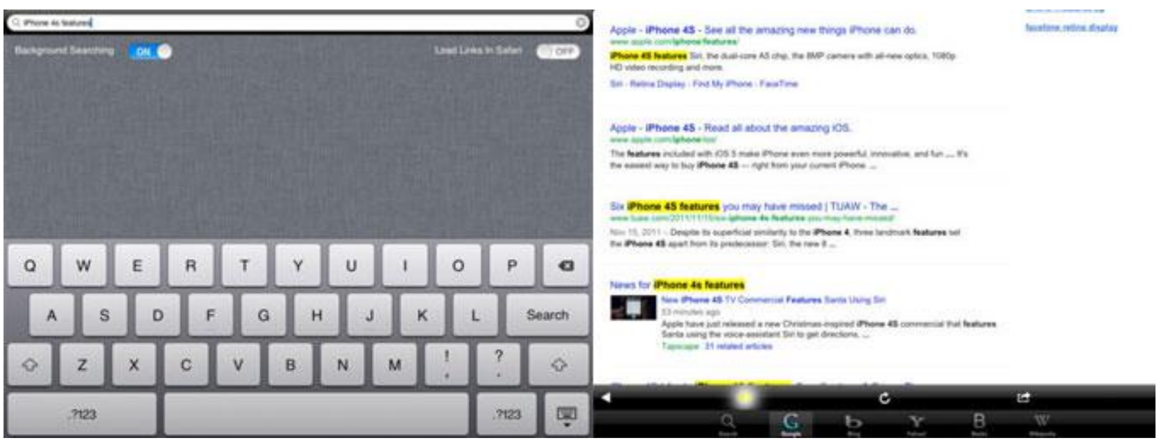
K-W-L charts are typically used before a lesson or unit of study to assess the information students know about a topic before instruction. At the conclusion of the lesson or unit, students return to the K-W-L chart and list what they learned, which visually displays the learning for students and the teacher. Though there is no single method for using a K-W-L chart, a common method for using it includes structuring it as a whole-class activity. In this example, the teachers would project the chart on a SMARTboard and ask students what they know and then want to know about a topic. As students respond, the teacher would record their comments on the chart. The teacher would then save the K-W-L chart and teach the lesson. At the conclusion of the lesson, the teacher would project the K-W-L chart again and lead students through a discussion of what they learned about the topic. As students responded, the teacher would record the information. In this example, the topic used for the K-W-L chart is the periodic elements. For the "What Do You **K**now" column, students will list background knowledge they already have about the elements. For the "What Do You **W**ant to Know" column, students will offer different questions they have about how the periodic elements are used. In this example, these questions are important because they constitute the students' hypothesis, as they provide a pre-instruction baseline of student schema regarding the periodic elements. At the lesson's conclusion, students will add the information they found to the "What We **L**earned" column.

Instructional Objective: Students will choose a periodic element and study it by constructing it at the atomic level, researching uses for the element and listing three facts about it, and then creating a detailed model of it.

Step 1: Students will use the NOVA Elements (2013) app[2] to select and construct a periodic element.



Step 2: Students will use the All Search Engines in One HD (2012) app to identify three facts about the element they selected.

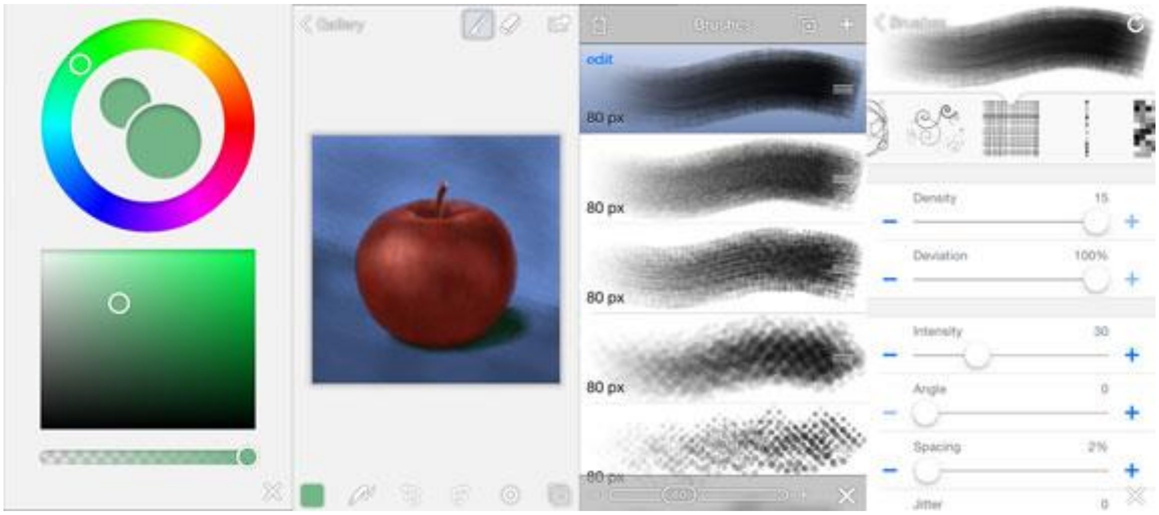


Step 3: Students will use the Brushes Redux (2016) app[3] to create a detailed model of the element they selected and list the facts they researched about it. _At the conclusion of the lesson, students will be able to use the information they learned from this lesson when they complete the "What We Learned" column on the K-W-L chart.

---

[2] The NOVA Elements app includes an interactive Table of Periodic Elements that provides detailed information about an element when an element is tapped. It also includes a feature that allows users to combine different amounts of protons, neutrons, and electrons together to create various elements.

[3] Brushes Reduxa allows users to create detailed drawings using a variety of writing utensils, images, and features. Once created, the drawings can be saved and shared over email.



Lesson Analysis

This lesson is designed to encourage students to make relevant connections between the periodic elements and the natural world. As part of it, students are required to deeply analyze the atomic makeup of a periodic element and then research ways the element is used. The hypothesis is the whole-class K-W-L chart activity in which teachers lead students in sharing information and questions about the periodic elements. This activity serves as hypothesis building because students must state what they think they know about an element before engaging in the lesson, and teachers will use this activity as a springboard into the app-based activities of the lesson.

For step 1, students are using an app to select an element and then construct it. Students will first choose an element and read about its particle makeup in this app. They will then use a feature in the app to form their element by adding protons, neutrons, and electrons together. As students add certain atomic particles together, they create different elements, and students will have to add the correct particles needed to create the element they selected. In Step 2, students use a search engine app to research ways the periodic element they selected is used. The uses can relate to artistic, manufacturing, and culinary purposes among others. The final step requires students to use an artwork production app to create a graphic that represents the element and includes three ways it is used. Teachers conclude this lesson by having students add information to the “What I **L**earned” column on the K-W-L chart based on the research they conducted in steps 2 and 3.

By completing this lesson, students will have used two content-based apps and one creation-based app that follows the Path A route shown in Figure 1. The students will use higher-order thinking skills to analyze the atomic makeup of an element and research it before creating a way to represent their findings. As students complete this lesson, they are making relevant connections between the periodic element they selected and ways in which society uses it.

APP-BASED LESSON FOR ENGLISH LANGUAGE ARTS: DEFINING PREFERENCES IN SHORT STORIES

The following inquiry-based lesson exemplifies how multiple apps can be used to engage short stories. The purpose of this lesson is for students to articulate the narrative elements they prefer a short story to include, test their preference by reading a short story, and then re-evaluate their original response.

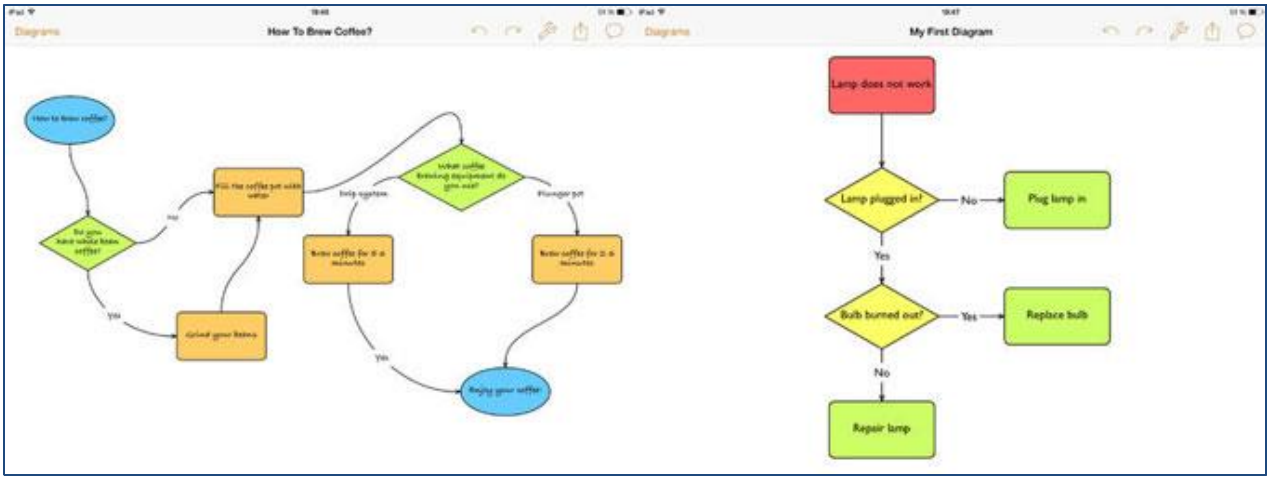
Problem Statement: What elements of a short story do you prefer?

Instructional Objective: Students will select and analyze a short story by completing a storyboard graphic organizer and justifying if they did or did not enjoy the story.

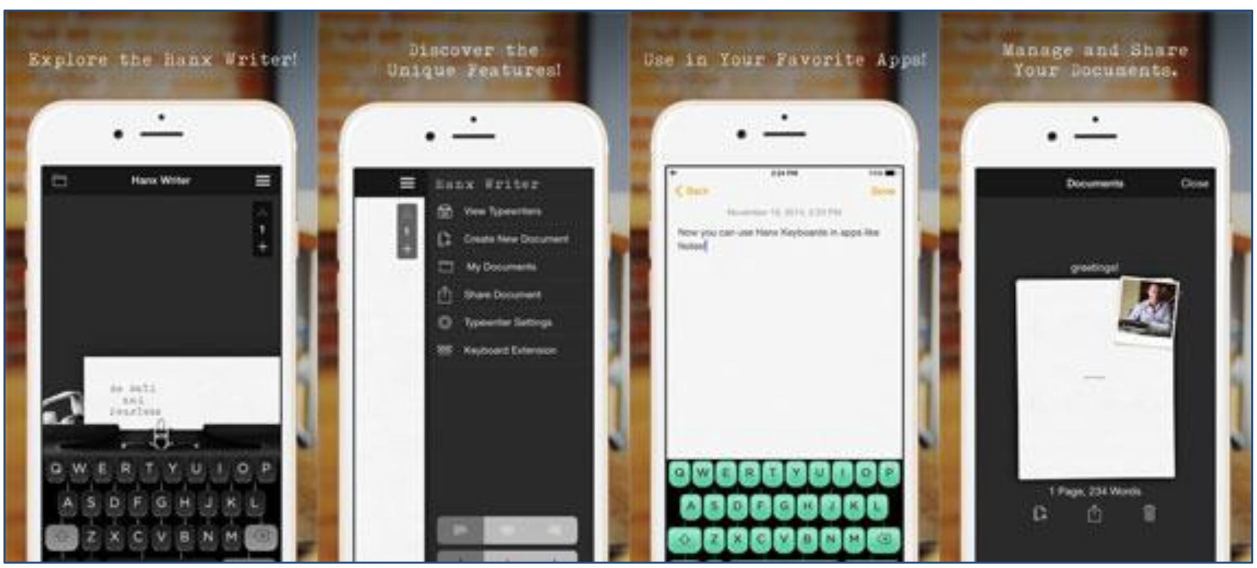
Hypothesis: Students will compose a list of 3-5 elements they prefer stories to include (e.g., different types of conflict, the use of suspense, or a gripping opening scene). As part of their hypothesis, students must include a 1-2 sentence rationale that explains why they selected each element.

Step 1: Students will use the 301+ Short Stories (2013) app to select a story.

Step 2: Students will use the PureFlow (2014) app to storyboard the main events in the story (at minimum the rising actions, climax, and resolution).



Step 3: Students will use the Hanx Writer (2015) app to compose a justification that states and explains why they did or did not like the story they selected.



Lesson Analysis

In this lesson, the problem statement is opinion-based and it uses an “In My Head” question (Hollas, 2008). Students respond by journaling about the different narrative elements they prefer short stories to include, and their response must offer rationales for each element. This journaling activity serves as their hypothesis before students complete the lessons’ remaining steps independently because they must state the elements they believe they enjoy a short story to include.

For Step 1, students choose a short story from a pre-selected content-based app, and Step 2 requires them to demonstrate their understanding of the narrative by creating a storyboard. Step 3 has students respond to the problem statement by connecting the elements they enjoy in short stories to the story they read. As they respond, students reflect on their original journal entry that served as their hypothesis before further developing it based on the story they read. If needed, teachers can further support students in developing their responses by offering them scaffolded prompts such as:

1. If the elements you identified originally were part of the short story, explain how they increased your enjoyment while reading.
2. Were there certain parts of the story you did not enjoy, such as extensive amounts of dialogue, rising actions, or imagery? If so, explain why the story would benefit from those parts being removed or limited.
3. Was there a particular element in the story you found enjoyable but did not originally identify? If so, discuss why you found that element so enjoyable.

By completing this lesson, students will have used three different apps – one content-based app and two creation-based apps – to deeply engage the problem statement and develop a thoughtful, personalized response to it. This lesson aligns to path B and it engages higher-order thinking and reflective skills because students first compose an opinion-based journal and then test it before re-evaluating it based on the text they chose.

IMPLICATIONS FOR PRACTICE AND FUTURE RESEARCH

When teachers use this framework, the authors advise them to begin by first experimenting with a limited number of creation-based apps that can be used for a variety of purposes. Examples of these apps include Haiku Deck (2016), Penzu (2016), and Popplet (2016). These different apps allow students to create learning artifacts that can be used for multiple purposes, both during the app-based lesson and at its conclusion. By focusing on a few apps that can be used for an array of purposes, teachers can avoid becoming overwhelmed with the thousands of apps available to them. Next, the authors suggest teachers browse content-based apps for their discipline and find ones suitable for the topic they are planning to teach. Once teachers have identified the content-based and creation-based apps, teachers should use backwards planning (Jones, Vermette, & Jones, 2009; McDonald, 1992) to decide upon their resolution for the lesson, as shown in Figure 1, and should plan how students are going to achieve that resolution through various steps of the app-based lesson. As teachers gain confidence in planning these lessons and using apps, the authors encourage them to begin exploring different apps that can be incorporated into learning opportunities for students. Use of the proposed framework for app-based lesson design has implications for future research.

Developers are continually creating, releasing, and marketing new educational apps, as evidenced by the swelling number of offerings available for mobile devices. Though the expectation that classroom teachers, teacher educators, and instructional technologists stay current of these technologies is prevalent, the reality is that keeping abreast of all the new educational apps being released is unrealistic. The authors' first recommendation is then to evaluate the available resources designed for educational apps. With a variety of these resources available online (e.g., App Ed Review [2016], Utah Education Network ([2016], and Common

Sense Media [2016] among several others), researchers are encouraged to assess the information, design, and research base these types of resources use. In turn, that research will be valuable to educators because it will guide them in using quality resources, which they could use when creating the app-based lessons described in this article.

The author's second recommendation is similar to the first in that researchers can critique the research used in frameworks that align instructional technologies with different taxonomies. For example, Carrington's (2016) "Padagogy Wheel 4.1" attempts to align different educational apps with Puentadura's (2010) Substitution, Augmentation, Modification, and Redefinition framework (SAMR) and the action verbs that appear in Webb's Depth of Knowledge (DoK) (Webb, 2002) and Bloom's Taxonomy (Krathwohl 2002). Though the "Padagogy Wheel 4.1" is a popular resource, there is no research or commentary that supports the alignment Carrington used when he matched educational apps to the different elements of SAMR's framework, Webb's DoK, or Bloom's Taxonomy. In fact, Hamilton, Rosenberg, and Akcagolu (2016) critiqued the SAMR model based on a lack of supporting research and its hierarchal design. As a result, teachers may be using Carrington's resource to guide how they are using technology to supposedly develop their students' higher-order thinking skills when, in turn, their misuse of instructional technology could actually be harming or frustrating students. Researchers would be wise to evaluate the research base behind the "Padagogy Wheel 4.1" and other resources in an attempt to validate their use, similar to Hamilton et al. (2016) critique of SAMR.

The authors' final recommendation to researchers is to conduct case studies of teachers who are using the framework presented in this article and analyze how they plan instruction with the framework, then evaluate the rigor of the learning students accomplish when completing app-based lessons. Researchers can then make further recommendations to modify the framework based on their findings.

CONCLUSION

There is a current mantra in secondary education that charges teachers with preparing students for college-level courses and for entry into the workforce upon graduating from high school. As part of this preparation, students must be able to think critically and use technology proficiently to solve problems. The authors believe that the framework presented in this article offers teachers a flexible approach they can use to plan and implement lessons that develop the content knowledge and technological skills students need in order to be successful. In addition, teachers are able to differentiate the lessons using the framework by designing them so that they follow different routes and, subsequently, have students engage apps for different purposes. The end result of this framework is that teachers have a much-needed tool they can use when planning blended learning lessons that utilize mobile devices and an array of apps.

Mrs. Bell roamed her classroom listening to all the creative hypotheses that her students were discussing. They were posing questions and counterpoints to their classmates about the hypotheses they proposed. She thought to herself that the students were developing the critical thinking and technology skills they needed for college and beyond. As she reflected on what she was observing, Mrs. Bell's tablet's email notification sound pinged. It was the first completed assignment that a student submitted. She quickly opened the email and scanned the student's original hypothesis, then the student's final, revised draft. Mrs. Bell smiled to herself.

REFERENCES

301+ Short Stories. (2013). 288 Vroom LLC (Version 6.2). [Mobile application software]. Retrieved from https://itunes.apple.com/us/app/301+-short-stories-lite/id342731343?mt=8

All Search Engines in One HD. (2012). Avatar Apps (Version 1.2) [Mobile application software]. Retrieved from https://itunes.apple.com/us/app/all-search-engines-in-one-hd/id478948302?mt=8

App Ed Review. (2013). *Home*. Retrieved from www.appedreview.com

Bains, S. (1997). End-user searching behavior: Considering methodologies. *The Katharine Sharp Review*, 1(4). Retrieved from https://www.ideals.illinois.edu/bitstream/handle/2142/78248/bains_end.htm?sequence=3

Branch, J. L. (2003). Instructional intervention is the key: Supporting adolescent information seeking. *School Libraries Worldwide*, 9(2), 47-61.

Brushes Redux. (2016). Christoffer Hoel (Version 3.2) [Mobile application software]. Retrieved from https://itunes.apple.com/us/app/brushes-redux/id932089074?mt=8

Carrington, D. A. (2016). *Padagogy Wheel 4.1*. Retrieved from http://designingoutcomes.com/assets/PadWheelV4/PadWheel_Poster_V4.pdf

Cherner, T., Dix, J., & Lee, C. (2014). Cleaning up that mess: A framework for classifying educational apps. *Contemporary Issues in Technology and Teacher Education*, 14(2), 158-193.

Chener, T., & Smith D. (2016). Reconceptualizing TPACK to meet the needs of twenty-first-century education. *The New Educator*, p. 1-22. DOI: 10.1080/1547688X.2015.1063744

Common Sense Media. (2016). *Common Sense Education*. Retrieved from https://www.commonsensemedia.org/educators

Driscoll, M. (2003). Blended Learning: Let's get Beyond the Hype. IBM Global Services. Retrieved from https://www-07.ibm.com/services/pdf/blended_learning.pdf

Friesen, N. (2012, August). Report: Defining blended learning. Learning Spaces. Retrieved from http://learningspaces.org/papers/Defining_Blended_Learning_NF.pdf.

Garrison, D. R., & Vaughan, N. D. (2008). *Blended learning in higher education: Framework, principles, and guidelines*. San Francisco, CA. Jossy-Bass.

Greaves, T. & Hayes, J. (2008). *America's digital schools 2008: The six trends to watch.* The Greaves Group. Retrieved from http://www.lcps.org/cms/lib4/VA01000195/Centricity/Domain/52/Americas_Digital_Schools_2008.pdf.

Haiku Deck. (2016). Haiku Deck, inc. (Version 4.2) [Mobile application software]. Retrieved from https://itunes.apple.com/us/app/haiku-deck-presentation-slideshow/id536328724?mt=8

Hamilton, E. R., Rosenberg, J. M., & Akcaoglu, M. (2016). The Substitution Augmentation Modification Redefinition (SAMR) model: A critical review and suggestions for its use. *TechTrends*, 1-9.

Hanx Writer. (2015). Hanx Writer (Version 1.1.2) [Mobile application software]. Retrieved from https://itunes.apple.com/us/app/hanx-writer/id868326899?mt=8

Harackiewicz, J. M., & Hulleman, C. S. (2010). The importance of interest: The role of achievement goals and task values in promoting the development of interest. *Social and Personality Psychology Compass*, *4*(1), 42-52.

Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn?. *Educational Psychology Review*, *16*(3), 235-266.

Hollas, B. (2008). *Question answer relationships: A simple taxonomy of questions*. Peterborough, NH: Crystal Springs Books.

Johnson, C., & Marsh, D. (2013). The laureate English program taking a research informed approach to blended learning. *Higher Learning Research Communications*, *3*(1), 45-55.

Jones, K. A., Vermette, P. J., & Jones, J. L. (2009). An integration of" backwards planning" unit design with the" two-step" lesson planning framework. *Education*, *130*(2), 357-360.

Kehrwald, B. A., & McCallum, F. (2015). Degrees of change: Understanding academics experiences with a shift to flexible technology-enhanced learning in initial teacher education. *Australian Journal of Teacher Education*, *40*(7), 43-56.

Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge. *Contemporary Issues in Technology and Teacher Education*, *9*(1), 60-70.

Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: An overview. *Theory into Practice*, *41*(4), 212-218.

Lacina, J. (2007). Technology in the classroom: Inquiry-based learning and technology: Designing and exploring WebQuests. *Childhood Education*,*83*(4), 251-252.

Lent, R. C. (2009). *Literacy for real: Reading, thinking, and learning in the content areas*. New York, NY: Teachers College.

Lucero, M., Valcke, M., & Schellens, T. (2013). Teachers' beliefs and self-reported use of inquiry in science education in public primary schools. *International Journal of Science Education*, *35*(8), 1407-1423.

McDonald, J. (1992). Dilemmas of planning backwards: Rescuing a good. *The Teachers College Record*, *94*(1), 152-169.

Mazur, A.D., Brown, B., & Jacobsen, M. (2015). Learning designs using flipped classroom instruction (Conception d'apprentissage a l'aide de l'instruction en classe inversee). *Canadian Journal of Learning and Technology*, *41*(2), 1-26.

Nicholson, S. (2012). A user-centered theoretical framework for meaningful gamification. *Games+ Learning+ Society*, *8*(1), 223-230.

NOVA Elements. (2013). PBS (Version 1.3) [Mobile application software]. Retrieved from https://itunes.apple.com/us/app/nova-elements/id512772649?mt=8

Ogle, D. (1986). K-W-L: A teaching model that develops active reading of expository text. *The Reading Teacher*, *39*, 564-570.

Penzu. (2016). Penzu, inc. (Version 3.4.2) [Mobile application software]. Retrieved from https://itunes.apple.com/us/app/penzu-free-diary-private-journal/id452674732?mt=8

Puentadura, R. R. (2010). SAMR and TPACK: Intro to advanced practice. Retrieved from http://hippasus.com/resources/sweden2010/SAMR_TPCK_IntroToAdvancedPractice.pdf

Popplet. (2016). Notion (Version 2.3) [Mobile application software]. Retrieved from https://itunes.apple.com/us/app/popplet/id374151636?mt=8

PureFlow. (2014). Aleksandr Kozlov (Version 1.4.3) [Mobile application software]. Retrieved from https://itunes.apple.com/us/app/pureflow/id600955222?mt=8

Richards, J. & Stebbins, L. (2014). 2014 U.S. educational technology market: PreK-12. Washington, D.C.: Software & Information Industry Association.

Savery, J. R. (2006). Overview of problem-based learning: Definitions and distinctions. *Interdisciplinary Journal of Problem-Based Learning*, 1(1), 9-20.

Shriner, M., Clark, D. A., Nail, M., Schlee, B. M., & Libler, R. (2010). Social studies instruction: Changing teacher confidence in classrooms enhanced by technology. *The Social Studies*, *101*(2), 37-45.

Smyth, S., Houghton, C., Cooney, A., & Casey, D. (2012). Students' experiences of blended learning across a range of postgraduate programmes. *Nurse Education Today*, *32*(4), 464-468.

So, H. J., & Brush, T. A. (2008). Student perceptions of collaborative learning, social presence and satisfaction in a blended learning environment: Relationships and critical factors. *Computers & Education*, *51*(1), 318-336.

Staker, H., & Horn, M. B. (2012). *Classifying K–12 blended learning*. Mountain View, CA: Innosight Institute, Inc.

Stanley, G. (2014, April 7). The rise of SOLEs (part 1): The decline of the webquest. [Web log post]. Retrieved from http://blog-efl.blogspot.com/2014/04/the-rise-of-soles-part-1-decline-of.html

Stoks, G. (2002). WebQuest: Task-based learning in a digital environment. *The Journal of Language Teaching and Learning*, 1. 56-58.

Taradi, S. K., Taradi, M., Radić, K., & Pokrajac, N. (2005). Blending problem-based learning with web technology positively impacts student learning outcomes in acid-base physiology. *Advances in Physiology Education*, *29*(1), 35-39.

Utah Education Network. (2016). *Apps4Edu*. Retrieved from http://www.uen.org/apps4edu/

Webb, N. L. (2002). Depth of knowledge levels for four content areas [Unpublished manuscript]. Wisconsin Center for Education Research, University of Wisconsin-Madison, Madison, WI. Retrieved from http://ossucurr.pbworks.com/w/file/fetch/49691156/Norm%20web%20dok%20by%20subject%20area.pdf