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Reviews of Biology and Mathematics APPs for Use by Science and Mathematics Teachers

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Abstract In science education, the question about using technology to teach the content and concepts is enduring. The complexity of teaching content, concepts and practices is expressed at the same time that technology has "advanced" to multiple devices beyond the desktop or laptop forms of computers to devices that are hand-held and range from e-readers to iPads and beyond. Each device has applications (Apps) that range from transmission of content to learning tools. Because no formal evaluation of Ipad Apps exists, a method was developed and implemented for our research. Researchers in this study developed a method for reviewing science and mathematics Apps and provided a list of the "top" Apps in an alphabetical topic list found in a newly developed website.

Keywords: *review, biology and mathematics APPs, learning tools*

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1. Introduction

In science education, the question about using technology to teach the content and concepts is enduring. While, the relationship between science and technology as integral portions of the study of science is documented in both *Benchmarks* and *A Framework for K-12 Science Education* [9], the pedagogy to teach the interrelationship between the two areas dates back to the science-technology-society movement. The new standards are adding engineering standards to the content, concepts, and practices that science teachers are expected to teach.

This complexity of teaching content, concepts and practices is expressed at the same time that technology has "advanced" to multiple devices beyond the desktop or laptop forms of computers to devices that are hand-held and range from e-readers to iPads and beyond. Each device has applications (Apps) that range from transmission of content to learning tools. Sun, Lin, and Yu [14] and Edleson note that lessons can be supported via technology or be technology-based. However, a list of which Apps are accurate, cost effective, and easily used in science is not available. Most lists of "the top science Apps" provide no reference to how these Apps were chosen to be the "top" Apps. Researchers in this study developed a method for reviewing science and mathematics Apps and provided a list of the "top" Apps in an alphabetical topic list found in a newly developed website.

Lessons in today's classroom are expected to have a technology component. The technology components vary from using the Internet to searching for information or for storing data for future analysis. The Apps range in formats from transmission of knowledge to creating analysis of labs students complete. Waight and Abd-El-Khalick [17] suggest that several research reports note that students' regularly engage inInternet-based searches for information. Mislter-Jackson and Songer [8] highlight that students use the Internet to network with peers and research scientists as well as real time satellite imagery to gain current scientific information. Wegerif, Littleton and Jones [18] explain that students can gain immediate feedback about their learning through computer-based responses. Edelson and Rodrigues [10] argue that lessons can incorporate hand held devices to assist with collection and storage of data. The forms of use for hand-held devices have a wide range of possibilities and the Apps available seem to match.

Questions then arise about which Apps are most effective. Secondly, which Apps are developmentally appropriate both in terms of content and practice? Research by Swan [15] notes that, "…the use of mobile computing devices can increase student motivation and engagement in learning, especially their motivation to complete written assignments" (p. 108). Swan also found that many of the teachers interviewed commented on ways in which the use of the mobile computing devices seemed to lessen the gap in academic achievement between regular and special needs students; the results provide some evidence for positive effects of mobile computing, particularly when supporting the learning of special needs students (p. 108). Thus, it is possible that hand held devices increase motivation for students to complete schoolwork.

A Framework for K-12 Science Education [9] lists the following science practices for the K-12 science student:

- Asking questions (for science) and defining problems (for engineering)
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations (for science) and designing solutions (for engineering)
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information (p. 3).

This framework also includes knowledge and concepts to be learned in the K-12 schooling for children. These knowledge and concepts were further delineated in the Next Generation Science Standards.

1.1. Constructivist Teaching

Russell et al. [11] found that, "teachers with constructivist beliefs were more likely to use technology in the classroom than were teachers with more traditional pedagogical beliefs (p. 305)." These beliefs include tenets such as students construct knowledge through interactions in the physical world and eventually, as noted by von Glasersfeld [3] in a thought world. Science educators use constructivist theories as developed by Piaget, Vygotsky, Bruner and Dewey in their development of current and future teachers. All of these theorists note the importance of the interactions of participants in group activities. Designing means for use of hand held devices creates a tension between the notions of a "personal" hand held device and ways in which to structure lessons for group exploration(s).

"The Kaiser Family Foundation's 'Generation M' research and the qualitative work of Mimi Ito and colleagues (2009) document the explosion of interest in digital technologies that allow youth not only to 'media multitask,' but also to explore, create, and share knowledge around their personal interests and across many knowledge domains" [7]. According to Conrad and Dunek [2], an inquiry-driven learner has the capability to explore and cultivate promising ideas. Inquiry-driven learners are characterized by core qualities of mind, critical thinking skills, expertise in divergent modes of inquiry, and a capacity to express and communicate ideas. The core qualities of mind that an inquiry-driven learner must have are: passion for pursuing ideas, ownership of inquiry, questioning of the self and existing knowledge and authority, engagement in dialogue and collaboration, contemplation, and commitment to inquiry for the self and the common good [2]. Conrad and Dunek [2] state that inquiry-driven learners must "purposefully consider" the flow of information that is available through technological devices. While these tools can enrich inquiry, their demand for immediate attention and quick action can also be distracting when pursuing and contemplating ideas. According to Conrad and Dunek [2], critical thinking of inquiry-driven learners involves asking "burning questions," accessing, understanding, and interacting with knowledge, and synthesizing information and knowledge into a coherent whole. Inquiry-driven learners can use online communities as opportunities for dialogue and communication of ideas [2]. Conrad & Dunek discuss several programs that use technology to develop inquiry-driven learners as listed below:

- The "Music, Math, and Motion" program at Evergreen State College, where students integrate ways to understand music and technology in order to engage in inquiry related to music and sound.
- Worcester Polytechnic Institute's "Interactive Qualifying Project," in which students addresses problems about how science or technology intersects with social challenges and human needs.
- Innovative programs at New Century College (a satellite campus of George Mason University) that promote the widespread use of technology.
- University of Wisconsin-Madison's Wiscontrepreneur 100-Hour Challenge, which involves students creating innovative products or services with materials from a campus unit that sells surplus supplies. Students must communicate their work through digital photo sets, videos, or other electronic communications posted on a publicly accessible website.

1.2. Hand-held Technology in the Classroom

Kim et al. [6] explain, "…mobile wireless technology is defined as technology that provides continuous accessibility to users anytime, anywhere without using wire or cable to connect to networks (like the internet), transmit data or communicate with others" (p. 55). Kim et al. [6]… "PDA is the commonly used term that refers to any small mobile wireless handheld device that provides computing, information storage and retrieval capabilities from the device as well as the Internet; they are also sometimes called handheld computers… In teaching and learning environments PDAs are currently the hottest mobile wireless technology, used more often than any other mobile wireless device in K-12 schools" (p 56). Kim et al. [6]… "The National Educational Technology Standards for Students (NETS-S) outline six skills students should master including: learning about available technology and how to use it, using effective communication skills, researching, learning, processing facts and concepts, and problem solving" (p 58). In addition to communication, Kim et al. [6] notes the following uses, according to NCTE, for mobile wireless phones in the classroom:

- To improve literacy among students by providing carefully designed lessons
- To facilitate collaborative and project-based learning
- To provide the capacity to access the Internet resources, for example, revision of class notes and news updates
- To facilitate wireless access to the Internet when used with a laptop, hence providing the internet access to students from any location in the school" (p. 59)

According to Kim et al. [6], teachers also use PDAs for to increase their efficiency, organization, and effectiveness in both instruction and classroom management (p. 61). Kim et al. [6]… "Overall, the benefits of PDAs and mobile wireless phones are derived from two main characteristics of mobile wireless technology -- mobility and reachability. Three elements of mobility -- convenience, expediency and immediacy – are valuable for teaching and learning and bring actual benefits in the learning environment" (p. 62).

Banister [1], "…the iPod Touch has emerged as a pocket computer with multiple–12 classroom possibilities; its sister device, the newly introduced iPod is larger and less mobile, but is certainly a contender for a new style of e-reader" (p. 122). Banister [1]… "Using the Photos, Music, Movies, and even the YouTube applications included on the iPod Touch, a plethora of pre-made educational media are available for K–12 classroom use, including podcasts, audio books, and video clips. Additionally, and perhaps more powerfully, teacher- and student-created media may be included on classroom iPod sets, customizing learning content to specific curricular needs" (p. 123). Banister [1] notes the uses of applications such as notes, clock, calculator, maps, and weather as ways to move beyond classroom media uses for the iPod Touch. (p. 123). Banister [1], "…It is possible that if students completed Internet research using mobile devices, such as the iPod Touch, they would be more likely to take notes and consolidate the information in their own words" (p 125). Banister [1], "While skeptics may find the premise of young children benefitting from the use of mobile devices to be far-fetched, small ones (as young as 21- months) are demonstrating that they can understand and interact with Web applications such as Preschool Adventures, At the Zoo, Wheels on the Bus, ABC Letters, and doodle (see Table 2). These applications are well aligned with the spirit of early childhood education and technology use, as articulated by the National Association for the Education of Young Children. Children are encouraged to play and discover, as they engage with these applications" (p. 125) Banister [1] suggests several applications that can be used in upper grades in various subjects, including mathematics, social studies, language, and science. These are listed in Table 1 below.

Table 1. Applications for Upper Grades by Subject Area

Mathematics	Social Studies	Language	Science
Flash Math	Weather	Blanks	Earth3D
Math Quiz	Maps	Mandarin	Molecules
Grafunc	iFlipr	YouNote	MIM
GraphCal (p 127)	AlisJigSaw	AirSharing	Epocrates

Banister explains: "this type of quick innovation and customization has the potential to yield powerful resources for individual classrooms and school curricula. Educators must be vigilant and selective when determining the resources to include on devices, or they could be overwhelmed with the sheer magnitude of options. Reading reviews of applications and rankings among users will assist teachers in locating Web applications that might make a difference in teaching and learning in their classrooms" (2010, p. 129).

Russell et al. [11] explains that, "teachers' beliefs about the value of a technology increases as they gain exposure to particular technologies, particularly for newer technologies and when technology is used directly by students (p. 303). These findings indicate that teachers' beliefs about using such devices can shift as they become familiar with devices and as they see the value of using the devices in relation to student learning outcomes. Russell et al. [11] further note that, "preservice and in-service teacher education programs may be encouraged to expose teachers to each of the six teacher technology use categories—emphasizing the different uses, available applications, possibilities, and practices for using diverse technologies to support and enhance various aspects of teaching and learning (p. 307)."

Swan et al. [15] highlights that, "Handheld computers thus have the potential to support both personalized and collaborative learning (p. 100)." They further note that portability of a device is especially important. The students sampled for this study note that hand held devices are basically the same thing, but small and easier to use because you can move the device as desired. In a complimentary fashion, the teachers from this study noted students were more likely to complete homework on time if they used a handheld device rather than paper and pencil. Teachers generally respond positively to methods and materials if the students use them and complete meaningful assignments. Teachers would be predicted to be especially responsive to hand held devices when students are completing content work through meaningful learning experiences.

Sampson and Zervas [12] state that "mobile devices can (a) engage students to experiential and situated learning without place, time, and device restrictions; (b) enable students to continue learning activities, initiated inside the traditional classroom, outside the classroom through their constant and contextual interaction and communication with their classmates and/or their tutors; (c) support on-demand access to educational resources regardless of students' commitments; (d) allow new skills or knowledge to be immediately applied; and (e) extend traditional teacher-led classroom scenario with informal learning activities performed outside the classroom." According to Sampson and Zervas [12] the benefits of context-aware adaptive and personalized mobile learning systems include providing learners with personalized experiences in real-world scenarios and detecting learners' behaviors in order to provide them with adaptive feedback and support. Sampson and Zervas also [12] state that "Adaptivity and personalization in mobile learning systems refers to the process of enabling the system to fi t its behavior and functionalities to the educational needs (such as learning goals and interests), the personal characteristics (such as learning styles and different prior knowledge), and the particular circumstances (such as the current location and movements in the environment) of the individual learner or a group of interconnected learners."

Gourova, Asenova, and Dulev [4] identify several advantages to using mobile devices in the classroom, including, increases in student motivation and performance, small, convenient, and easy to use devices, communication opportunities, flexibility and accessibility, and support of educational resources. Thus, according to Gourova, Asenova, and Dulev [4], tablets allow students working in groups to maintain a dialogue, share and transfer resources and results, and exchange information while working on a task. Van't Hooft [16] states that although mobile learning research is still in its infancy, various studies have displayed the use of mobile technologies in specific subject areas, such as mathematics, science, language learning, and social studies. Van't Hooft [16] cites a study of how a mobile learning game called Frequency 1550 elicits narrative learning and influences cognitive and affective outcomes. Frequency 1550 uses GPS and Ultra Mobile Telephone System (UMTS) to combine real and digital worlds to help teenage students to learn about the history of medieval Amsterdam. The results showed that students using Frequency 1550 learned more history content than students who received a more traditional lesson. However, the program did not show any increases in motivation. Van't Hooft [16] cites a study of MyArtSpace, a program that uses Smartphones and personal web space to enhance a museum visit. The results showed that the mobile phone usage was appropriate and easy, students were more motivated and engaged, students spent more time exploring the museum and were more likely to visit again, the lessons before and after the museum visit were more enjoyable and meaningful, and the program supported different abilities and various subjects. Van't Hooft [16] discusses the GeoHistorian Project, in which students learn about local history, digital storytelling, and how to be a historian through hands-on activities, high-level thinking, and research and local historical sites. Specifically, each site had a Quick Response code marker that students could scan with a mobile device to access that site's digital story. Initial data analysis showed learning gains in local history, thinking like a historian, and digital storytelling.

1.3. Challenges and Barriers

Hew and Brush [5] note that a common barrier to technology use in classrooms is a lack of resources, including insufficient hardware and software, lack of time, and lack of technical support. (p. 226-7) "The lack of specific technology knowledge and skills, technology-supported pedagogical knowledge and skills, and technology-related-classroom management knowledge and skills has been identified as a major barrier to technology integration." ([5], p 227) "Many teachers have not been exposed to transformative technology-supported pedagogy because professional development activities have focused primarily on how to merely operate the technology." ([5], p 228) Hew & Brush [5] identify five main strategies for overcoming barriers: having a shared vision for technology integration, overcoming a lack of resources, changing attitudes and beliefs, professional development, and reconsidering assessments. (p. 232)

The literature notes several challenges and barriers to the use of hand held devices in teaching. One Russell et al. [11] finding was the surprising fact that new teachers hold strong beliefs about hand held devices making students more lazy, decreasing research skills and decreasing quality of student writing. It is not clear if the new teachers were talking about all hand held devices or if they were thinking about texting when describing student writing. Swan et al. [15] note several issues especially in relation to elementary age students in that small screen size is a developmental issue and that, text input is problematic for students when learning to write and spell. Students across the K-12 spectrum tend to be frustrated when programs freeze, work "gets lost," materials don't sync as planned or if they have tactile difficulties because of lack of fine motor skill development. Swan et al. [15] further note that schools have issues because they need to pay special attention to classroom logistics, and equipment maintenance. The cost of education per child may also increase because of additional needs for technical support, and additional professional development for teachers using mobile computing options. These are important considerations in a time when per pupil expenditures are under fire.

Levine and Santo suggest several ways to embrace the shift towards technology use, including taking a "digital learning inventory" of afterschool and summer programs. The inventories should "identify funds that are currently available, the barriers to using new resources for digital learning in these programs, and the capacity of local partners to contribute tools that are needed for technology-based innovations." Another important step Levine & Santo identify is to build capacity and awareness of new materials and projects, which requires the support of policy leaders and the creation of professional learning communities to learn and understand these new ways of learning. Gourova, Asenova, and Dulev [4] identify several challenges involved in the development of mobile learning, such as the fact that mobile learning systems do not support e-learning specifications; ensuring interoperability of different devices and applications, system scalability, extensibility, and reusability, security, and privacy; and the need for management of courses, preparation of self-study educational materials, and design of educational modules." Gourova, Asenova, and Dulev [4] identify several disadvantages to using mobile devices in the classroom, including cost of communications, software limitations, loss of assessment data, and increased time to enter data.

1.4. After School/Summer Environments

As Wise and Schwartzbeck [19] state, "It is also critical that leaders focus on the instructional needs of students first and then look at the ways in which technology can be used as a tool to meet those needs." "The ideas of anytime, anyplace learning has especially strong potential for high school students, whose unique needs and challenges are often best met outside the traditional high school structure" [19]. Wise & Schwartzbeck [19] note that online summer school programs or programs that combine online courses with face-to-face interactions can provide more accessible and affordable opportunities to close the achievement gap. Wise & Schwartzbeck also discuss the benefits of technology-based learning programs such as online tutorials that include interactive practice, immediate assessment, and feedback. "Some school districts have also found that when they implement one-to-one technology initiatives or bring-your-own-device programs, supported by adequate Internet access and learning management systems that are available 24 hours a day, they are effectively lengthening the school day" [19]. Levine & Santo [7] describe their vision for after school programs as one that "positions young people as creators, makers, and innovators" and provides opportunities for collaboration and feedback through technology.

1.5. Theoretical Frameworks for Review of Apps

"The technology available for instruction continues to improve, while the cost of that technology continues to decrease. More and more students today are digital natives, already accustomed to the rapid feedback, collaborative nature, and ease of use of many digital technologies" ([19], p. 110). "Another view—and the one we argue for here—is that expanded learning-time programs should exist as part of the larger ecology of a young person's 21st century existence. This ecology is framed by the digital, interconnected world in which we all live and should, therefore, incorporate systemic links between what are now disparate venues of learning" [7]. Sampson and Zerva [12] classify mobile learning as ubiquitous learning, which they define as "the potential of computer technology to make learning possible at any time and place." Sharples et al. [13] define mobile learning as "the processes of coming to know through conversations across multiple contexts amongst people and personal interactive technologies." According to Van't Hooft [16], "definitions of mobile learning have evolved from a focus on technology to the learner to context," however, all three components are important.

1.6. Purpose

The purpose of this study was to identify apps that meet specific criteria for use in biology and mathematics in the high school curriculum.

2. Method

Table 2. Topic List-Biology

Carbon Compounds	Amino Acids	Chemical Reactions	Enzymes	Matter	Nature of Science	pH
Water	Aquatic Ecosystems	Biodiversity	Biome	Biotic and Abiotic Factors	Climate	Cycles of Matter
Ecological Footprint	Energy Flow (Food Chains and Webs)	Human Activity	Human Population	Limiting Factors (Carrying Capacity)	Niches	Population Growth
Populations	Producers and Consumers	Resources	Succession	Sustainable Development	Symbioses	Active Transport
Asexual Reproduction	ATP	Calories	Cancer	Cell Cycle	Cellular Respiration	Chromosomes
Homeostasis	Fermentation	Microscopes	Organelles	Passive Transport	Photosynthesis	Prokaryote and Eukaryote
Sexual Reproduction	Alleles	Bacteria	DNA	Franklin, Krick, Watson	Independent Assortment	Karyotype
Meiosis	Mendel	Mutation	Other Patterns of Inheritance (Codominance, Multiple Alleles)	Pedigrees	Biotechnology	Protein Synthesis
Punnett Square	RNA	Segregation	Biogeography	Cladogram	Darwin	Adaptation
Fossil Record/ Paleobiology	Geologic Time Scale/History of Life	Gradualism and Punctuated Equilibrium	Homologous/ Analogous Structures	Lamarck	Molecular Evolution	Natural Selection
Scientific Names	Speciation/ Diversity of Species	Microbiology (Bacteriology, Virology, Protists)	Fungi	Botany	Animal Development	Animal Behavior
Anatomy	Comparative Anatomy	Embryology	Digestive System	Endocrine System	Nervous System	Respiratory System
Reproductive System	Immunology and Immune System					

Table 3. Topic List-Mathematics

High School- Number and Quantity	High School-Algebra	High School-Functions	High School-Modeling	High School-Geometry	High School-Statistics and Probability
The Real Number System	Seeing Structure in Expressions	Interpreting Functions		Congruence	Interpreting Categorical & Quantitative Data
Quantities*	Arithmetic with Polynomials and Rational Expressions	Building Functions		Similarity, Right Triangles, & Trigonometry	Making Inferences & Justifying Conclusions
The Complex Number System	Creating Equations*	Linear, Quadratic, & Exponential Models		Circles	Conditional Probability & The Rules of Probability
Vector & Matrix Quantities	Reasoning with Equations & Inequalities	Trigonometric Functions		Expressing Geometric Properties with Equations	Using Probability to Make Decisions
				Geometric Measurement & Dimension	
				Modeling with Geometry	

Because no formal evaluation of Ipad Apps exists, the following method was implemented for our research. A running Biology/Mathematics topic list (Table 2) was determined using "Biology Resources In The Electronic

Age" list [1], Biology (Miller and Levine) and the CCSS for Mathematics (2010). The following evaluation form (Table 3) was developed using the website form in the "Biology Resources in the Electronic Age" as a template in order to evaluate each App. Each researcher was assigned part of the Topic list to search and evaluate. For cost reasons, only free Apps would be reviewed. Each researcher typed into the App search window one of the terms from their list of terms. For instance, if the topic word was “heredity”, the word “heredity” was typed into the App search window. If no Apps were listed, the topic would be eliminated from the list. When a topic that was typed into the search window displayed multiple Apps, the researcher then reviewed only the first ten, English language, free Apps. Each of the first ten Apps was then reviewed using both the initial marketing screen and then the full App was opened for review. After all ten Apps were reviewed, the researcher ranked the Apps and then used the top ranked App for inclusion in the website which would be available for teachers to review. The website was created for listing topics with No Apps and for listing the Top Apps which also included the reviews.

Table 4. Evaluation Form

1-Topic word

2-Found or not found (if we are eliminating topics from the list if no app is found, wouldn’t all the reviews have yes for this category? Delete this one?)

3-App name

4-Seller

5- Category

6-Updated

7-Requires

8-Ratings and reviews

Table 5. Evaluation of App Site

1-Contains links that lead to further information.
2-Links are active
3-App is interactive
4-Navigation is easy
5-Reliable content information
6-Contains popups
7-Review containing no more than 250 words:
9-Rank of app 1-10, 1 being not good and 10 being superior

3. Data Analysis

All apps were reviewed by a minimum of three reviewers. Only apps found to contain all the elements listed on the evaluation form and evaluations of the site form are listed in Tables below. The app that had the highest composite score per content topic is named in Table 6 and Table 7.

Table 6. List of Topics not Found Referred to as No Appsin Biology

BIOLOGY				
Active Transport	Biotic and Biotic Factors	Diversity of Species	Human population	Multiple Alleles
Asexual Reproduction	Carrying Capacity	Ecological Footprint	Immunology	Niches
ATP	Co-Dominance	Endocrine System	Karyotype	Pedigrees
Biogeography	Cycles of Matter	Franklin, Crick, Wilson	Limiting Factors	Producers and Consumers
Biomes	Cycles of Matter	Human Activity	Mendel	Prokaryote and Eukaryote
Symbiosis				

Table 7. List of Topics not Found Referred to as No Apps in Mathematics

MATHEMATICS				
Conditional Probability & the Rules of Probability	Expressing Geometric Properties with Equations	Interpreting Categorical & Quantitative Data	Making Inferences & Justifying Conclusions	Quantities
Creating Equations	Geometric Measurement & Dimension	Linear, Quadratic, & Exponential Models	Modeling with Geometry	The Real Number System

4. Discussion of the Results

The evaluation form included steps that need not be done. For instance, the “found or not found” section could be eliminated because all the Apps reviewed were found. “Contains popups” was also not necessary. Various added components including “appropriate grade level” and perhaps a more intense discussion of “navigation” would add positively to the review.

5. Implication to Theory and Practice

Review of the research shows definite value and support for the use of hand held devices in increasing motivation. The potential for increased learning outcomes exists, but the research is still scanty with the majority of positive results for students with special needs. Part of the issue is finding the apps that will assist with learning outcomes followed by professional development that creates opportunities for teachers to effectively and appropriately use the apps.

The first step in getting apps into the classroom is to find useful materials. A second step is to find free apps so that teachers are not adding costs to their personal finances to support their teaching. To find useful materials, we used the concepts listed in the standards for mathematics and science. There are several concepts that we found no free apps. Perhaps others can begin the process of developing such apps.

We then discovered that there was a lack of an organized method for evaluation of the many Apps that are available. Without a consistent format and selected information used to evaluate apps, it was not possible to ensure that apps that were on the topics that teachers need to teach could be identified. This lack of data could preclude the universal use of good Apps in teaching. The results presented in this paper are the beginning of a catalog of Apps that were evaluated by professionals such as professors of science and mathematics education as well as in-service classroom teachers. All the apps are free and on topics in the curriculum for high school biology and mathematics teachers.

Table 8. List of Topics with Top App Names Biology

Topic	Top App
Amino Acids	BioChem Euchre Deck
Biodiversity	EarthViewer
Biotechnology	HudsonAlpha iCell
Cancer	Bodyxq Cancer
Chemical Reactions	Chemical Reaction
Chromosome	Abbott FISH Chromosome Search
Chromosome	Gene Screen
Darwin	If Darwin Had Known About DNA
Digestive System	3D4Medical Images & Animations
DNA/RNA	Tools Gene Link
Enzymes	NEB Tools
Homeostasis	Diseases 3Dme
Matter	States of Matter
Microscopes	Smart Microscope Lite
Molecular Evolution	TimeTree HD
Mutations	DinoaryHD
Natural Selection	Khan Biology
Nature of Science	Science Reader
Nervous System	IsdCoordination2
Organelles	Cell Explorer: The Animal Cell (Free)
PH	pH Life
Populations	Population Matters
Population Growth	Population Matters
Protein Synthesis	Virtual Cell Animations
Punnett Square	Gene Screen
Reproductive System	3DMedical Images & Animations
Resources	Geogebra
Respiratory System	3DMedical Images & Animations
Segregation	Hazmat Load Segregation Guide
Succession	Mathix Successions-Math for Everyone
Sustainable Development	Outside Now
Water	The Water Cycle
Algebraic Expressions	Alegbra Genie
Circles	Circle Geometry
Complex Numbers	Simply Complex
Functions	Function Mystery
Functions	Functions f(x)=ax
Mathematics	MathBoard
Polynomial	Algebra, Matricies & Polynomials
Probability and Statistics	SAT Math: Data Analysis
Reasoning with Equations and Inequalities	Mathspace
Trigonometry	Overseas Family School

This collection can be used by teachers and other who are interested in finding apps that are recommended by the people who use the in their own teaching. This is a work in progress that can serve as a reference point for those who wish to integrate hand held devices into their teaching strategies. Our next review topics will be interdisciplinary/mathematics. Specifically trying to aim at those teachers trying to include both the Next Generation Standards and STEM into their curriculum. The website to find all reviews is posted below:

Website to find reviews

http:zorak2.monmouth.edu/~jbazler

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