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ENVIRONMENTAL SCAN OF EDUCATIONAL TECHNOLOGY IN U.S. PUBLIC SCHOOLS

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TABLE OF CONTENTS

Section	Page
ACKNOWLEDGEMENTS	1
EXECUTIVE SUMMARY	2
CHAPTER I: BACKGROUND AND OBJECTIVES	6
CHAPTER II: METHODOLOGY	8
A. Environmental Scan Design	8
B. Methodology: Literature Review	9
C. Methodology: Formative Research	10
CHAPTER III: LITERATURE REVIEW	21
A. Societal Context: Access and Ownership of Internet Connectivity and Digital Technology in U.S. Households	23
B. Digital Technology and Broadband Internet Access in U.S. Public Schools	29
C. Technology Integration in U.S. Public School Libraries	34
D. Technology Policy at the Federal, State and Local Level	38
E. Teacher, Parent, and Student Attitudes towards Educational Technology Issues of Technology Integration, Including Training and Support	43
F. Current Practices, Uses and Trends in Educational Technology	48
G. Approaches to Technology Integration in Schools	52
H. Educational Media and Technology Used for Health and Nutrition Education	60
I. Research on the Effectiveness of Educational Technology Tools, Programs and Pedagogy	69
J. Market Leaders in Educational Technology	72
K. Summary of Results and Future Trends in Educational Technology	76
CHAPTER IV: FORMATIVE RESEARCH AND PRIORITIZED RECOMMENDATIONS	79
A. Focus Group Interviews with K–12 Public School Teachers	79
B. Survey Research with K–12 Heath Educators	95
C. Interviews with State Educational Technology Directors	101
D. Conclusions from Formative Research Findings	103
E. Prioritized Recommendations	104
CHAPTER V: RECOMMENDATIONS AND COST ESTIMATES FOR THE CONVERSION OF SELECTED TEAM NUTRITION MATERIALS	109
A. Recommendations for the Delivery and Conversion of the Select Team Nutrition Materials	109
B. Recommendations for the Digital Conversion of Selected Lessons from Team Nutrition MyPlate and Nutrition Voyage	114
C. Cost Estimates	118

TABLE OF CONTENTS

REFERENCES 119

APPENDICES 130

Appendix A: Working Group 131
Appendix B: Search Terms Used for Literature Review 132
Appendix C: Information on Schools of SHAPE Conference FGI Participants 141
Appendix D: Information on Schools of FGI Participants at Colorado Focus Group Facility 142
Appendix E: Introduction Email for School Focus Groups 143
Appendix F: Consent Package for School Focus Groups 144
Appendix G: Principal Letter of Agreement 148
Appendix H: Introduction Email for Teachers of Health Education Survey 149
Appendix I: Flyer for Focus Group Participation 150
Appendix J: Scheduling Email for School Focus Groups 151
Appendix K: Consent Package for SHAPE Conference Focus Groups 152
Appendix L: Recruitment Screener for Teacher Focus Groups 158
Appendix M: Moderator's Guide for Teacher Focus Groups 161
Appendix N: Teachers of Health Education Survey 169
Appendix O: Consent Package for Teachers of Health Education Survey 173
Appendix P: State Educational Technology Officer Interview Guideline 176
Appendix Q: Current High-Speed Internet Service Availability Across States and U.S. Territories by Geographic Location 178
Appendix R: 2014 Digital Learning Report Card Grades Awarded to States in the Category of "Delivery," Reflecting the Presence of Infrastructure to Support Digital Learning 179
Appendix S: Student Access to Technology 180

TABLE OF TABLES & FIGURES

Table 2.1	Profile of FGIs by Type of School, FGI Setting, Number of FGIs, and Number of Participants	14
Table 2.2	Focus Group Profile by FNS Region, Locale, State and Type of School	15
Table 2.3	Focus Group Participant Demographic Profile	16
Table 2.4	Subjects Taught by Survey Respondents	19
Table 3.1	Percentage of Americans Without Broadband Internet Service Availability in 2015, by Geographic Locale	24
Table 3.2	Digital Learning Report Card Grades Awarded to States in 2014, in the Category of Delivery	30
Table 3.3	Availability of Technology and Digital Devices for Instructional Use in the Classroom	31
Table 3.4	Percentage of Students in Grades 4–12 with Access to Devices in School in 2015	32
Table 3.5	Percentage of Library Media Centers with Laptops Available for Teachers and Students to Use Outside of the Media Center in 2012, by School Level	35
Table 3.6	Average Number of Computer Workstations Located in School Library Media Centers in 2012, by Percentage of Students in the School Who Qualified for Free or Reduced-Price Lunch	35
Table 3.7	Percentage of Library Media Centers with Laptops Available for Teachers and Students to Use Outside of the Media Center in 2012, by Percentage of Students who Qualified for Free or Reduced-Price Lunch	36
Table 4.1	Websites Used by Teachers to Find Teaching Resources	82
Table 4.2	Technologies and/or Digital Pedagogies Teachers Reported Using in the Classroom	95
Table 4.3	Frequency of Reported Use of Classroom Devices	96
Table 4.4	Frequency of Reported Browsers Used	96
Table 4.5	Frequency of Reported Use of Video Players	97
Table 4.6	Teacher Agreement with Attitudinal Statements	98
Table 4.7	Average Weekly Hours Spent Using Technology for Select Tasks	100
Table B.1	Search Terms Used for Section A: Societal Context: Access and Ownership of Internet Connectivity and Digital Technology by U.S. Households and Section B: Digital Technology and Broadband Internet Access in U.S. Public Schools	132
Table B.2	Search Terms Used for Section C: Educational Technology in U.S. Public School Libraries	133
Table B.3	Search Terms Used for Section D: Important Education Technology Policy at the Federal, State and Local Levels	134

TABLE OF TABLES & FIGURES

Table B.4	Search Terms Used for Section E: Teacher, Parent and Student Attitudes Toward Educational Technology	135
Table B.5	Search Terms Used for Section F: Current and Emerging Educational Technology Practice, Use and Trends in U.S. Public Schools	135
Table B.6	Search Terms Used for Section G: Approaches to Technology Integration in Schools	136
Table B.7	Search Terms Used for Section H: Current Use of Educational Technology and Media for Health and Nutrition Education	137
Table B.8	Search Terms Used for Section I: Research Studies of Effective Educational Technology Use	139
Table B.9	Search Terms Used for Section J: Market Leaders in Educational Technology	140
Table B.10	Search Terms Used for Section K: Future Trends in Educational Technology	140
Table C.1	Information on Schools of SHAPE Conference FGI Participants	141
Table D.1	Information on Schools of FGI Participants at Colorado Focus Group Facility	142
Figure 2.1	Grades Taught by Survey Respondents	19
Figure 3.1	Percentage of U.S. Households Who Owned Broadband Internet Service in 2015, by Geographic Locale	24
Figure 3.2	Percentage of U.S. Households Who Owned Broadband Internet Service in 2015, by Household Income	25
Figure 3.3	Percentage of Children Who Reported Personal “Ownership” of Smartphones, Laptops and Tablets in 2015, by Grade Level	27

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EXECUTIVE SUMMARY

Introduction, Background and Objectives

This report presents the findings from a recent environmental scan of educational technology in U.S. public schools. The report was commissioned by the Food and Nutrition Service (FNS) of the United States Department of Agriculture (USDA) to inform the development of technology-based nutrition education materials. Conducted by the Michael Cohen Group LLC (MCG), the environmental scan is designed as a resource for FNS staff and decision makers, providing a comprehensive description and understanding of the use of technology in school-based education.

The FNS Team Nutrition provides nutrition education materials for children, schools and communities. Educational technology has advanced rapidly in the school environment. The President's Council on Science and Technology has called on the federal government to be on the forefront of developing technology-based instructional materials for all subject areas. In this context, FNS has identified the importance of educational technology in providing rich learning experiences for children in U.S. public schools, grades K–12.

The environmental scan method is designed to enable decision makers to understand the external environment and translate this understanding into an institution's planning processes. The overall objective of the current environmental scan is to provide FNS staff and decision makers with an overview of educational technology, including ownership and use in U.S. public schools. The report also provides findings-based implications and recommendations for FNS to develop technology-based educational materials as well the application of these recommendations for select Team Nutrition materials. Specific objectives are identified in detail in Chapter I of the report.

Methodology

In order to meet these objectives, the research design of the Environmental Scan (the overall report) includes both a Literature Review and Formative Research. Additionally, an expert consultant Working Group of technology and health educators provided literature review sources and reviewed formative research instruments.

The Literature Review is comprised of three research components, including: a review of scholarly literature published in peer-reviewed journals; a review of grey literature available outside of peer-reviewed journals, including survey research, reports, conference proceedings, summaries and other literature produced by government agencies, research centers, associations, corporations and professional organizations; and a review of digital resources relevant to health and nutrition education (e.g., websites, social media networks and digital apps). The Literature Review covers ten distinct subject areas relevant to educational technology.

The Formative Research is also comprised of three components, including: focus group interviews (FGIs) with 144 educators (K–12 teachers and school librarians) across seven FNS regions; an online survey of health educators' perceptions and use of educational technology; and, individual in-depth interviews (IDIs) with state educational technology directors.

Detailed methodologies, including research processes for both the Literature Review and Formative Research, are provided in Chapter II of the Environmental Scan report.

Literature Review – Key Findings

The literature review results indicate that there are four categories of findings that provide a foundation for describing and understanding the current landscape of educational technology and the identification of future trends. These categories include: 1) findings on student and school broadband Internet access; 2) findings on student and school ownership of technologies and devices to access the Internet; 3) findings on the use of technology in schools and classrooms, including teaching models and approaches, preferred and effective digital content, and technology use for nutrition education; and 4) findings on marketing, distribution, delivery and teacher and school librarian education technology-related professional development.

Overall, findings indicate that current school-based access to broadband Internet connectivity and technology ownership varies widely at the state and local levels. Recent data indicates that a slight majority of U.S. public schools have adequate broadband connectivity. However, findings forecast an increase in school-based broadband connectivity to near-universal levels by 2018.

Currently, home broadband access is limited. Approximately one-third of public school students do not have home broadband access. Findings indicate an increase in the exclusive use of mobile devices, smartphones and cellular service for home Internet connectivity, particularly by low-income households. This rising incidence of reliance on mobile devices and cellular service for home Internet access presents serious barriers to home access of FNS online education materials. Schools are the key entry points for FNS technology-based educational materials.

Findings also forecast an overall increase in school ownership of technology and devices. However, there are wide variations at the school level in technology ownership. Instructional materials distributed online will increasingly be accessed in schools on the full range of available technologies and devices, including computers, touchscreen tablets and smartphones.

Findings forecast a continuation of teachers' focus on core academics and standardized testing with less instructional time for supplemental materials and topics. The need to align health and nutrition materials with core curriculum is essential. Findings indicate that the trend in the use of educational technology will continue to be towards a student-centered, personalized-learning approach. As a result, market-leader curriculum producers (Pearson, Houghton Mifflin Harcourt, McGraw-Hill) will be increasingly developing interactive digital learning products. Additionally, curriculum producers will be developing sophisticated adaptive digital learning programs, including performance feedback and formative assessment as product features. As learning materials become more sophisticated, ensuring ease-of-use and providing teacher professional development becomes critical.

There are several approaches to educational technology use, including a variety of learning models and instructional strategies (e.g., blended learning, flipped classrooms, collaborative learning, project-based learning, etc.). However, the use of several of these approaches, including flipped classrooms, create serious challenges for students with limited or no home Internet access.

The use of social media for communications between teachers, parents and students, as well as teacher participation in online communities is forecast to increase.

Findings indicate that there is a substantial body of technology-based instructional materials focused on nutrition, health and fitness education. Studies of educational effectiveness identify the importance of learning context as a predictive variable for instructional success. More research is urgently needed on effective technology-based learning across all subject areas. Findings indicate that increased FNS participation and visibility in the education community will engender product awareness and differentiation.

Formative Research – Key Findings

The detailed Formative Research findings are presented in Chapter IV of the Environmental Scan report. The Formative Research was comprised of focus group interviews (FGIs) with teachers; an online survey with health teachers; and individual in-depth interviews with state level educational technology officers. The interviews and surveys were designed to identify teacher perceptions, attitudes, and behaviors regarding educational technology. Findings are provided by research component and as a summary of the collected findings.

Overall, the Formative Research and Literature Review findings are strongly aligned. Formative Research indicates that teachers use technology to support classroom instruction. Teachers report that students are more engaged when using technology and identify interactive digital content, interactive games, videos, and social media as the core components of student digital engagement. Findings indicate a range of teacher technology use, including: communicating with families; finding and sharing instructional materials and resources; and for professional development.

Teachers are interested in, and welcome, the use of technology for health and nutrition education. Teachers had suggestions for FNS regarding the development of educational digital materials. Teachers recommend including interactive digital content, interactive games, and videos in the development of instructional content. Additionally, teachers recommend including non-digital, hands-on components as well as digital content. In order to facilitate and ensure use, teachers report that digital material needs to be easy to access and easy to use. Teachers highlighted the importance of aligning FNS content with core academic curricula.

Teachers and state level educational technology officers identify specific challenges regarding educational technology. These findings, confirming the results of the Literature Review, indicate that many students lack Internet access at home, there are significant disparities in school broadband access and school technology ownership, and many teachers lack adequate professional development.

Teachers and technology officers report successful technology use in facilitating personalized learning, allowing for adaptable and flexible use in a variety of learning approaches, including collaborative learning, and increasing student engagement.

Key prioritized recommendations for FNS development of technology-based educational materials

Prioritized recommendations (presented in Chapter 4, Section E) are offered as a directional resource for FNS staff and decision makers in developing technology-based educational materials. Overall, recommendations are organized into four categories, including: recommendations for the distribution, delivery and accessibility of FNS technology-based educational materials; recommendations for developing FNS educational material aligned with school technology use; recommendations for the marketing of FNS materials; and recommendations to increase the use of FNS materials.

Key recommendations for adapting and converting select Team Nutrition materials for educational technology use

Recommendations for converting select Team Nutrition materials for technology use, including cost estimates, are provided in Chapter 5 of the report. These specific recommendations were based on the results of the Environmental Scan, the overall prioritized recommendations and a comprehensive review of the selected FNS materials.

Recommendations are provided for *My Plate*: *A Yummy Curriculum* and for *Nutrition Voyage: The Quest to be Our Best Curriculum*. Additionally, recommendations are provided for specific selected lessons from both curricula. Recommendations were made based on evaluative criteria, including: an alignment with the Environmental Scan findings; implications and prioritized recommendations; and a determination of feasibility, educational impact, and accessibility.

CHAPTER I
BACKGROUND AND OBJECTIVES

A. Introduction and Background

The Food and Nutrition Service (FNS) administers the nutrition assistance programs of the United States Department of Agriculture (USDA). The FNS mission is to provide children and families-in-need with better access to food and healthful diets through various assistance initiatives, including the Child Nutrition Programs. Team Nutrition is an initiative of the USDA Food and Nutrition Service to support the Child Nutrition Programs through training and technical assistance for food service, nutrition education for children and their caregivers, and school and community support for healthy eating and physical activity. Team Nutrition provides nutrition education for children and their caregivers, and support to schools and communities for healthy eating, healthy behaviors and physical activity.

Working in partnership with State agencies and other cooperating organizations, FNS helps ensure children's access to sufficient food, nutritious meals and nutrition education. Team Nutrition educational programs are designed to increase children's learning and promote healthy choices, behaviors and physical activity. FNS is committed to continually improving these programs by increasing reach, use and educational effectiveness. In this context, Team Nutrition has identified the important role of educational technology and technology-based instructional materials in providing rich learning experiences for children in grades K–12 in U.S. public schools.

In this context, FNS has contracted with the Michael Cohen Group, LLC (MCG) to conduct an environmental scan of educational technology in U.S. public schools. The environmental scan method "enables decision makers both to understand the external environment and the interconnections of its various sectors and to translate this understanding into the institution's planning and decision making processes" (Morrison, 1993). The current environmental scan provides an overview of educational technology, including its ownership and use in U.S. public school, as well target users' (families, teachers, librarians and K–12 students) attitudes towards technology.

B. Objectives

The environmental scan is designed to collect comprehensive information about the rapidly changing use of technology in U.S. public schools and the effective technology-based methods currently in use and to identify the technology-based methods effective in increasing children's nutrition knowledge, healthy eating and physical activity. Research findings indicate that an individual's health status is influenced by multiple factors, including genetics, social circumstances, environmental exposures, health care and behavioral patterns (Rizzo et al., 2015). The identification of the educational technology tools and approaches that best support children's healthy behaviors and physical activity provides FNS with a valuable resource for use in strategic planning.

The specific research objectives of the environmental scan are:

- To identify the ways in which technology is used to support K–12 classroom instruction, communicate with families and community, facilitate reading in the school library, discover and share instructional materials, provide professional development, and promote the availability of healthy food at schools;
- To identify examples of the effective use of technology-based nutrition education to change children's eating behaviors and physical activity;
- To identify effective methods and best practices for using technology to engage parents/caregivers in school activities and events;
- To identify and understand contextual factors that may engender or inhibit the use of technology in K–12 schools;
- To identify and understand differences and disparities, and barriers and facilitators, in the use of technology by K–12 schools, such as in urban versus rural settings, teacher/parent/student attitudes towards and experiences with technology, and community access to the Internet or technology devices;
- To identify and understand differences between the attitudes and technology experiences of nutrition/health/physical education teachers and those who teach core content areas;
- To identify and understand the school processes and policies that shape technology access and usage;
- To review the current educational technology marketplace, including company offerings and usage; and
- To identify future trends in educational technology relevant to organizations seeking to develop products in the health/nutrition education sector.

CHAPTER II
METHODOLOGY

A. Environmental Scan Design

In order to meet these objectives, the research design of the Environmental Scan includes both a comprehensive Literature Review (Task 1) and Formative Research (Task 2). Additionally, an expert consultant Working Group, comprised of educational technology and health educators, provided literature review sources and reviewed formative research instruments (see Appendix A). The design for both the Literature Review (Task 1) and the Formative Research (Task 2) were comprised of several components.

Task 1 - Literature Review

Component 1. A review of scholarly literature published in peer-reviewed journals.
Component 2. A review of grey literature available outside of peer-reviewed journals, including survey research, reports, conference proceedings, summaries and other literature produced by government agencies, research centers, associations, corporations and professional organizations.
Component 3. A review of digital resources relevant to technology-based health and nutrition education (e.g., websites, social media networks and digital apps).

Task 2 - Formative Research

Component 1. Focus group interviews (FGIs) with educators (K–12 teachers and school librarians) across the seven FNS regions focused on the integration and use of educational technology.
Component 2. An online survey of health educators' perceptions and use of educational technology.
Component 3. Individual in-depth interviews (IDIs) with state educational technology directors. Interviews with directors focused on the decision making process regarding the purchase and use of educational technology from the perspective of State Educational Technology Offices.

Notes on Report Terminology

For clarification, the current report utilizes the following terminology. "Environmental Scan" refers to the entire report (comprised of Task 1 and Task 2). "Literature Review" refers to Task 1 (including all Task 1 Components). "Formative Research" refers to Task 2 (including all Task 2 Components). The specific approaches and methodologies for each research component are described below.

B. Methodology: Literature Review

Search Parameters

By design, the literature review focused on subject areas pertinent to educational technology in U.S. public schools. These subject areas included: the ownership and use of technology by students and families; trends in the ownership and use of educational technology in U.S. public schools and school libraries; the policies that shape and impact school technology adoption; the digital communications used for educational purposes; the attitudes of teachers, parents and students towards educational technology; trends in the approaches and use of technology for teaching and learning; evidence of the effectiveness of technology for health and nutrition education; trends in the educational technology industry and market; and the projected future for educational technology. The review was designed to include literature and source material from 2008 and later. Literature and source material prior to 2008 were cited when relevant or if more recent data were unavailable.

Process

Gathering adequate and current information on this wide range of subject areas required a search strategy comprised of components covering three source domains, including scholarly literature, grey literature and relevant digital resources. The first step in the process was a systematic review of scholarly literature. The search strategy was designed to use information from the retrieved publications to direct the review to other relevant sources across domains. As the review proceeded, the availability and relevance of existing literature differed by subject area, and source material from all three domains provided valuable direction for the ongoing search (e.g., scholarly literature directed the search to survey research, and education news sources identified unpublished reports and digital resources, etc.). Additionally, the expert Working Group provided direction for literature and source material in all three domains. The research process for each component is detailed below. The key topic areas and search terms employed for the literature review are listed in Appendix B.

Once collected, the literature was reviewed by MCG researchers and team members. Sources were selected and data were retrieved and organized with the goal of providing adequate information for reporting findings for all the identified subject categories. The collective findings of the subject categories were subsequently reviewed to provide an understanding of the complex reality of educational technology in U.S. public schools and strategic recommendations for FNS.

Literature Review – Component 1: Review of Scholarly Literature

The initial step in the research process was a systematic literature search of multiple electronic databases including EBSCO, ERIC, PsychInfo, PubMed and Proquest. The review identified scholarly, peer-reviewed literature on educational technology, evaluation and research, with a specific focus on technology and health and nutrition education. The bibliographies and references from the retrieved literature were reviewed to identify additional literature and relevant publications.

Literature Review – Component 2: Review of Grey Literature

The search of grey literature was conducted using multiple strategies.

First, a review of the scholarly literature bibliographies identified existing survey research on the incidence of ownership and use of specific technology devices, including national surveys conducted by Common Sense Media, The Joan Ganz Cooney Center, the National Center for Education Statistics (NCES), The Pew Research Center, the Public Broadcasting Service (PBS), SRI International (formerly the Stanford Research Institute) and the U.S. Department of Education Institute of Education Sciences (IES).

Secondly, papers and reports were identified and reviewed through a search of the websites, including conference proceedings of prominent national educational and technology organizations and associations, including, but not limited to: the International Society for Technology in Education (ISTE); Early Education and Technology for Children (EETC); and the American Educational Research Association (AERA).

Thirdly, a search was conducted of online journals focused on educational technology news, including: EdSurge, EdWeek, THEJournal and Edutopia. These online resources report on breaking news and identify national trends in the use of educational technology. The educational online journals also provided links to local case studies of educational technology practice and policy.

Literature Review – Component 3: Review of Digital Resources

Information derived from the ongoing literature review literature and sources identified by the Working Group, combined with feedback from the ongoing formative research, provided direction and links to relevant educational technology and technology-mediated health and nutrition education websites, social media networks and digital apps. These various digital sources include: BrainPOP, YouTube, Facebook, Instagram and Wii Fit.

C. Methodology: Formative Research

The overall methods for Task 2 include a combination of qualitative individual and group interviews, and a quantitative survey.

Formative Research – Component 1: Focus Group Interviews with Educators

Objectives. The main goal of the focus group interviews was to gather information directly from K–12 educators about their perceptions of and real-life experiences with educational technology in general, and pertaining to nutrition and health education when applicable. The key questions centered on educators' use of educational technology in the classroom, including types of technology, purposes of use, benefits and challenges encountered, and school/district policies in place.

Design. This component of the formative research utilized focus group interviews (FGIs) as a qualitative methodology. FGIs allow for more in-depth exploration of topics through discussions and dialogue exchanges that provide insight into participants' beliefs, attitudes, and behaviors. Formative research activities were conducted with educators, including health and physical education teachers and school librarians, employed at K–12 schools participating in the National School Lunch Program (NSLP).

Recruitment Specifications. Public schools, from which the sample of K–12 teachers, teachers, librarians and health educators was recruited, were selected in order to meet the following specifications:

- Represent a mix of elementary schools, middle schools and high schools;
- Denote geographic diversity, representing all FNS regions;
- Represent a mix of urban (city, town), suburban and rural schools;
- Participate in the NSLP, with at least 33% of the student population eligible;
- Include at least 2 schools with more than 40% African-American students;
- Include at least 2 schools with more than 40% Hispanic/Latino students;
- Have fewer than 4 schools with more than 80% non-Hispanic White students; and
- Include a mix of K–12 teachers, school librarians and health educators.

Recruitment Procedures. In order to meet the above specifications, a database of all U.S. public schools was compiled using publicly available data from the National Center for Education Statistics (NCES) and Office for Civil Rights (OCR). This database served as the primary source of school selection from which the sample of K–12 educators was drawn. This database aggregated schools by number of students, number of teachers, grade levels, students' race and ethnicity, number of students who qualify for free/reduced-price lunch and school-level NCES locale code, which locates a school on the urban-rural continuum.

In addition to the public schools described above, a sample of K–12 health education teachers attending the Society of Health and Physical Educators (SHAPE) conference in Minneapolis, Minnesota in early April 2016 was recruited to participate in the FGIs. The conference draws teachers of health education from across the country and, as such, all FNS regions, allowing for a regionally diverse sampling of teachers of health education. Although the profiles of FGI participants' schools was unknown prior to the groups, they were subsequently verified to meet the above stated specifications, with one school identified as having NSLP participation levels below 33%. The profile of the SHAPE Conference participants' schools is in Appendix C.

Another sample of K–12 teachers was recruited to participate in one FGI held at a focus group facility in the Denver, Colorado, area. The profile for these teachers' schools is in Appendix D. Two participants' schools were subsequently identified as having NSLP participation levels below 33%.

School-Based Focus Group Recruitment Procedures. A four-step procedure was utilized to recruit focus group participants and encourage them to participate without the use of incentives.

1. First, teachers of health education were emailed directly (see Appendix E) and recruited to participate in focus groups. Teachers' email addresses and phone numbers were obtained from publicly available databases and school websites. A consent packet with detailed information about the study and their rights as research participants (see Appendix F) was distributed to interested teachers. These teachers served as primary contacts and coordinators at each school.

2. After a primary contact was established, approval was obtained from the school principals (see Appendix G). Principal approval was required for school sites to be selected. However, the principal's approval did not guarantee teacher participation because principals cannot appoint or nominate participants. This constitutes a manipulation of power dynamics and may be viewed as exploitative by IRBs.

3. After principal approval was obtained and a primary contact established, all teachers in the participating schools received email invitations to participate in FGIs (see Appendix E), using contact information obtained from publicly available databases. In addition, the designated primary contact at each school was provided with flyers with information about the study (see Appendix I) to share with other teachers. Attempts were made to include a health teacher in every focus group, but this was not always possible.

4. Finally, after times were selected, participating teachers were sent a scheduling email (see Appendix J) to remind them where and when the focus groups would take place.

5. Consent packets included a brief survey for teachers to complete (see Appendix F). These surveys asked teachers about demographic information, familiarity with technology and teaching experience. Signed consent forms were collected at the conclusion of the FGIs.

Once interest and consent was established at one school in any given FNS region, to reduce the cost of travel between school sites, researchers focused recruitment on additional schools within 150 miles. However, these efforts were not always successful. The lack of incentives for focus group participants negatively impacted recruitment efforts, evidenced by low response rates, which lead to significant delays in fielding the FGIs. Consequently, an OMB request was submitted in May 2016, and subsequently approved in June, to offer FGI participants a $50 stipend to cover childcare and transportation costs for participating teachers. This change facilitated the successful recruitment of the remaining FGIs.

SHAPE Conference Focus Group Recruitment Procedures. Trained MCG research staff attended the SHAPE Conference and approached teachers of health and physical education in between conference events and during networking breaks at the FNS Team Nutrition booth on the expo floor. Interested teachers signed up to participate in one of two FGIs, given the location of the FGIs (a meeting room in the convention facility), and asked to meet there on the designated date and time. Completed consent packets (see Appendix K) were collected at the conclusion of the FGIs.

Research Facility Focus Group Recruitment Procedures. A recruiting firm was employed to recruit one FGI in Denver, Colorado. Recruiters were provided with a screener (see Appendix L) for use when contacting potential participants from the firm's proprietary databases. Completed consent packets (see Appendix F) were collected at the conclusion of the FGIs.

Compensation. Participating schools hosting FGIs received a $150 facility fee to cover the cost of using a conference room, classroom or the library to conduct focus groups. FGI participants were provided with a meal during lunch or after school. The meal was arranged by the research staff through local food establishments, and in most cases averaged $8 per participant. As of June 17, 2016, OMB approval allowed for a $50 stipend per participant to cover childcare and transportation costs.

Educators participating in FGIs conducted at the SHAPE Conference were provided with lunch during the groups by the Conference's catering department. Educators who participated in the FGI conducted at a research facility received food, refreshments and a $50 stipend.

Fielding of the FGIs took place from mid-April to early August 2016. One to two FGIs were conducted at each of 21 schools across the seven FNS regions, either before school, during lunch, during free periods, or after school, depending on teacher availability. FGIs were held at school libraries or empty classrooms. Additionally, as previously mentioned, two focus groups were conducted at the SHAPE conference in Minneapolis, Minnesota, and one FGI was conducted at a focus group facility in Denver, Colorado.

Sample Profile. A total of 26 45-minute FGIs (see Appendix M for moderator's guide) were conducted. The number of participants for each FGI ranged between 2 and 9, for a total of 144 teachers. Of these, 120 teachers participated in FGIs at schools, 15 participated at the SHAPE Conference, and 9 participated at a focus group facility. Where possible, at least one teacher of health education participated in each group.

School Profile. Twenty-one (21) schools were recruited for participation representing elementary, middle and high schools. Table 2.1 below presents an overview of the numbers and percentages of schools, FGIs and teachers; the school types; and the FGI settings represented in the study. The FGIs held outside of school settings included a mix of teachers representing a variety of school types. The schools' profiles from these FGIs can be found in Appendices C (SHAPE Conference) and D (Focus Group Facility).

Table 2.1

Profile of FGIs by Type of School, FGI Setting, Number of FGIs, and Number of Participants

Type of School and Setting	*n* (Schools)	% (of schools)	*n* (FGIs per School Type)	% (of In-School FGIs per school type)	*n* (Out of School FGIs)	% (of Out of School FGIs)	*n* (Educators)	% (of educators)
Elementary School (K-4 or K-5)	9	42.9%	10	43.5%			52	36.1%
Middle School (5-8 or 6-8)	5	23.8%	6	26.1%			26	18.1%
High School (9-12 or 7-12)	7	33.3%	7	30.4%			42	29.2%
Subtotal (In School)	21	100%	23	100%			120	83.4%
Out of School					3	11.5%	24	16.6%
	n (Schools)		***n*** (In-School FGIs)		***n*** (Out of School FGIs)		***n*** (Educators)	**100%**
TOTAL	**21**		**23**		**3**		**144**	

Geographic Diversity. The participating schools were recruited based on NCES School Locale Codes that differentiate the type of locale in order to assure distribution of different types of schools from urban (city, town) to rural areas.

Initially, one state per FNS region was targeted, and, whenever possible, more than one school was recruited from each state. The number of states covering each FNS region was expanded as needed in order to fulfill the number of FGI participants targeted for each FNS region. Table 2.2 below summarizes the FNS regions, locales, states, and type of school where FGIs were conducted. The SHAPE Conference FGI participants were from various states and were separated out under "Other" in the FNS Region column. The FGI conducted at a focus group facility is included under Colorado since all participants were from the Denver area.

Table 2.2

Focus Group Profile by FNS Region, Locale, State and Type of School

FNS Region	Locale*	States	Type of School	*n* (FGIs)	*n* (Educators)
Mid-Atlantic	Suburban	Delaware	Elementary	1	5
		New Jersey	Middle	1	4
Midwest	City	Indiana	Elementary	1	5
		Ohio	Middle	1	2
		Wisconsin	Elementary	1	5
Mountain Plains	Rural	Colorado	High	1	7
	Suburban		High	1	7
	City		Various	1	9
Northeast	City	Connecticut	High	1	7
		New York	Middle, High	2	10
	Town	New York	High	1	4
Southeast	Rural	Florida	Middle	2	9
		Kentucky	Elementary, Middle	2	14
Southwest	Town	New Mexico	Elementary	2	8
		Oklahoma	Elementary	1	9
Western	Suburban	Arizona	High (2)	2	12
		California	Elementary (3)	3	11
Other: SHAPE Conference	Various	Various	Various	2	15
TOTAL	**3 City, 3 Suburban, 2 Rural, 2 Town**	**14**	**9 Elementary, 5 Middle, 7 High Schools**	**26**	**144**

*The locales are taken from the NCES http://nces.ed.gov/ccd/commonfiles/localedescription.asp.

Educator Profile. A majority of educators reported teaching multiple grades and subjects. More than a quarter of those who provided a response said they have been teaching for over 15 years. The sample was predominantly White. However, more than a quarter of participants did not provide information on their race/ethnicity. More than two-thirds of the FGI participants were female. Table 2.3 below summarizes the participants' demographic characteristics.

Table 2.3

Focus Group Participant Demographic Profile

Demographics	*n*	%
Grades Taught		
Elementary (K-5)	60	41.7%
Middle (6-8)	33	22.9%
High (9-12)	32	22.2%
K–12	6	4.2%
Other: Middle & High	1	0.7%
No response	12	8.3%
Total	**144**	**100%**
Subject Taught*		
English Language Arts	46	31.9%
Health/Nutrition	42	29.2%
Math	36	25%
History/Social Studies	26	18.1%
Physical Education	23	16%
Science	29	20.1%
Total**	**202**	**140.3%**
Number of Years Teaching		
First Year	4	2.8%
2 – 5 years	22	15.3%
6 – 10 years	20	13.9%
11 – 15 years	13	9%
15+ years	41	28.5%
No response	44	30.5%
Total	**144**	**100%**

* Includes only top 6 subjects cited.

** Respondents were able to select multiple subjects, so totals add up to more than 144 and 100%.

Table 2.3
Continued

Demographics	*n*	%
Race/Ethnicity		
American Indian or Alaskan Native	1	0.7%
Black or African American	6	4.2%
Hispanic or Latino	7	4.9%
Native Hawaiian or Other Pacific Islander	1	0.7%
White	91	63.2%
No response	38	26.3%
Total	**144**	**100%**
Age		
Under 25	5	3.5%
25-34	25	17.4%
35-44	32	22.2%
45-54	25	17.4%
55+	13	9%
No response	44	30.5%
Total	**144**	**100%**
Gender		
Female	96	66.7%
Male	29	20.1%
No response	19	13.2%
Total	**144**	**100%**

Analysis. All focus groups interviews were conducted using the moderator's guide (Appendix M), audio-recorded (with respondent permission), and transcribed. This text became the data for qualitative analysis. Codes, representing new insights and relevant participant experiences and opinions, were identified using Grounded Theory coding methods, by which codes and themes are allowed to emerge from the text (Charmaz, 2014) and entered into the Dedoose software package in order to organize themes. In order to ensure that individuals did not bias findings, multiple researchers coded interview transcriptions, and themes were compared and synthesized in Qualitative Debriefing Sessions. Findings are considered to be descriptive and directional, but not definitive. No attempt has been made to generalize findings as nationally representative or statistically valid.

Formative Research – Component 2: Online Survey with Health Educators

Objectives. The overall goal of the online survey component was to target and collect data from additional teachers of health education about their experiences with and attitudes towards educational technology. Questions focused on devices and technologies used, attitudes towards educational technology, time spent using technology, and technology use for health education.

Design. This component of the formative research utilized a survey questionnaire as a quantitative methodology. An online survey (see Appendix N) was administered to health education teachers employed at schools participating in NSLP. Surveys took approximately 10 minutes to complete, and contained open-ended questions about health educators' experiences with technology, as well as multiple-choice questions about their use, attitudes toward, and perceptions of technology.

Sampling Procedures. A database of all public schools was compiled using data from NCES and OCR, which includes school size, grade level, locale code and the percentage of students eligible for free or reduced lunch. Using this database, schools in which at least 50% of students qualified for free/reduced price lunch were identified and organized by FNS region. Schools serving specific grade levels and with specific locale codes were targeted in each region to achieve a diverse sample. Schools that hosted FGIs were excluded. Teachers of health education who participated in focus groups were not eligible to participate in the survey.

Once a clean database of qualifying schools was created for each FNS region, schools were randomly selected for inclusion in the survey sample. For each school, researchers identified teachers of health education using the school and district websites. For the purpose of this study, teachers of health education include health, nutrition, physical education (PE) or Family and Consumer Science teachers.

Email addresses were compiled for all qualifying teachers of health education at the randomly selected schools. If contact information was not available on school websites or through district or state databases, additional schools were identified until the final sample was met.

Survey Recruitment Procedures. Using an estimated return rate of 4–10%, a total of 1,190 teachers of health education were contacted in order to achieve the desired sample of 50-100 teachers of health education. A total of 170 teachers of health education were contacted from each region.

An email invitation (see Appendix H) was sent to all qualifying teachers using the SurveyMonkey web-platform. The email invitation described the purpose of the study, the content of the survey and information about their rights as research participants. Teachers were also given the option to opt-out of any future communications about the study. For a period of three weeks, reminder emails were sent to non-responding teachers every two to three days. Finally, one reminder email was sent at the end of data collection to teachers who began the survey but did not complete the survey.

All teachers completed a digital consent form (see Appendix O) prior to providing any survey responses. Using the Agreement on Security of Comments Form, participants were informed of confidentiality and privacy act provisions before responding to the survey. System of Record FNS-8, FNS Studies and Reports, published in the Federal Register on 4/25/1991 at 56 FR 19078, covers personal information collected under this study and identifies safeguards for the information collected.

Sample Profile. A total of 70 teachers completed the online survey. A total of 1,190 teachers were invited to participate by email; 72 teachers consented to participate and 2 teachers opted out. Percentages reported are based on the total number of participating teachers (n=70).

Survey participants reported teaching more than one subject, selecting an average of 1.94 subjects (range = 1-10 subjects) from a provided list of 14. Sixty-nine (69) participants (n=98.6%) reported teaching Health, Physical Education (PE), or Family & Consumer Science (FCS). The majority of participants, 53 (n=75.8%), reported that they teach Health exclusively, or in conjunction with PE. Table 2.4 below lists the breakdown of subjects taught by number of teachers and percentage of total.

Table 2.4

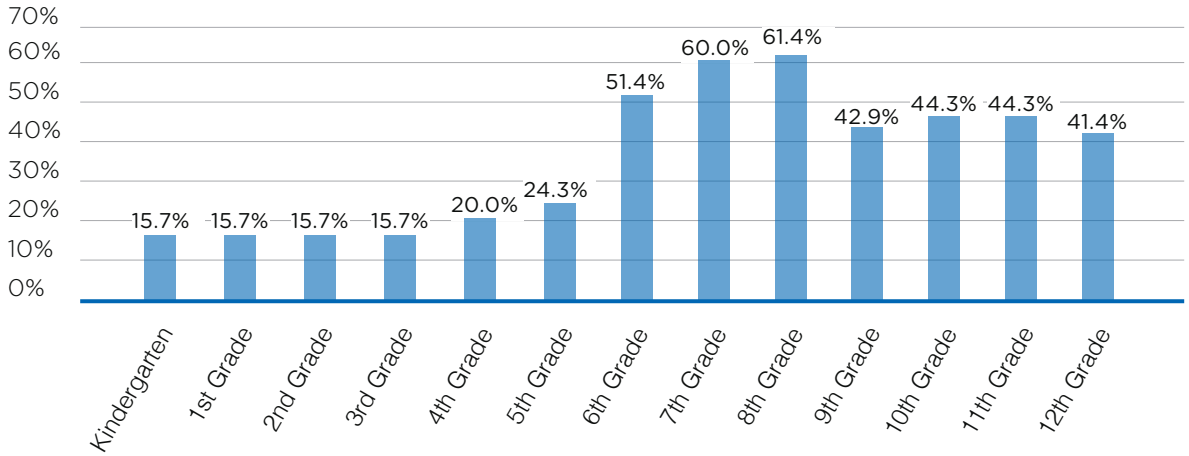
Subjects Taught by Survey Respondents

Subject	*n*	%
Health & PE	31	44.4%
Health Only	22	31.4%
PE Only	11	15.7%
Only FCS	5	7.1%
Dance	1	1.4%
Total	**70**	**100%**

The number of grades these teachers taught varied, with some reporting teaching one grade only, while others said they taught multiple grades at their school. When asked to indicate which grades they taught, teachers provided an average of 4.53 responses (range 1-13). The most common grade levels reported were the middle school grades (6th=51.4%, 7th=60.0%, 8th=61.4%) followed by the high school grades (see Figure 2.1 below).

Figure 2.1

Grades Taught by Survey Respondents



Analysis. All educator surveys (Appendix N) were entered into PASW Statistics Program of quantitative analysis, and descriptive analyses were conducted. Though the results of this analysis are quantitative in nature, no attempt was made to generalize findings to the larger population, given the sample size and sampling procedure. Open-ended questions were analyzed using the same methods as the qualitative interviews. The text became the data for qualitative analysis using Grounded Theory coding whereby codes and patterns emerged from the data.

Formative Research – Component 3: Interviews with State Educational Technology Directors

Objectives. The goal of interviewing state educational technology directors or specialists was to gain an understanding at the state level of the process of implementing educational technology in K–12 public schools. Key interview questions covered state policies and practices regarding the integration of educational technology, decision-making processes regarding the purchase and use of educational technology, types of technology found in schools, challenges to technology integration, and successful uses of educational technology.

Design. This component of the formative research utilized in-depth individual interviews (IDIs) as a qualitative methodology.

Recruitment Procedure. Potential interviewees were identified through the State Educational Technology Directors Association (SETDA) website, which lists several educational technology contacts for each state. Initial outreach was done via phone calls or emails, and interviews were scheduled with those who responded positively. An effort was made to secure interviews for each FNS region. Interviews were conducted by phone using a structured interview guideline (see Appendix P).

Sample Profile. Six state level education technology directors (Connecticut, Iowa, New Jersey, Oklahoma, Texas and Wisconsin) and one district level superintendent from California participated.

Analysis. All the interviews were audio recorded (with participant consent) and transcribed. MCG researchers reviewed the transcripts and entered key point interview summaries into a curated spreadsheet. Common themes and patterns that emerged informed the basis of the findings.

CHAPTER III
LITERATURE REVIEW

Introduction

This chapter presents the findings from the literature review of educational technology in U.S. public schools, including a description and understanding of current access, ownership, integration, use, and emerging trends. Throughout, findings from the literature review are translated into actionable knowledge and presented as "Implications for FNS," designed to inform ongoing FNS planning, decision-making, and activities. The literature review methodology is presented in Chapter II, Sections A and B.

During the past decade, there has been a rapid and transformative integration of digital technology -- including mobile devices, digital content, and broadband and cellular Internet access -- into all societal sectors, including education. The range of available digital technologies, content and online accessibility is vast, and includes: desktop and laptop computers; touchscreen tablets; smartphones; broadband and cellular Internet connectivity via computers and mobile devices; interactive games; apps; streaming audio and video; websites; search engines; email; and social media. Technology overall and educational technology, specifically, are now defined as the combination of digital devices and Internet connectivity.

Overall, the responsibility and authority for U.S. public education, including curricula decisions, school operations, and equipment and instructional material purchases, resides primarily at the state and local levels. It is currently estimated that state, local, and private sources are responsible for upwards of 90% of the funding for U.S. public schools annually (Horrigan & Duggan, 2015). State and local control of educational technology is an important factor in understanding the significant differences and variations in its integration and use at the state, district and school levels.

Federal legislation, executive policies and U.S. Department of Education leveraged funding have resulted in greater national uniformity in specific aspects of U.S public education. These aspects include: enforced student civil rights and school access; Title I provisions aiding disadvantaged children; standardized assessment; and support for the increased development and integration of educational technology, including broadband access in U.S public schools.

This literature review provides an overall understanding of the complex reality of educational technology in U.S. public schools. The review is organized by subject area in Sections A – J. Implications for FNS, relevant to each section, are included. Section K provides an overall Summary and Conclusion, including the identification of future trends for educational technology.

Organization

Section A. provides an overall description of broadband Internet access and ownership of digital technology in U.S. households overall, and differences in ownership by household income, and households with school-age children.
Section B. provides an overall description of broadband Internet access and ownership of digital technology in U.S. public schools.
Section C. provides an overall description of educational technology in U.S. public school libraries.
Section D. provides an overview of important education technology policy at the federal, state, and local levels.
Section E. provides an overview of teacher, parent and student attitudes toward educational technology.
Section F. provides an overview of current and emerging educational technology practice, use, and trends in U.S. public schools.
Section G. provides an overview of existing and emerging approaches to technology integration in U.S. public schools.
Section H. provides an overview of the current use of educational technology and media for health and nutrition education.
Section I. reports on research studies of effective educational technology use.
Section J. provides an overview of market leaders in educational technology.
Section K. provides overall results including future trends in educational technology.

A. Societal Context: Access and Ownership of Internet Connectivity and Digital Technology in U.S. Households

Key Points – Summary

- In 2015, the vast majority of Americans, 90%, lived in a region where broadband Internet service is available. Americans living in rural areas, on tribal lands and in U.S. territories are disproportionately represented in the areas lacking availability. In locations where broadband Internet service is available, lower income households and rural households disproportionately lack ownership of a home broadband subscription to access the Internet.

- A substantial number of school age-children do not have access to broadband (i.e., high speed) Internet at home, which is necessary to access online educational media and learning tools. One third (33%) of U.S. households did not own a home broadband subscription in 2015, and there are significant geographic and socioeconomic disparities in children's access to Internet.

- The use of mobile devices has expanded rapidly, and there is an increasing number of Americans (13% in 2015) who lack home broadband access and depend on smartphones for Internet connectivity. This group is disproportionately comprised of low-income households.

- Households with school-age children have high rates of technology ownership. Children's access to technology at home varies importantly by age and by household income. Computer and smartphone use increase with age. Teens are more likely to use a smartphone, while young children are more likely to use a tablet and less likely to use a smartphone or computer, compared to all other age groups. Children's access to computers, as well as to mobile technology at home, increases with household income.

American Household Technology Access and Ownership

Internet Speed Criteria – 2015 Residential Broadband Benchmarks. The digital revolution has been marked by a proliferation of increasingly diverse and sophisticated forms of digital media and telecommunications. In its continual evolution, digital content grows increasingly data-rich; as a result, accessing digital content online requires Internet connectivity at increasingly faster speeds. The U.S. Federal Communications Commission (FCC) defines the minimum speed threshold for broadband in terms of the capacity to reliably access "today's high-quality voice, data, graphics and video offerings" (Federal Communications Commission, 2016). In 2015, the FCC updated residential broadband benchmarks to 25 megabytes per second (Mbps) for downloads and 3 Mbps for uploads, as the prior speed criteria set in 2010 (10 Mbps for downloads and 1 Mbps for uploads) were no longer adequate to reliably access digital content online (FCC, 2016).

Availability of Broadband Internet Service in the United States, U.S. Territories and Tribal Lands. In 2015, approximately 90% (306 million) of Americans lived in a region where broadband Internet service is available. The remaining 10% (34 million) lacked available Internet service that met FCC broadband criteria. As seen in Table 3.1 residents of rural areas, tribal lands and U.S. territories are disproportionately likely to lack broadband Internet availability (FCC, 2016). The National Telecommunications and Information Administration (NTIA) National Broadband Map provides up-to-date mapping of the geographic distribution of Internet access across the 50 states and U.S. territories (the NTIA map of current high-speed Internet service availability across states and U.S. territories by geographic location is included in Appendix Q).

Table 3.1

Percentage of Americans Without Broadband Internet Service Availability in 2015, by Geographic Locale

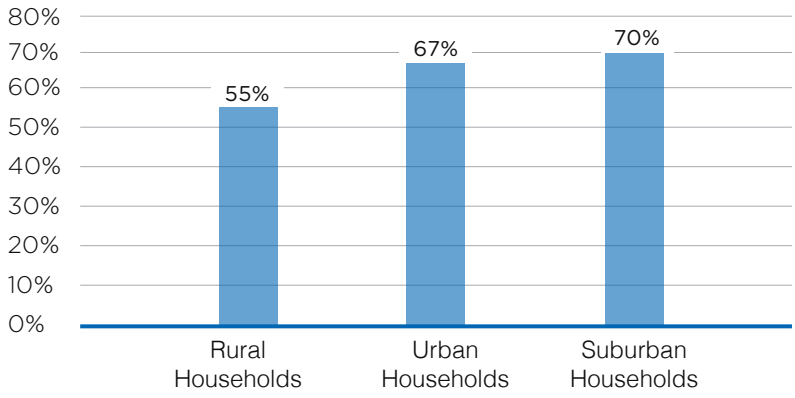
Residential Geographic Locale	% of Residents Without Broadband Internet Service Availability
Urban residents without availability	4
Rural residents without availability	39
Tribal Land residents without availability	41
U.S. Territory residents without availability	66

Source: Federal Communications Commission, 2016

Broadband Ownership Among U.S. Households. In 2015, 67% of households owned a home subscription to broadband Internet service (Horrigan & Duggan, 2015). In locations where broadband Internet service is available, differences in income account for the greatest disparities in broadband ownership; adults in households with an annual income of $50,000 or more were twice as likely to own home broadband (80%), compared to those (41%) with a household income under $20,000 (Horrigan & Duggan, 2015). Differences in home broadband ownership by geographic locale, and by income, can be seen in Figures 3.1 and 3.2.

Figure 3.1

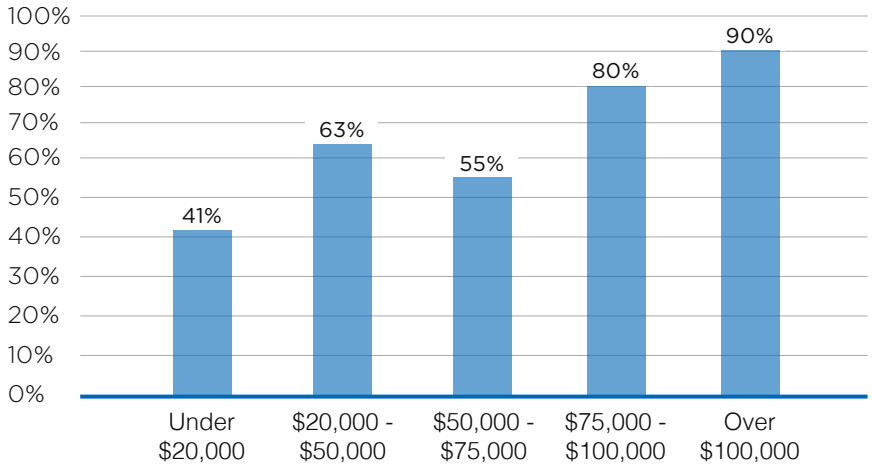
Percentage of U.S. Households Who Owned Broadband Internet Service in 2015, by Geographic Locale



Source: Horrigan & Duggan, 2015

Figure 3.2

Percentage of U.S. Households Who Owned Broadband Internet Service in 2015, by Household Income



Source: Horrigan & Duggan, 2015

Device Ownership Among U.S. Households. In 2015, computers and smartphones were the most commonly owned Internet-capable devices in U.S. households; 73% of adults reported owning a computer, and 68% reported owning a smartphone (Anderson, 2015; Horrigan & Duggan, 2015). Over the past several years, there has been a rise in mobile device ownership and Internet use, and a simultaneous decline in computer ownership. In 2012, 80% of U.S. adults reported owning a computer. Adult ownership of computers decreased to 73% in 2015 (Anderson, 2015). During the same time period, the rate of smartphone ownership nearly doubled (from 35% in 2012 to 68% in 2015; Anderson, 2015; Horrigan & Duggan, 2015). Adult ownership of tablets increased from 3% of adults in 2010 to 45% in 2015 (Anderson, 2015).

The Shift Towards Mobile Device Ownership and Internet Access. Recent mobile expansion has been accompanied by a decline in broadband ownership and an increasing reliance on mobile devices (i.e., tablets and smartphones which provide Internet access through a cellular data plan) to go online. In 2015, smartphone ownership reached parity with broadband ownership among U.S. households (Horrigan & Duggan, 2015). This trend reflects not only a sharp rise in mobile adoption, but also a concurrent decline in broadband ownership. Between 2013 and 2015, the number of households that reported owning a broadband subscription fell from 70% to 67% (Horrigan & Duggan, 2015). Notably, during the same period, the number of households that reported exclusive reliance on a smartphone for Internet access rose from 8% (in 2013) to 13% (in 2015: Horrigan & Duggan, 2015).

"Smartphone-Dependent" Internet Access. Thirteen percent of Americans own "smartphone-dependent" Internet access (as of 2015), defined as reliance on smartphones for Internet access and lack of home broadband (Horrigan & Duggan, 2015). "Smartphone-dependent" households are disproportionately low income (Horrigan & Duggan, 2015). In 2014, 48% of smartphone-dependent Americans reported having had their mobile data service suspended or canceled due to financial constraints, and 30% reported frequently reaching the limit of their data plans (Rideout & Katz, 2016; Smith, 2015).

Child and Student Access to Technology at Home

Device Ownership Among Households with School–Age Children. According to Census data reported by Child Trends DataBank (2015) and File and Ryan (2014), as well as nationally representative survey research (Pearson Education, 2015; Rideout & Katz, 2016), the majority of school–age children have access to technology at home, ranging from personal use of Internet and shared devices available in the home, to personal "ownership" of devices purchased and dedicated for their individual use. In 2013, 79% percent of households with children ages 3–17 reported owning 1 or more Internet-capable device such as a desktop, laptop or notebook computer, and/or tablet (Child Trends DataBank, 2015). Consistent with this estimate, various survey research indicates that approximately 75%-80% of children ages 6–18 had access to a portable laptop, tablet or smartphone at home for their personal use in 2015 (Pearson Education, 2015; Rideout & Katz, 2016). Importantly, these data also indicate that between 20% and 25% of school–age children do not have access to technology at home, and that children's access to technology is strongly associated with household income (Child Trends DataBank, 2015; File & Ryan, 2014).

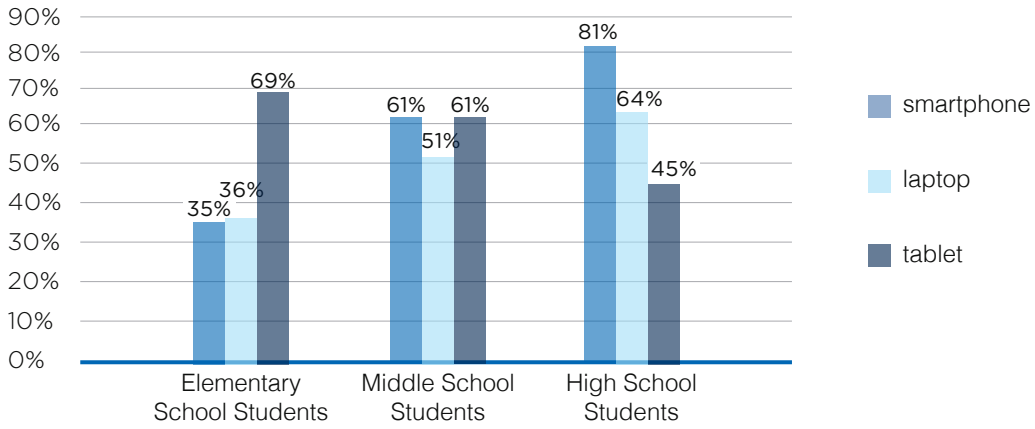
Differences in Children's Access, Use and Personal "Ownership" of Technology, by Age. Children commonly, and regularly, use Internet and a variety of devices at home. According to U.S. Census data, 57% of children aged 3–17 use a mobile device at home to go online (Child Trends DataBank, 2015). In 2015, children in grades 4–12 reported using a laptop (80%), tablet (49%) or smartphone (47%) for schoolwork (Pearson Education, 2015). These children's most preferred device for homework was a laptop (36%), followed by a tablet (25%) (Pearson Education, 2015).

Children's use of technology, and personal "ownership" of devices, vary importantly by age. Children's use of mobile devices at home to access the Internet increases with age (Child Trends DataBank, 2015), and young children are more likely to use a tablet, while older children are more likely to use a smartphone or laptop (Pearson Education, 2015; Project Tomorrow, 2014; Rideout & Katz, 2016). As seen in Figure 3.3, more elementary school students reported personally "owning" a tablet, compared to any other age group in 2014 (Pearson Education, 2015). At the same time, markedly fewer elementary school children reported owning a smartphone or laptop, compared to older children. This trend was reversed among high school students, more of whom reported owning a smartphone, or laptop, and fewer of whom reported owning a tablet, compared to any other age group.

Note that while tablet ownership is higher among primary school students than any other group at this time, such age distinctions in children's use of technology could change in the future. The expansion of mobile technology has been marked by an increasing convergence of technologies. (The smartphone, for example, now combines the functions of a telephone, a touchscreen, and a computer into one single device.) Portable computers are growing increasingly smaller (e.g., "notebook" computers), smartphone offerings include increasingly larger screens, and "hybrid" devices now combine the portability and touchscreen features of a tablet with the computing power and keyboard features of a small laptop (Pearson Education, 2014). This growing convergence of mobile device forms introduces the possibility that the tablet may be displaced in the future by a new generation of touchscreen devices that have the potential to be adopted equally by older and younger children alike.

Figure 3.3

Percentage of Children Who Reported Personal "Ownership" of Smartphones, Laptops and Tablets in 2015, by Grade Level



Source: Pearson Education, 2015

Variations in Children's Access to Digital Devices, by Household Income

The trend towards increased ownership and use of digital technology is evident at all income levels, with a higher incidence of ownership among upper-income households. According to Census data, children (ages 0–17) in households with incomes of $75,000 or more, were more than twice as likely to have access to technology at home in 2013, compared to children in households with incomes below $15,000 (Child Trends DataBank, 2015). Specifically, in 2013, 94% of children in households with incomes of $75,000 or more had access to a computer or smartphone at home, and 71% used Internet, compared to 49% and 33% (respectively) of children in households with incomes below $15,000 (Child Trends DataBank, 2015).

In 2015, the vast majority of parents of school-age children (ages 6–18) reported owning computers and/or mobile devices (Rideout, 2015; Rideout & Katz, 2016). However, there was a marked difference in reported technology ownership between parents in households at upper-income levels (above $100,000 annually) and lower-income levels (under $35,000 annually; Rideout, 2015). Specifically, 93% of parents in the upper-income households reported having access to a smartphone, compared to 65% of parents in the lower-income households. The lower-income households were less likely to own laptops or touchscreen tablets (Rideout, 2015). Additionally, among parents in households below median income (designated in 2014 as below $65,000) 23% reported being dependent on smartphones for Internet access (Rideout & Katz, 2016). Of those parents in households below median income who did have a home Internet connection, many reported that household Internet access was constrained as the result of too many people sharing the same device (26%), or interrupted Internet service in the past year due to financial constraints (20%; Rideout & Katz, 2016).

Implications for FNS

- As FNS begins to develop digital materials, the context of household technology ownership has important implications for reaching and engaging school–age children. In 2015, nearly one–third of U.S. households did not own home broadband Internet service.
- Home Internet access varies importantly by region and household income. Among families who own Internet-capable devices, technology access in the home ranges from one or more computers and/or mobile devices connected to high speed Internet, to exclusive reliance on a smartphone and cellular data plan.
- Distribution of FNS materials to environments that provide children access to digital technology outside of the home, such as schools and libraries, will increase reach and engagement among children who have limited or no access to technology at home.
- Mobile optimization of digital materials is important to reach and engage mobile device users, particularly among households who rely on smartphones to go online.
- Mobile touchscreen devices are the most universal form of technology used across all age groups, including adults. Alignment of digital materials with the functionality of mobile touchscreen devices is particularly important to reach and engage elementary school-age children, who are the most likely to use a touchscreen tablet, and the least likely to use a computer, as compared to all other age groups.

B. Digital Technology and Broadband Internet Access in U.S. Public Schools

Key Points – Summary

- In 2015, 59% of schools were connected to the Internet through broadband, meeting the FCC speed criteria for schools. While approximately two out of five schools did not have adequate broadband access, funded policy is ensuring the expansion of broadband Internet to more schools.
- The 2013 Presidential ConnectED Initiative launched a five-year plan to speed the integration of technology and digital learning in K–12 schools across America, with the objective of connecting 99% of schools to the Internet via broadband with next-generation speed (1 gigabyte per second) by 2018.
- The integration of technology and digital learning in schools, recently spurred by funded policy, is ongoing. The range of technology available to students and teachers in K–12 classrooms varies markedly between and within states. In 2014, the Digital Learning Report Card awarded a grade of C or above to 12 out of the 50 States in the category of infrastructure to support digital learning, which includes teacher and student access to the Internet and connected devices.
- National data indicates that across schools at different levels of technology integration, all (or nearly all) teachers in K–12 public schools can be expected to have access to one or more computer, a projector, and an Internet connection (although not necessarily broadband) for instructional use in the classroom.

Broadband Internet Access in Schools

School Broadband Access and Speed Criteria. The State Educational Technology Directors Association (SETDA) issued a report in 2012 underscoring the national imperative of achieving school Internet connectivity and digital infrastructure requisite for 21st century education (Fox, Waters, Fletcher, & Levin, 2012). In the report, SETDA identifies broadband speed targets with capacity to support and sustain technology integration and digital learning in schools, classrooms and library media centers. Specifically, a minimum capacity of 100 Mbps per 1,000 students and staff (users) to enable reliable access to current offerings, and 1 gigabyte per second (Gbps) per 1,000 students and staff (users) for the next generations of innovative digital learning tools (Fox et al., 2012).

Progress Towards Digital Learning Infrastructure. As of 2015, 77% of school districts (representing 59% of schools and 53% of students) were connected to the Internet through broadband meeting FCC speed criteria (Education SuperHighway, 2014). While the remaining 41% of schools did not have adequate Internet access, recent progress towards the goal of universal access has been promising. Importantly, the existence of funded policy supporting broadband attainment for 99% of schools by 2018 ensures that there will be continued progress.

In 2013, only 30% of school districts and 37% of schools were connected through broadband at speeds deemed sufficient by the SETDA for digital learning (Education Superhighway, 2015). The 2013 Presidential ConnectED Initiative (White House, 2013) launched a plan to integrate technology and digital learning across American K–12 schools and connect 99% of students and schools to next-generation (i.e., 1 Gbps) high speed Internet by 2018. In conjunction with this initiative, the FCC raised the minimum broadband speed criteria for public schools. Based on specific recommendations of the SETDA, the FCC set short-term criteria of 100 Mbps by 2014, and a long-term target of 1 Gbps (next-generation speed) by 2019, a year later than the ConnectED Initiative.

The Digital Learning Report Card (Foundation for Excellence in Education, 2014) grades each state on progress towards integration of high-quality digital learning in schools, according to a grading system established by the SETDA. In the category of "delivery," the infrastructure required to support digital learning, schools are graded on the criteria of: 1) broadband Internet connectivity; 2) teacher and student access to connected digital devices; and 3) implementation of quality assurance practices for educational data. In 2014, 12 states were awarded a grade of C or above, and 23 states were awarded a failing grade (see Table 3.2, below). Appendix R provides a map of states' 2014 grades in the category of delivery.

Table 3.2

Digital Learning Report Card Grades Awarded to States in 2014, in the Category of Delivery

Grade Score in the Category of Delivery	States
A (90-100)	KY
B (80-89)	IN, MD, ME, VA, WI, WV
C (70-79)	DE, FL, GA, HI, UT
D (60-69)	AL, AR, CT, MA, MI, MN, NC, OH, OR, PA, RI, SC, TN, TX, WA
F (59 or below)	AK, AZ, CA, CO, IA, ID, IL, KS, LA, MS, MO, MT, ND, NE, NH, NJ, NM, NY, NV, OK, SD, VT, WY
	Grades are calculated based on the following metrics: 1. All schools have high-speed broadband Internet access. 2. All teachers are provided with Internet-capable, connected devices. 3. All students have access to Internet-capable, connected devices. 4. All of the Data Quality Campaign's 10 State Actions to Ensure Effective Use are implemented.

Source: Foundation for Excellence in Education, 2014

Access to Devices in Schools for Instruction and Learning

The most recently available national data on teachers' access to technology for instructional use in the classroom was collected in 2009. Between 1995 and 2009, the U.S. Department of Education, Institute of Educational Sciences (IES), National Center for Education Statistics (NCES) tracked the number of instructional computers at U.S. public schools. As reported by Gray, Thomas, and Lewis (2010), in 2009 nearly all teachers had access to an Internet connection in the classroom, as well as at least one computer located in the classroom for daily instructional use. A projector, i.e., a portable digital light processing (DLP) projector and/or non-portable liquid crystal display (LCD) projector, was available to the majority (84%) of teachers for use in the classroom. Additionally, over half of teachers (59%) had access to an interactive whiteboard[1] for classroom use (either located in the classroom or available to be brought into the classroom).

Table 3.3

Availability of Technology and Digital Devices for Instructional Use in the Classroom

Technology Available in U.S. Public Schools for Teachers' Instructional Use in Classrooms	% of Teachers Who Reported Access
Internet connection in the classroom	99%
One or more computer located in the classroom for daily use (desktop or laptop)	97%
Interactive whiteboard available for use in the classroom	59%
Multiple laptops available to bring into classrooms	54%
DLP (small, light, portable) projector available for use in the classroom	48%
LCD (non-portable) projector available for use in the classroom	36%
Tablets and/or E-Readers available for use in the classroom	35%
Digital Camera available for use in the classroom	23%

Source: Gray, Thomas & Lewis, 2010

[1]An interactive whiteboard is an instructional tool that allows computer images to be displayed onto a board using a digital projector. The instructor can then manipulate the elements on the board by using his finger as a mouse, directly on the screen.

The expansion of school infrastructure to support digital learning, recently spurred by new regulatory criteria (e.g., for broadband connectivity) and invigorated by funded policy, is unfolding in real time. As evidenced by the Digital Learning Report Card (Foundation for Excellence in Education, 2014b), the rate of progress for technology integration has not been uniform across locations.

The current landscape for digital learning is marked by wide heterogeneity, as some schools, districts and states advance more rapidly than do others. The majority of states have not yet achieved the infrastructure required to support mobile digital learning throughout classrooms in schools (Foundation for Excellence in Education, 2014b). Thus, while the 2009 data precede the proliferation of mobile connectivity and accompanying adoption of tablets, as well as more recent advances in digital learning tools, they may be expected to reflect the reality of technology access in many classrooms. National data from 2012, and survey research in 2015, support the likelihood of this scenario. The percentage of K–12 teachers who reported having access to multiple computers available to bring into the classroom (54%) in 2009 is consistent with the percentage of schools (54%) that reported, in 2012, providing laptops in the school media center available for teacher use outside of the media center (e.g., to bring into the classroom). Additionally, among students (in grades 4–12) surveyed in 2015 (Pearson Education, 2015), a majority (58%) reported that their means of accessing a device in school, for schoolwork, consisted of either use of a computer in a computer lab (i.e., outside of the classroom) or use of a shared laptop in the classroom[2]. (A detailed infographic of these survey data is provided in Appendix S).

Table 3.4

Percentage of Students in Grades 4 Through 12 with Access to Devices in School, in 2015

4th - 12th Grade Students' Access to Devices in School for Schoolwork	% of Students Who Reported Access
Computer Lab	34%
Shared in-class computers	24%
1 computer for each student	12%
1 tablet for each student	8%
Students can bring their own devices to school	12%
No devices are available	10%

Source: Pearson Education, 2015

Computers have become ubiquitous in schools; whiteboards are now available to over half of U.S. public school teachers for use in their classrooms; and tablets, while not widespread, are increasingly present. The presence of educational technology in U.S. public schools is evident, with the important caveat that a substantial number of schools lack adequate broadband Internet connectivity, and access to devices located in the classroom for daily use may be limited to a single computer.

[2] Data describing the survey sample do not include participants' residential location.

Implications for FNS

- The heterogeneous landscape of digital learning in schools is an important context for consideration in the design and delivery of FNS digital nutrition education materials. Schools throughout the majority of the 50 States lack the infrastructure necessary to support digital learning in the classroom in the form of broadband Internet capacity and connected devices available for use by all teachers and students.

- Digital materials designed for direct use by students, individually or in groups, may be most commonly accessed either outside of the classroom, in a computer lab or media library, or in classrooms, when multiple devices are available for in-classroom use.

- The majority of teachers have access to one or more dedicated classroom computers, as well as a projector available for in-classroom use. Digital materials designed for teachers' instructional display would be commonly accessible in the classroom.

- Over half of teachers have access to interactive whiteboards available for use in their classrooms. Interactive digital materials designed for teachers' use to lead group interactive lessons would be commonly accessible in the classroom.

- Given the limited access to broadband Internet connectivity and connected devices for classroom use in many schools, the capacity for streaming media to one or multiple devices may not be available. Digital formats that allow for content to be downloaded and do not require online streaming would be more universally accessible for in-school use.

C. Technology Integration in U.S. Public School Libraries

Key Points – Summary

- Libraries are media hubs and media centers of public schools. Librarians are advocates for the school's use of digital content, and many are certified Media Specialists. In K–12 schools, the majority (83%) of Library Media Center professionals are Certified Media Specialists.
- Librarians acquire and disseminate digital content in all media formats, and purchase digital tools to access and use content, including search engines and databases. As advocates, school librarians introduce and champion digital learning material to teachers and students.
- Librarians are frequently the school technology expert and lend laptops, touchscreen tablets and e-readers as well as books to the school community. Importantly, librarians also instruct teachers and students on the use of devices and software.

In 2012, a library media center was present in 90% (81,200) of the 90,000 U.S. K–12 public schools. With the proliferation of computers and digital content, the library has evolved to be the technology hub and digital media center in schools. Library media centers provide computer workstations that are available for individual and group use, as well as training centers for student and teacher technology skills (Barack, 2015). K–12 public schools reported, on average, providing 18 computer workstations for use by staff, students and community members within the Library Media Center (U.S. Department of Education, 2012). Additionally, 54% of the K-12 library media centers reported providing laptops that were available for teachers, and 40% reported providing laptops that were available for students, to use outside of the library media center (U.S. Department of Education, 2012).[3]

Teacher and student access to technology in school library media centers is not equally distributed across schools and communities. The number of computers made available to teachers, and students in the library media center increases by school level (i.e., from primary, to middle and high school), as well as by student socioeconomic status (i.e., conversely, as the percentage of students who qualify for subsidized lunches declines, the access to technology increases). This was the case for both access to workstations within the media center and access to laptops available for use outside of the media center (U.S. Department of Education, 2012).

Library media centers in primary schools reported the least number of computer workstations (12), on average, compared to those in middle schools (23) and high schools (33; U.S. Department of Education, 2012). As seen in Table 3.5, the percentage of library media centers that provided laptops available for teachers, and students, to take outside of the library was also lowest among primary schools, compared to other school levels.

[3] Data indicating the number of laptops available to teachers, and to students, were not available.

Table 3.5

Percentage of Library Media Centers with Laptops Available for Teachers and Students to Use Outside of the Media Center in 2012, by School Level

School Level	Percentage of Library Media Centers with Laptops Available for Student Use Outside of the Media Center	Percentage of Library Media Centers with Laptops Available for Teacher Use Outside of the Media Center
Primary	38%	52%
Middle	46%	60%
High	42%	56%

Source: U.S. Department of Education, 2012

In 2012, children and teachers in schools serving higher income communities had greater access to computers in the library media center (U.S. Department of Education, 2012). As seen in Table 3.6, schools that served the highest income communities reported 1.6 times the number of workstations (22, on average) available in the library media center than did schools in which the majority of students (75% or more) qualified for subsidized lunches (which had on average 14 workstations in the media center). Library media centers in higher income schools were also more likely to report providing laptops for students to use outside of the library media center (see Table 3.7). Importantly, as shown in Table 3.7, teachers' access to laptops for their use outside the library media center was roughly equal across schools at all income levels, and slightly higher among schools in which over more than one-third of students qualified for subsidized lunches.

Table 3.6

Average Number of Computer Workstations Located in School Library Media Centers in 2012, by Percentage of Students in the School Who Qualified for Free or Reduced-Price Lunch

Percentage of Students Who Qualified for Free or Reduced-Price Lunches	Average Number of Computer Workstations in the Library Media Center
0–34	22
35–49	20
50–74	16
75 or more	14

Source: U.S. Department of Education, 2012

Table 3.7

Percentage of Library Media Centers with Laptops Available for Teachers and Students to Use Outside of the Media Center in 2012, by Percentage of Students Who Qualified for Free or Reduced-Price Lunch

Percentage of Students Who Qualified for Free or Reduced-Price Lunches	Percentage of Library Media Centers with Laptops Available for Student Use Outside of the Media Center	Percentage of Library Media Centers with Laptops Available for Teacher Use Outside of the Media Center
0–34	42.1	52.6
35–49	41.6	55.4
50–74	41.0	55.2
75 or more	36.2	55.4

Source: U.S. Department of Education, 2012

As more information becomes available in digital form, school librarians and media specialists are often the advocates and innovators in uses of educational technology, encouraging the use of instructional technology to engage students and to improve learning (Barack, 2015). The roles that librarians play are essential to the effective and successful use of technology, instructing both teachers and students in software and hardware use, and in the integration of technology for learning and teaching (Barack, 2015). Importantly, librarians facilitate access to information and knowledge through search engines and databases; they essentially provide guidance to an emerging, shared global resource library available at all times and accessed online.

Across K–12 schools, the majority (83%) of professional staff who work in school library media centers are Certified Media Specialists (U.S Department of Education, 2015). In 2015, over half of school librarians were also Certified Media Specialists, (U.S Department of Education, 2015). In 2015, 36% of school librarians reported that they acquire and curate apps as part of the overall library collection (Barack, 2015). Many are also instrumental in curating the "collection" of portable devices available for teacher and student use (American Association of School Librarians, 2009), and even maintaining them in the absence of a school Technology Specialist (Lagarde & Johnson, 2014).

In 2015, librarians (58%) reported a preference for touchscreen tablets for younger readers, specifically iPads, iPad minis and the NOOK e-reader (Barack, 2015). Libraries (40%) also provide Chromebooks and small laptops (Barack, 2015). However, in 2015, 87% of librarians reported overall student interest in e-books to be moderate or low, regardless of the device used for access (e.g., Nook, Kindle or tablet; Barack, 2015).

Additionally, using technology for school community communications is a primary focus for librarians and library activity. In addition to email, in 2015, 76% of librarians reported using social media for educational purposes, including to post library information and communicate with parents - an increase from 59% in 2013 (Barack, 2015). The specific social media platforms librarians use include: Pinterest, Google+, Goodreads, Twitter, and Edmodo (Barack, 2015).

Implications for FNS

- Librarians and school libraries are an important entry point for providing FNS digital materials about health and nutrition to public schools, as well as to communicate with teachers and parents. Librarians directly acquire and purchase digital resources, tools, and content for the entire school community. Importantly, librarians are also responsible for ensuring school-wide content awareness and use of acquired instructional material.

- As the technology hub in schools, the Library Media Center provides access to devices for individual and group use, including computer workstations, laptops, tablets and e-readers. While the type and number of available devices varies between schools, the library setting accommodates group technology access for teachers and their classes, and therefore offers an important environment to support the use of FNS digital materials.

- Communicating directly with librarians and understanding the resources and search strategies they employ would aid in successful adoption of FNS material for use by school communities. Professional associations and conferences targeted to librarians offer an optimal context for initial exploration and identification in this regard.

D. Technology Policy at the Federal, State and Local Level

Key Points – Summary

- Federal, state, and local policies regarding educational technology are continually evolving and adapting. The literature search identified four policy categories. The first is policy focused on *universal school broadband Internet connectivity*. The second is policy focused on *technology* and *device ownership* and use in schools, school libraries, and classrooms. The third policy is focused on *student data privacy and use*. The fourth is policy focused on *social media use.*

- *Broadband Internet connectivity.* There is alignment at the federal, state and local levels regarding universal school-based access to broadband Internet. Importantly, this national policy initiative is funded and currently being implemented. All U.S. public schools are scheduled to acquire broadband Internet access by 2018.

- *Technology ownership and use.* Overall, there are several shared policy orientations at the federal, state and local levels, including: a stated commitment to the increased integration of educational technology; the use of big data for administrative decision-making; and a migration to conducting standardized testing online. However, the purchase and use of educational technology, available funding, student in-school technology access and use, and policy regarding the role of technology for instruction, varies significantly at the local level.

- *Student data privacy and use.* Overall, there is shared policy alignment at the federal, state and local levels, including: a stated commitment to safeguard data privacy, provide transparency on data use, and ensure parental rights regarding third party collection and use of their children's data. However, policy is evolving at the state level to address new data privacy issues introduced by education technology integration. Importantly, states are introducing new legislation to address the activities of education technology providers, and to grant new responsibilities to districts to safeguard student data.

- *Social media use.* Policy addressing online media and social media use is developed at the district level, and school principals have the authority to restrict or grant access to specific websites for educational use.

Policy Focused on Technology Integration and Use

Federal level policy. The National Assessment of Educational Progress (NAEP) consistently reports that U.S. public school students' academic achievement is low compared to their peers worldwide (NAEP, 2015). Federal education policy is appropriately focused on raising academic performance and preparing students with skills and knowledge required in the 21st century global economy.

The U.S. Department of Education (ED) has identified educational technology as a critical component in the national initiative to transform U.S. public education and raise student academic achievement. Both ED and the K–12 educational community have identified student-centered and personalized learning as optimal educational learning approaches (McCarthy, 2015; Cavanagh, 2014). The ED National Educational Technology Plan (NETP) is focused on the use of technology, specifically, for effectively delivering student-centered and personalized learning (U.S. Department of Education, 2010).

The 2013 Presidential ConnectED Initiative prioritized universal broadband access for all public schools, and federal funds have been reallocated and coordinated with private sector investments to finance this effort. More than $10 billion has been committed to the ConnectED five-year program to ensure public school broadband access, including $7.5 billion dollars in Federal Communications Commission (FCC) funding and $2.5 billion from private sector investment. (U.S. Department of Education, 2014).

The FCC has modernized the E-rate program (a federal program providing communications subsidies to schools and libraries), and increased funding by 60% to improve broadband access and enable Wi-Fi/Local Area Networks in public schools. Importantly, the FCC has also raised the threshold criteria for public school broadband capacity, adopting short-term criteria of 100 Mbps (per 1000 users) by 2014, and long-term criteria of 1 Gbps (per 1000 users) by 2019.

Other federal legislation and policy has also impacted the integration and use of technology in public schools. The 2015 Every Student Succeeds Act (ESSA), the revision of No Child Left Behind (NCLB), identifies student academic performance, measured by standardized testing, as evidence of school effectiveness (Association for Supervision and Curriculum Development, 2015). Current ED policy promotes student school-based standardized testing to be conducted online ("Race to the Top Assessment Program," 2014).

State level policy. Building on the existing Federal legislation, states are currently enacting new laws to regulate student data privacy. From 2013 to September 2016, 49 states have introduced bills pertaining to student data privacy, and 36 states have passed a combined total of 73 bills into law (Data Quality Campaign, 2016). Four prominent themes of this legislation concern the activity of online school service providers; contracting requirements for online service providers and other third parties; increasing transparency on data privacy and use; and assigning new data safeguarding responsibilities to districts (Data Quality Campaign, 2016; Foundation for Excellence in Education, 2015).

California's 2014 Student Online Personal Information Protection Act (SOPIPA) is the first legislation to define the permissible activities of online school service providers. The law applies to online services, websites, and mobile apps that are designed and marketed primarily for use in K–12 schools, whether or not the provider has a contract in place with schools. SOPIPA took effect in California and New Hampshire in January 2016, and other states are modeling new legislation after SOPIPA provisions (Data Quality Campaign, 2016).

District and local level policy. The implementation of education technology policy occurs primarily at the district and local level. At this level, the integration and use of technology varies widely by district, school system, schools and individual classrooms. There is no comprehensive overview available of technology use at the district, school and classroom level. Multiple profiles of districts and schools exist, and these profiles provide a wide range of in-depth case studies representing both successful and failed uses of educational technology.

Policy Focused on Student Data Privacy and Use

Federal level policy. Student data privacy and responsible use have emerged as major issues relating to technology integration in schools. Three pieces of Federal legislation govern student data privacy and access. While the specific goals and focus of each piece of legislation are distinct, all three relate to education technology service providers, including non-profit and government organizations.

The Children's Online Privacy Protection Act (COPPA), enacted by Congress in 1998, and regulated by the Federal Trade Commission, allows parents to control what information can be collected from their children online. The law applies to any website operators or online service providers (including providers of educational programs, games and apps) that collect, store or disclose personal data from children under age 13. COPPA applies to data collected directly from children, at school or at home; however, it does not apply to data that pertains to children and is collected from adults.

The Protection of Pupil Rights Amendment (PPRA), enacted in 1978, allows parents the right to have informed consent, review the content of data collection materials, and/or opt their children out of participation in any student survey, analysis or evaluation, depending on (1) the level of sensitivity of the data being collected, and (2) whether or not the survey is federally funded. Importantly, and relevant to all education technology service providers, the PPRA also grants parents the right to be notified of, and to opt their children out of, activities that involve collection or use of personal information obtained from students in order to distribute the information to others.

The Family Educational Rights and Privacy Act (FERPA), a federal law passed in 1974, bars any disclosure of personally identifiable data in student records to third parties without parental consent. Recent revisions of FERPA have weakened the requirements for parental consent, through the addition of exceptions that enable the data to be shared with school officials and contractors (including outside vendors) for instructional, administrative and assessment purposes, as well as with organizations designated to use the data for audit or evaluation purposes. Importantly, even in the case of such exceptions, FERPA assures parents the right to be informed of the school's or district's criteria for determining who constitutes a legitimate third party to whom the data can be disclosed without parental consent.

Policy Governing Use of Online Social Media

Social media includes the range of diverse online communications channels that enables community-based content sharing, interactive communication and/or collaboration, including, but not limited to; websites; social networks; blogs; forums; videocasts; and podcasts (e.g., Wikipedia, YouTube, Facebook, Twitter, and Flickr).

Social media use is governed by policy at the state, district, and/or individual school level (Willard, 2016). Districts develop social media policy and guidelines, including which websites can be accessed, while principals have the authority to have social media websites blocked or unblocked in their buildings by submitting a formal request to the School Board (Assistant Superintendent, Curriculum and Instruction, 2015; New York City Department of Education, 2016; Pottsville Area School District, 2011).

Implications for FNS

- The achievement of universal broadband connectivity in all U.S. public schools is targeted for 2018. Universal school broadband connectivity will provide FNS with a secure, stable and available delivery system for online educational content in all media forms (e.g., text, interactive, video, etc.) as well as for online communications.

- Currently, however, school broadband connectivity is not universal and it will be several years before FNS can assure equity in the distribution of educational materials online. Additionally, the use of broadband connectivity and online educational material, at the school and classroom levels, depends on the school-based technologies available and student and educator access to the appropriate technologies.

- Overall, school technology infrastructure is increasing. However, significant variations exist at the local level. FNS digital educational material will be accessed on a range of devices. The availability of technology for teacher and student use will vary at the school and classroom level.

- States are currently introducing new legislation to address student data privacy, especially pertaining to education technology vendors and service providers. As FNS develops digital materials, the Student Online Personal Information (SOPIPA) provides an important point of reference to understand the evolving policy landscape, and offers a model to inform an FNS strategy to meet student data privacy requirements and best practices.

- Policy on social media use is established at the district level, and principals have authority to determine website access and restrictions at school level. Direct communication with school boards and principals, to understand social media policies, will be important in ensuring in-school access to FNS online digital materials and resources, as well as to inform effective online marketing and distribution strategies.

E. Teacher, Parent and Student Attitudes towards Educational Technology Issues of Technology Integration, Including Training and Support

Key Points – Summary

Teachers:

- Teachers' perceptions and attitudes are important to the successful integration of technology into instructional practices.
- Professional development is important for teachers to recognize the benefits of integrating technology and increase their confidence, comfort and knowledge.

Parents:

- Overall, parents classify technology as an important educational issue and parental attitudes towards digital technology are generally positive.
- The majority of parents feel that mobile and portable devices and media content serve as opportunities for students to learn, collaborate and communicate in the classroom.

Students:

- Students value the use of technology in the classroom, particularly when these devices are tablets, laptops and other portable devices, such as Chromebooks (i.e., mobile devices).
- Students across grade levels would like to see an increase in the integration of mobile devices in the classroom.

Attitudes of Teachers towards Technology

Research indicates that teachers have positive perceptions of and attitudes toward educational technology which is correlated to frequency of use (Hur, Shannon, & Wolf, 2016; Ottenbreit-Leftwich, Glazewski, Newby, & Ertmer, 2010); Project Tomorrow, 2015). A 2015 national survey of K–12 teachers reported that integrating technology in the classroom is important to student achievement (Samsung Electronics America, 2015). Teachers also considered the integration of technology to be a contributing factor in increasing student engagement and motivation and raising test scores (An & Reigeluth, 2012; Gibson & Sodeman, 2014; Ottenbreit-Leftwich et al., 2010; Project Tomorrow, 2014; Shapley, Sheehan, Maloney, & Caranikas-Walker, 2011). Research

conducted with teachers in 2011-2012 (Hur et al, 2016) indicated that both teacher confidence levels regarding technology and teacher participation in technology-oriented professional development were positively correlated to teachers' increased use of educational technology with students.

Confidence with technology. Research indicates that teachers favor the implementation of technology in classrooms (Polly, Mims, Shepherd, & Inan, 2010; Wang, 2002; Zhao & Bryant, 2006). However, teachers lack the necessary skills and confidence to effectively integrate technology in order to positively impact student learning (An & Reigeluth, 2012; Bennison & Goos, 2010; Ottenbreit-Leftwich et al., 2010). This situation likely reflects the time required by teachers to engage with and integrate technology into classroom instruction to achieve favorable learning outcomes (An & Reigeluth, 2012; Hur et al., 2016; Slay, Siebröger, & Hodgkinson-Williams, 2008). Teacher participation in technology oriented professional development is positively correlated to teachers' increased confidence levels regarding their ability to integrate and use technology as well as to increased positive perceptions and attitudes regarding the benefits of technology for their students' learning (An & Reigeluth, 2012; Bennison & Goos, 2010).

Professional development for teachers. Effective integration of instructional technology into classrooms requires coordinated efforts to ensure that school leaders and administrators sufficiently support teachers through professional development. This support should address teachers' concerns regarding their ability to use technology in the classroom and their impressions of its utility to improve student achievement. Teachers' knowledge (i.e., best practices when using technology to deliver student-centered instruction), self-efficacy (regarding their ability to use technology), pedagogical beliefs (i.e., the evidence-based conviction that technology can support/impact student achievement), and school culture (i.e., the impact of environment on how technology is viewed and integrated) need to be considered when designing and implementing professional development programs (Ertmer & Ottenbreit-Leftwich, 2010; Hur et al., 2016).

Various studies and surveys (An & Reigeluth, 2012; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Ertmer & Ottenbreit-Leftwich, 2010; Samsung Electronics America, 2015) have been conducted among K–12 teachers to determine which types of help and support teachers would like to have to effectively and efficiently integrate technology into their classrooms. In 2015, 76% of teachers reported the desire for professional development devoted to technology (Samsung Electronics America, 2015). One in three teachers were disappointed with the technology- related professional development they received from their schools (Samsung Electronics America, 2015). Research also indicates that professional development increases teachers' confidence with technology and strengthens the value of technology for enhancing student learning (Bennison & Goos, 2010; Hur et al., 2016; Inan & Lowther, 2010; Ottenbreit-Leftwich et al., 2010). Further, in 2015, 33% of K–12 educators indicated that the lack of professional development opportunities remained a barrier to integrating technology in classrooms (Rebora, 2016).

Attitudes of Parents towards Technology

Parents generally share positive attitudes toward the potential of digital technology (especially regarding the impact of educational technology) to improve students' completion of schoolwork, their ability to learn at their own pace, and their capacity to communicate with teachers (APM Marketplace, 2015; Grunwald Associates, 2013; Project Tomorrow, 2014). Parents reported that digital technology provided an equitable learning opportunity for all children, including children from different socioeconomic backgrounds (APM Marketplace, 2015). A majority of parents felt mobile devices (i.e., smartphones and tablets), portable devices (e.g., laptops and Chromebooks), and media content (e.g., applications or apps) served as additional opportunities for engaging students in learning, including collaborating, connecting, and communicating in the classroom (Grunwald Associates, 2013).

According to Project Tomorrow's Speak Up survey (Project Tomorrow, Speak Up, 2014), administered in 2013, 56% of parents of high school students classified instructional technology as "extremely important" for student achievement. Similarly, in 2015, 46% of parents of students in grades 3–12 identified technology as one of the "top three most important educational issues," along with teacher quality and class size (APM Marketplace, 2015, p.5). Parents indicated that educational technology provides students with the opportunity for deep learning and meaningful interactions with others (Grunwald Associates, 2013; Project Tomorrow, Speak Up, 2014). More specifically, parents identified mobile and portable devices as having the ability to personalize instruction for students through the use of including digital tools and resources (Speak Up, 2014).

However, some parents also hold conflicting attitudes regarding technology. Parents, primarily of younger children, share negative attitudes toward the influence of video games on children's educational development, including students' reading, math and communication skills (Wartella, Rideout, Lauricella, & Connell, 2013). In addition, parents expressed concerns that mobile devices were primarily used for entertainment, instead of educational purposes (Grunwald Associates, 2013; Wartella et al., 2013). A majority of parents (62%) believed that mobile devices could be distracting; one in four parents felt that mobile devices were not effective educational tools and did not belong in school (Grunwald Associates, 2013). Parents also had concerns about the confidentiality of information, advertisers' access to their children, and children's potential exposure to inappropriate content while using technology (APM Marketplace, 2015; Wartella et al., 2013).

Student Attitudes towards Technology

Current K–12 students have been greatly shaped by advances in technology at home and school, including the ability to multitask and engage with several devices and applications simultaneously (Gibson & Sodeman, 2014). Technology allows students to learn using different platforms and provides students with opportunities to self-regulate their learning. Students tend to value technology's relevance in the classroom when integration is effective and enhances learning (Project Tomorrow, 2015; Riemer & Schrader, 2015).

Students value the use of mobile devices in the classroom, particularly tablets, laptops, or Chromebooks, and share the belief that the access to mobile devices enhances and strengthens learning (Project Tomorrow, 2015). Pearson Education (2015) released survey results indicating that 90% of students in grades 4–12 believed that tablets change how they learned. Further, 89% of these students claimed that tablets made learning fun, and 82% of students reported tablets allowed them to learn in a way that worked best for them (Pearson Education, 2015). The 2015 Project Tomorrow survey indicated that the majority of students in grades 6–8 (75%) think smartphones should be used in school. These students prefer smartphones for communicating with teachers (46%), communicating with classmates (72%), and for providing access to social media (64%; Project Tomorrow, 2015). Students across grade levels desire an increase in the integration of mobile devices in the classroom (Pearson Education, 2015; Project Tomorrow, 2015).

Implications for FNS

- Overall, teachers, parents, and students have positive perceptions of, and attitudes towards, educational technology.

- The ease-of-use of educational technology is a critical component of teachers' positive perceptions and attitudes. Digital materials need to be easy to access and download for use on various devices as well as provide for easy classroom and student use. Teachers with limited knowledge and/or low confidence with technology are particularly in need of digital materials that are "user-friendly" (e.g., easy to understand, navigate, update, and troubleshoot).

- Teachers' positive attitudes towards educational technology are directly correlated with the level of teachers' technology knowledge, skills and confidence. Ongoing and effective professional development is critical for developing teacher confidence and increasing educational technology use. Resources and opportunities for professional development are critical components for FNS consideration.

- Parent and student perceptions and attitudes underscore the importance of mobile devices. Mobile-friendly educational materials are important to parents and students. Parents perceive mobile devices, including smartphones and tablets, to be positive educational tools for their children. By extension, the development of educational materials for use on mobile devices is essential for FNS consideration.

- Overall, teacher, parent and student attitudes provide positive opportunities and do not present barriers for the acceptance of or use of educational technology materials.

F. Current Practices, Uses and Trends in Educational Technology

Key Points – Summary

- Educators are implementing new practices and instructional strategies to integrate educational technology into the classroom.
- Teachers use educational applications, websites, e-books, online textbooks, and interactive information providers to deliver content and assess students.
- Students use school-issued devices for school-related work inside the classroom, as well as communication and collaboration that occurs outside the classroom.
- Many students in middle and high school access homework assignments online using school websites, textbook publisher online portals, or other web based platforms.
- Digital communication platforms and tools such as text-messaging, social media, and a variety of apps have made communication between teachers and families accessible, efficient, and meaningful.

The current practices and trends in educational technology are considered from different and important perspectives:

- Uses of educational technology for teaching in K–12 classrooms
- Uses of technology for communication with parents, students, and school staff (e.g., text-messaging platforms, learning management systems, and online homework)

Uses of Technology for Teaching in K–12 Classrooms

Usage of digital devices in schools varies, depending on the devices available and the approaches to using educational technology in the classroom (Project Tomorrow, 2014). According to Project Tomorrow's Speak Up survey (Project Tomorrow, 2015), administered in 2014, 47% of K–12 teachers reported that students in their classrooms have regular access to mobile devices (i.e., laptops, tablets, and Chromebooks). These students either utilize their own device in school or have a school-assigned device for use at home and school that provides digital access to educational tools, resources, and information while at school, home, and anywhere in between (Project Tomorrow, 2015). According to the Speak Up survey, mobile devices were used in classrooms for school-related work, including:

- accessing information through a school portal;
- taking assessments online;
- using online textbooks;
- creating presentations;
- watching videos from outside sources (e.g., homework help, additional instruction);
- accessing Internet-based services (e.g., *Google Apps* for Education);
- watching teacher-created videos designed to enhance instruction.

Teachers use different technology in various learning contexts. Among teachers with tablets for classroom use, 71% indicate that applications or apps are the most beneficial for their teaching, followed by websites (64%) and e-books and online textbooks (60%; Project Tomorrow, 2015). Teachers are also using interactive information providers (e.g., *BetterExplained*) and web-based materials (e.g., *instaGrok, Duolingo*) to deliver instruction and assessments to students. For example, *Kahoot!* is an online tool for creating in-class quizzes, questionnaires, or surveys across a variety of devices to determine the knowledge level or interests of students through a game-like learning experience (Noodle Staff, 2015). Additionally, teachers are using online texts or e-books in the classroom. Using e-books through the library can be a cost effective way to support classroom instruction and enables teachers and students to access materials on a short-term basis.

Students in middle and high school often access homework assignments online using school websites, textbook publisher online portals, or other web-based platforms. For example, Pearson Education provides the *MyLab* platform and McGraw-Hill offers the *Assessment and Review Instruction System* (ARIS). These types of platforms offer tutorial and automatically graded homework exercises and instructional videos of lectures and completed examples (Pearson Education, 2014). Online homework portals offer parents a chance to check on children's work, gauge how well they are performing and determine whether they have submitted assignments. In some cases, parents are encouraged to check homework grades, and provide positive reinforcement for their child or intervene if there is an issue (U.S. Department of Education, Office of Educational Technology, 2016).

Uses of Technology for Communication in K–12 Schools

Communication between teachers, administrators, parents and students has changed dramatically over the last decade. Teachers use multiple resources, typically a combination of email, text, and phone calls, to communicate and collaborate with families. Teachers use mobile apps to conveniently provide parents with class information, including updates on how their children are performing in the classroom (Gilgore, Peele, & Riser-Kositsky, 2015; McCrea, 2013). Two- thirds of students use mobile devices to communicate (e.g. text, email, etc.) with classmates and teachers about schoolwork (Project Tomorrow, 2014). Likewise, students use devices to search for online videos to assist with homework, take photos of assignments or class notes, collaborate and discuss schoolwork with peers through shared documents or video conference platforms (e.g., Skype or FaceTime), or use an online school portal (Project Tomorrow, 2014; Project Tomorrow, 2015).

Digital communication platforms and tools such as text-messaging, social media and a variety of apps have made communication between teachers and families accessible, efficient and meaningful. Text-messaging platforms, such as *Remind, Ringya* and *SchoolInfoApp*, are designed for use by schools, teachers, parents and students for communication. *Remind allows* teachers to send assignments, reminders, or motivational messages directly to parents' and students' phones while keeping phone numbers private. Similarly, *Ringya* supports individual and group communication through voice calls, text messaging, email and live chat between teachers, parents and students (Gilgore et al., 2015; McCrea, 2013).

Some school districts are not only encouraging teacher-to-parent communication through technology, they are implementing messaging platforms, such as *SchoolMessenger* and *Call-em-all*, to facilitate these exchanges (Williams, 2014). Specifically, the San Francisco School District implemented the platform designed by *SchoolMessenger* to provide timely notifications to parents regarding student attendance, school activities and reminders, and emergency alerts using a combination of text messages, emails and voice calls (Gilgore et al., 2015).

Technology offers families an opportunity to strengthen early childhood education (i.e., preschool and kindergarten) using various text-messaging platforms, such as READY4K! and *ReadyRosie* (Daugherty, Dossani, Johnson, & Wright, 2014). *READY4K!* provides subscription-based educational content, including ways to incorporate early literacy skills at home, delivered as a text message to parents (York & Loeb, 2014). Parent engagement in literacy education and literacy activities at home (i.e., telling stories, playing games) increased, according to the pilot study of *READY4K!* (York & Loeb, 2014). School districts in 20 states currently subscribe to *READY4K!*. Similarly, *ReadyRosie* provides families with a daily text message that includes a short video (offered in English and Spanish) of educational activities that support early math and literacy skills outside the classroom (Daugherty et al., 2014).

Digital Content Forms

Educational technology is increasingly utilizing a variety of engaging digital content forms. These digital forms include:

Streaming video. Content sent in compressed form over the Internet and displayed by the viewer in real time.

Interactive media. Typically refers to products and services on digital computer-based systems which respond to the user's actions by presenting content such as text, moving image, animation, video, audio, and video games.

Non-interactive Digital Content. A fixed, self-contained and pre-conceived passive experience where the user is not able to interact, participate, change or influence the content or experience directly.

Interactive infographic. A visual representation of information that integrates different modes – e.g., image, video, written text, sound, layout – into a coherent whole and offers at least one navigation option to control the graphic. An interactive infographic allows the user to tap or swipe the infographic to produce different outcomes. Infographics features can be very simple, like rollovers or pop-ups or they can be more sophisticated. The communicative function of an interactive infographic is to inform.

Implications for FNS

- There is a wide range of current educational technology practice and use in U.S. public schools. This range provides FNS opportunities for multiple entry points and expanded use of educational materials. It also presents the challenge of creating educational materials that allow for flexible and adaptable use across a range of teaching strategies.

- Current educational technology practice and use requires online materials that are accessible on the range of connected devices. FNS materials need to be accessible and useable on smartphones, touchscreen tablets and computers.

- Online educational content needs to be in forms that are technically up-to-date, interactive, and easily integrated into existing curriculum and educational technology practices.

- Content that is easily converted into formats currently used by students, such as Microsoft Word and Google Docs, will be easier for teachers to integrate into current practices.

- Content easily converted into a range of classroom presentation formats currently used by teachers, such as PowerPoint, Google Slides or Prezi, provides more opportunities for classroom use.

- Current practice and use indicates that video is an optimal format for content delivery. The availability of FNS content as videos, perhaps presented in a *YouTube* interface or an *NBC Learn* database will allow for increased use.

- Schools and teachers are communicating with parents and students via text-messaging and other digital notification platforms providing a bridge between school and home. FNS can extend learning about health and nutrition via digital communications. Platforms that currently provide a bridge to families of grade school children, such as *READY4!* and *ReadyRosie,* provide models and opportunities for FNS.

G. Approaches to Technology Integration in Schools

Key Points – Summary

There are many established and emerging approaches to the integration of educational technology being used by U.S. public schools. Current approaches to the integration of technology in schools and classrooms presented below include the following categories:

- **Learning Models.** Personalized learning, adaptive learning, blended learning, flipped classroom and distance learning are types of learning models that have unique characteristics and provide opportunities to improve learning and instruction.
- **Instructional Strategies.** Project-based collaborative learning and game-based learning are types of instructional strategies that teachers integrate into learning and assessment.
- **Organizational and Analytic Tools.** Big data, analytics and learning management systems are organizational and diagnostic tools that help educators improve student learning experiences and educational decision-making.
- **Community Resources.** Open educational resources and social media platforms represent a community of educators for the purpose of sharing resources, ideas, experiences and advice.

Approaches to the Integration of Educational Technology

There are four established and emerging approaches to the use and integration of digital technology and media for education. These approaches are listed below with in-depth descriptions following.

Learning Models. Personalized learning, adaptive learning, blended learning, flipped classroom, and distance learning are types of learning models that have unique characteristics and provide opportunities to improve learning.

Personalized Learning. Personalized learning is the current predominant pedagogy and is oriented to student-centered, individualized learning (Cavanagh, 2014). Similar to differentiated instruction, personalized learning designs and implements different forms of instruction in response to students' various needs. Personalized learning continuously adapts and improves as a student progresses through the learning experience (Abbot, 2013; Brooke, 2015).

While the use of technology is not required to implement a personalized learning program, several digital programs exist including *DreamBox, BrainX* and *Lexia Learning. Lexia Learning* provides online early literacy instruction. *Lexia Learning* also allows teachers to individualize literacy learning instruction for students at different levels. Additionally, the *Lexia Learning* program monitors student progress and helps teachers create individualized student instruction (Brooke, 2015).

Adaptive Digital Learning. Adaptive learning aids personalized learning by adapting instructional material to individual student's learning needs. Adaptive digital learning also provides ongoing digital performance feedback (formative assessment) to students, teachers and parents (U.S. Department of Education, 2010b). Adaptive learning requires the use of technology (i.e., software programs and online platforms) to collect and analyze data prior to presenting content or assessments to students (Project Tomorrow, 2015). Student progress is monitored and students receive suggestions about what skills to practice and topics to study. Additionally, teachers receive feedback on student performance. Administrators can utilize data to adapt programs to improve instruction, learning, and graduation rates (Bienkowki, Feng, & Means, 2012).

There are several interactive and digital adaptive learning programs used in schools, including *Knewton Math Readiness System, iReady, Realizeit, Fishtree, Math180* and *Read180.* Created by Scholastic, Read180 is a program leveled to individual reading abilities of students and tracks progression throughout the program. Students read sections of text and answer questions about the material in short exercises focused on comprehension. The program adapts, providing similar or more challenging content based on the student's responses (Scholastic Research and Validation, 2008). Similarly, Knewton Math Readiness System uses data to adapt instruction to students' strengths and weaknesses while preparing students for future content (Bienkowski et al., 2012).

Blended Learning integrates both online digital learning and non-digital, traditional classroom activities. Blended learning combines traditional classroom instructional methods with the use of online and digital resources and personalized learning programs. Blended learning is a hybrid approach that empowers teachers with the opportunity to provide personalized instruction with an emphasis on individual students' learning styles and interests (Staker & Horn, 2012). Blended learning is designed to enrich the students' learning experience and increase efficiency by enabling teachers to focus on instructional methods that work best in a face-to-face classroom setting, while students engage in self-directed learning and communication using online learning programs, digital textbooks and mobile apps (Brooke, 2015; ItsLearning, Inc., n.d.).

There are four models of blended learning that have emerged in K–12 U.S. public schools: rotation (e.g., flipped classroom), flex, self-blend, and enriched-virtual (e.g., distance learning; Staker & Horn, 2012). Educational technology programs such as Blackboard and Moodle have been used with a blended learning model with positive evaluation outcomes that used Quality Matters quality assurance program (Brooke, 2015).

Flipped Classroom reverses the classic classroom and homework model. Instruction, including lectures, is provided online and assigned for after-school or home use. Classroom time is devoted to working through assignments, writing essays, conducting research and tutoring. A flipped classroom is a rotational model that moves traditional group instruction from the classroom to an individual learning experience outside the school (Staker & Horn, 2012). Students watch video lessons and use educational online resources as part of home learning. Students spend class time face-to-face with teachers. Class time is involves students applying, practicing and using content (Project Tomorrow, 2015).

According to "Best Apps and Websites for the Flipped Classroom" (Common Sense Media, n.d.), instructional websites and apps, such as *Khan Academy, Newsela, Ted-Ed* and *NOVA,* are available to help students with instructional content at home. Similarly, flipped classroom resources, such as *Nearpod, ClassFlow, Office Mix* and *EDpuzzle,* can help teachers create, curate, and deliver content that students access at their own pace. *Newsela* provides students, teachers and parents with access to current event articles with different reading comprehension levels and aligned assessments for each article. For example, teachers can assign students articles and monitor their progress using the *Newsela* Binder feature. The *Nearpod* platform empowers a teacher to share and control content in real-time during instruction with students. Additionally, students participate in activities and assessments that teachers monitor during class and also have the opportunity to access a detailed data report after class.

Distance Learning and virtual classrooms provide curriculum, lessons, resources, complete courses and other educational experiences online. Distance learning is an enriched-virtual model of blended learning where students primarily access curriculum and classes via virtual classrooms or online courses with infrequent face-to-face contact. Synchronous distance learning includes educational courses in virtual classrooms in real time through video-streaming software or platforms that enable students to communicate, pose questions, and collaborate with instantaneous feedback (Watts, 2016). Virtual classrooms provide students with the opportunity to collaborate and share resources with one another at a distance. Further, students from different countries can interact and learn with each other in global virtual classrooms.

In asynchronous distance learning programs, teachers manage online courses and present curriculum, lectures, and lessons that students access at different times (Watts, 2016). Asynchronous distance learning differs from synchronous distance learning in that the student does not interact directly in real time with the teacher or other students, although the possibility of communicating with teachers and students via email or online discussion boards is available in the design of some courses and platforms. Additional characteristics of asynchronous distance learning courses include social media, collaborative documents, and e-portfolios. These types of interactions provide students with flexibility and time to deeply engage in course content (Watts, 2016). One type of asynchronous distance learning known as "massive open online courses," or MOOCs has unlimited participation, and open access via Internet. Many established universities (e.g., Harvard, MIT, Boston University, NYU, Duke) often offer these courses. Several MOOCs are free, using online course sites (e.g., *edX, Coursera, Udemy*), and offering course completion certificates (Hendricks, 2014).

Instructional Strategies. Project-based collaborative learning and game-based learning are types of instructional strategies that provide learning and assessment.

Project-Based Collaborative Learning. Collaborative learning involves groups of students/learners working together on hands-on and constructivist learning projects. The process encourages students to develop products using creativity, real-world problem-solving, and collaboration. The goal is to solve a problem as a group. Integrating technology into these collaborative learning experiences enhances student engagement and communication. Students use online resources and Web 2.0 tools, working in groups to develop projects and respond to real-world problems with unique solutions (Fletcher, 2012).

Many digital platforms or project management systems are available and accessible to organize the planning and collaboration of a project, such as *Redbooth, Slack, Teamwork, Basecamp* and *Glasscubes*. Redbooth is a free system for communication and collaboration that provides a centralized location for file storage and includes messaging and video chat options ("5 Software for Students for Better Project Management," 2015).

Game-Based Learning. Game based learning integrates curriculum into a game activity. Integrating learning into games increases student engagement and motivation (Blumberg & Fisch, 2013; Riemer & Schrader, 2015). Learning games vary in content and the extent to which learning is embedded in the game. Simulations provide visual models or gamifications of real-world processes, from medical procedures or science experiments to learning economics by constructing a business simulation online (Fleischmann & Ariel, 2016).

Organizational and Analytic Tools. Big data, analytics, and learning management systems are used to organize data sets and provide diagnostic tools and information that help educators and administrators improve learning experiences across districts and states.

Big Data and Analytics to Track Student Progress. Big data and analytics are the collection and analysis of large data sets to meet the objectives stated above. The digital records that are part of online learning programs and assessment records kept in digital files by school database systems provide a "big data" record for tracking student progress and assessing the impact of educational programs and interventions. The phrase "big data" refers to extremely large sets of data (Manyika et al., 2011) and represents an intentional recording of activity that is analyzed for feedback from teachers and students, educational programs, resources and research (Cope & Kalantzis, 2016). Big data can support teachers by helping them to determine what students know and what techniques are most effective for each student (West, 2012). For example, in blended-learning classrooms, educators can use analytics from personalized learning programs (i.e., *Blendspace, DreamBox*) to obtain feedback about which concepts students are struggling to understand and further customize their learning (Dumon, 2014). Big data also enables researchers to assess the efficacy of learning methods through provision of performance trajectories among students (Drigas & Leliopoulos, 2014).

Learning Management Systems (LMS). Learning management systems provide online portals for communication between administrators, teachers, students, and parents, as well as online resources and tools such as calendars and homework logs. LMS are software programs that manage, document and track information and educational records, and also provide teacher education and training for school districts and/or classrooms. LMS platforms are accessed by administrators, teachers, students and parents. These platforms enable users to share information, engage in different learning programs, virtually collaborate, and augment or track courses and lessons. LMS programs were initially used primarily in higher education, but many systems have been adapted to K–12 schools and classrooms. Each learning management system has unique features; however, many platforms provide basic tracking of assignments and assessment grades. Some platforms also incorporate communication systems where teachers can post calendars, homework assignments and course-related dates, as well as mechanisms for exchanging information with students and parents through the platform. Many systems offer digital instructional resources and assessments (Gross, 2014). LMS examples include: *Moodle, Edmodo, Blackboard, Skillsoft, Schoology, Google Classroom, Cornerstone, Collaborize Classroom, Haiku Learning, Pearson SuccessNet, Desire2Learn, Agilix Brainhoney* and *Sakai.*

Some LMS programs are open-source (free to use, share, and modify) technologies, and other systems are an investment for schools. LMS systems often charge per learner enrolled or per active learner (actively engaged as opposed to registered), while others charge for a limited time or use/require perpetual licensing (Gross, 2014). Before purchasing an LMS, school districts should request details regarding the type of data that will be generated by the LMS including analyses that can provide teachers and administrators with useful information they can utilize to enhance learning and teaching (Bienkowski, Feng, & Means, 2012).

Community Resources. Open educational resources and social media platforms offer the opportunity for membership in learning communities – allowing for the sharing of resources, ideas, experiences, and advice.

Open Educational Resources (OER). Open Educational Resources provide extensive access and allow for user input to educational and instructional materials online. OERs are online portals and websites used extensively by teachers to obtain ideas, lessons, projects related to teaching, learning and assessment. Most OERs are free, openly licensed resources; some charge fees for access to materials. OERs are available for use in schools or in informal learning situations, such as home schooling or community programs (Van Acker, Vermeulen, Kreijns, Lutgerink, & van Buuren, 2014). Examples of OER websites include: *OpenEd, Teachers Pay Teachers, PowerMyLearning, SAS Curriculum Pathways, CK–12, Curriki, Gooru, Learning.com, Knewton Free Learning Programs, OER Commons, Learn Zillion* and *Lumen Learning.*

E-learning resources represent another category of OERs, such as *Khan Academy* and *Peer-to-Peer University*. Also, *Zing* is a free e-book site, which includes both English and Spanish e-books, fiction and nonfiction, along with lesson plans for teachers (Byrne, 2015). The U.S. Department of Education's #GoOpen Campaign has encouraged the use of OERs in K–12 education and recognized states, districts and schools for developing quality, curated, openly licensed educational resources.

Social Media as an Educational Tool. Social media allows for community membership, involvement and communication. Social media is a dynamic tool for educators and students to communicate, share resource and collaborate. Participation in social media is open, free, and relatively seamless and allows for continued asynchronous interaction and activity after the school day is over. Despite the controversial nature of social media's use in popular culture, it can be a powerful and multimodal educational tool. Social media can be used for communication between teachers, students, and parents; teacher professional development; sharing of lessons and ideas among teachers; and collaboration among students for school projects (Thibaut, 2015).

Social Learning Networks (SLNs) are customized networks of social media used by educators and students for shared learning, communication and collaboration. There are a number of SLNs specifically designed for K–12 school use. For example, Edmodo provides a free and customizable SLN to provide students with tools to collaborate and share content. Nimbus is a product from Schoolwires that provides an instructional community for teachers, parents and students to collaborate and build problem-solving skills.

There are several types of social media platforms that are frequently used by educators and students:

Facebook is a popular social media website in the U.S. for sharing personal posts, photos, videos and website links (Thibaut, 2015). The following Facebook groups are related to communication between educators, sharing of teaching resources and uses of educational technology in the classroom:

- Educational Technology and Mobile Learning (https://www.facebook.com/Educational-Technology-202077286473233/);
- Teachers Sharing Resources and Ideas for the Classroom (https://www.facebook.com/groups/17723199360/);
- Free Technology for Teachers (https://www.facebook.com/FreeTech4Teachers/);
- Emerging Ed Technology (https://www.facebook.com/EmergingEdTech);
- ISTE (International Society for Technology in Education) (https://www.facebook.com/ISTEconnects/);
- Educator Network (https://www.facebook.com/groups/12230540441/); and
- Facebook in Education (https://www.facebook.com/education?fref=pb).

Public Facebook groups provide a way for administrators and teachers to communicate with other educators across the country and as a source of new ideas and best practices for educational technology integration. Facebook groups are also searchable, which enables members of the group to search for specific information within the group. Facebook can potentially be used by K–12 students to form virtual study groups for homework or collaboration on a project (Thibaut, 2015).

Twitter is also being widely used by educators and students. Twitter is a microblogging and social networking platform designed for continued conversation and interaction. Research regarding Twitter as an effective classroom tool is limited. However, educators indicate that Twitter is a dynamic tool for the delivery and communication of information, collaboration and locating new resources (Junco, Elavsky, & Heiberger, 2012). Many educators are using Twitter for: polling students to ask their opinion on a topic and discuss the results in class; sending reminders for homework or tests; posting a question to the class that is answered on Twitter to encourage participation for all students; assigning an article review that students post as a tweet (140 character limit); communication with students in other parts of the world; and connecting with professionals and organizations (DeLoatch, 2015).

Twitter accounts related to educational technology include:

- *@web20classroom* (https://twitter.com/web20classroom);
- *@EdSurge* (https://twitter.com/EdSurge);
- *@Edudemic* (https://twitter.com/Edudemic);
- *@rmbyrne* (https://twitter.com/rmbyrne);
- *@EdTechTeacher21* (https://twitter.com/EdTechTeacher21);
- *@ShellTerrell* (https://twitter.com/ShellTerrell); and
- *@edutopia* (https://twitter.com/edutopia).

Pinterest involves virtual pinning of online resources (e.g., charts, assignments, links to websites, text, pictures) on a "pin board" organized by themes or topics. Educators are using Pinterest for: sharing quotes and inspiration; sharing art, suggested reading material or providing links to sites related to a given topic of study; student work; and encouraging student participation or critique. Educators can use Pinterest to search a range of topics, such as "classroom management techniques for kindergarten" or "trigonometry lesson plans" ("The Teachers' Guide to Pinterest," 2012).

Pinterest boards related to educational technology include:

- Education & Ed Tech (https://www.pinterest.com/brbpins/education-ed-tech/);
- Stanford Graduate School of Education EdTech (https://www.pinterest.com/StanfordEdtech/);
- Alan Natachu (https://www.pinterest.com/alanatmadcol/);
- Cult of Pedagogy (https://www.pinterest.com/cultofpedagogy/);
- FISD Digital Learning Coaches (https://www.pinterest.com/techtators/).

Blogs are another way that educators can share interests, ideas, and activities. *EdWeek* provides a curated online list of education blogs on its website (http://www.edweek.org/ew/section/blogs/#tech.

Blogs related to educational technology include:

- *Buzzmob,* a blog platform for improving communication in education between teachers, parents and students (http://blog.buzzmob.com/);
- *The Edublogger,* a blog that provides teachers with emerging educational technology (https://www.theedublogger.com/);
- *Edutopia,* a blog that offers teachers classroom practices, lesson plans, innovative ideas, tips and strategies (http://www.edutopia.org/blogs);
- Education to the Core, a recommended list of 20 teachers to follow on *Pinterest* (http://educationtothecore.com/2015/06/20-teachers-to-follow-on-pinterest); and
- *Tumblr,* a social-media network of blogs, which can be used to search for specific educational topics (https://www.tumblr.com)

Instagram can be used in the classroom to showcase students' work, capture pictures from field trips or lessons, document student progress, and provide a venue for exploring students' ideas. Examples of Instagram use for educational purposes can be found on various blogs (Phillips, 2013):

- *Education World* (http://www.educationworld.com/a_tech/instagram-classroom-student-activity-ideas.shtml);
- *Emerging Ed Technology* (http://www.emergingedtech.com/2013/02/using-instagram-in-an-educational-context/);
- *We Are Teachers* (http://www.weareteachers.com/blogs/post/2014/08/07/10-ways-to-use-instagram-in-the-classroom).

YouTube, a video sharing website, provides a searchable category titled "YouTube education" that includes resources like:

- *Tech Ed* (https://www.youtube.com/user/TEDEducation);
- *#Education* (https://www.youtube.com/channel/UC3yA8nDwraeOfnYfBWun83g);
- *Teacher Users* (https://www.youtube.com/user/teachers);
- *Science and Education List* (https://www.youtube.com/channels/science_education).

Implications for FNS

- There are currently varying approaches to integrating technology, and each approach provides a different context for developing FNS educational health and nutrition materials. These approaches can be organized into categories, including: learning models; instructional strategies; and community membership. Digital educational materials will benefit from alignment with these approaches.

- Current technology-based learning models are oriented to a personalized learning approach. Models applied to achieve personalized learning include adaptive learning; blended learning; flipped classrooms; and distance learning. The unique characteristics of each model offer promising opportunities to improve learning. Providing FNS digital materials (e.g., curriculum materials, educational health videos, etc.) that are easily integrated into these models will increase use.

- There is a current focus in educational technology on several instructional strategies, including; project-based collaborative learning; constructivist hands-on learning; and game-based learning. Developing FNS digital materials in alignment with these instructional strategies increases opportunities for FNS product use.

- Open educational resources (OER) and social media platforms offer teachers and students the opportunity for membership in learning communities – allowing for the sharing of resources, ideas, experiences, and advice.

- OER educator websites (e.g., Institute for the Study of Knowledge Management in Education or ISKME, Open Education Consortium, and The Orange Grove) provide a distribution outlet for providers of educational products and resources.

- Additionally, providers can raise product awareness through focused and strategic community participation on social media platforms (e.g., Facebook, Twitter, Pinterest and Instagram).

H. Educational Media and Technology Used for Health and Nutrition Education

Key Points – Summary

- A range of technologies and digital media platforms are currently focused on health and fitness education. In order to meet the specific goals of health and fitness education, developers use features unique to different technologies and media platforms.
- There is widespread use of online and social-media based communities and resources by teachers. The challenge for developers is ensuring awareness and visibility of new resources in a crowded and poorly curated online marketplace.
- Interactive digital platforms for school lunch menus enable parents and students to access school food menus and nutrition information using mobile apps.
- There is a growing body of evidence identifying effective health and nutrition technology-based educational interventions.

There is a wide range of educational technology focused on health and nutrition. This section provides a description of current health and fitness educational products and their use. It is organized by technology categories. These categories include:

1. OER Websites with health-related information and activities;
2. Educational Videos with health and nutrition information;
3. Educational Apps for touchscreen devices with interactive activities and information about health and nutrition;
4. Educational Games for learning about and improving health and nutrition;
5. Digital Screens for display of menus or video related to healthy lifestyle; and
6. Exercise Trackers worn to monitor physical activity and exercise.

These uses are examined below with reflection and research (when available) on their function and potential as options for promoting change in learning and behavior (Satterfield, 2015).

OER Websites

OER websites centered on health and nutrition have become increasingly available. Along with broadly focused OERs that also include health and nutrition information and materials (e.g., *KhanAcademy.org*) there are numerous OER sites focused specifically on nutrition education. A review of "100 Best Nutrition Websites" provides a list of health and nutrition related sites, including many OERs (Rosen, 2013). The following list of websites represents the range of available nutrition-focused OER sites.

- *BAM* (Body and Mind) is a child-friendly website from the Centers for Disease Control and Prevention, with games that teach middle school-age children about healthy lifestyle choices, disease, food, and nutrition (http://www.cdc.gov/bam/);
- *FOOD4KIDS* is an online program administered by individual states to mitigate food insecurity which includes several games intended to teach children safe food-handling (e.g., http://www.food4kidsfl.org/);
- *GoNoodle* provides videos for school and home use that encourage exercise (https://www.gonoodle.com);
- *Kids Health* provides health and nutrition related resources for parent, children, and teachers of grades Pre-K through 12, including informational resource links, downloadable activities and lesson guides (http://www.kidshealth.org/);
- *Nourish Interactive* provides families with helpful nutritional information and educates children about the importance of nutrition and exercise (http://www.nourishinteractive.com); and
- *Sugar Stacks* provides images of everyday food items and shows users the amount of sugar in these foods, as represented by a number of sugar cubes to equal the number of grams of sugar contained in each food (http://www.sugarstacks.com).

There is a wealth of health and nutrition information online; educators must discern which OER sites provide accurate and engaging information relevant to their student populations. The U.S. Department of Education, State Educational Technology Offices and Amazon, among others, are currently developing curated websites with OER links for educators. The challenge for OER developers is gaining visibility in a crowded landscape.

Educational Videos

Videos designed to teach and motivate better health and nutrition choices are readily available on YouTube and OER websites *(e.g., TED Talks)*, where they have achieved wide distribution. *Genevieve's Playhouse - Toy Learning for Kids* (https://www.youtube.com/watch?v=YPfo2Tw9SHo&t=4s), a YouTube channel featuring toy- and play–based learning activities for young children, has achieved a view count of over 302 million and an audience of nearly 600,000 subscribers since its creation in January of 2016. This channel's video catalogue includes a number of videos focused on nutrition education, one of which, *Healthy Foods - Learn Colors: Sorting, Nutrition, Fruits, and Vegetable Toys* (https://www.youtube.com/watch?v=YPfo2Tw9SHo) has been viewed over one million times. *The Ted Talks* website currently features over 200 videos on the topic of health (available at https://www.ted.com/topics/health) with view counts of up to 14 million. These talks, which are targeted to a general audience, are age-appropriate for adults and high school students, while short, animated lessons targeted specifically to elementary-, middle- and high school students are also available at Ed.TED.com.

Video viewing can be integrated into lessons during class time to provide information and multiple perspectives, as well as assigned outside of class time, to promote thinking on a lesson topic before and/or after it is covered in the classroom (Cucinotta, 2014). In a world that is increasingly geared toward active and interactive engagement with digital technology, video is a medium that can be leveraged for variety of active and interactive applications. Ellen Schuster (2012) proposed video workshops as part of an active, blended-learning plan as a way to engage students in health and nutrition. Schuster (2012) proposed that teachers could use digital apps and existing online health videos to engage a class in making health videos (e.g., using Screenr, Screencast-o-Matic, Community Clips). Participants in workshops could make short informational videos on health-related themes (e.g., reading labels, hypertension, *MyPlate*, etc.). Participants could also watch existing videos and engage in hands-on projects related to the content or theme of the video during workshop time (Schuster, 2012).

Research conducted on a summer Migrant Education program in Texas that utilized student-made health videos showed positive educational outcomes. Middle School students produced five health "infomercials" as part of the program curriculum; the research findings showed significant improvements in 12 knowledge and attitude measures concerning health and nutrition (Kilanowski & Lin, 2014).

Educational Apps

Health and nutrition apps are readily downloadable to tablets or smartphones. Apps' interactivity and portability make them an engaging form of media for young learners. The *Apps for Healthy Kids* competition launched as part of Michelle Obama's Let's Move campaign highlights a range of different topic areas for which apps can be beneficial to promote children's health by increasing health literacy and/or healthy lifestyle behaviors (Let's Move, 2010). The list of topic areas for which contestants were invited to design and submit apps is reproduced below for reference:

- Teaching kids to eat more whole grains
- Increasing fruit and vegetable consumption
- Focusing on consuming more low- or non-fat milk
- Choosing lean sources of protein (meat and beans)
- Making food group education fun
- Understanding calories
- Increasing foods with high nutrition value and decreasing amounts of solid fats and added sugars ("extra" calories), and decreasing amounts of sodium
- Identifying and consuming proper portion size
- Being more physically active
- Balancing physical activity and food intake

Educational nutrition and health apps are now readily available and used by teachers as part of health education programs. In *Edutopia*, Burns (2013) reviewed the following four apps, which are relevant to nutrition education and available on iTunes or Google Play.

- *Fooducate* enables users to scan the barcode on any food. The app then shows and explains a letter grade for that food. While not specifically targeted to children, this app can prove beneficial to teens, and even some elementary students;
- *Big Fork Little Fork* is a free app that shares tips on cooking, good nutrition, produce and healthy living skills with how-to videos and games. The app was designed for children to use with their families, and is appropriate for children of all ages;
- *Awesome Eats* is a free app designed for elementary school children that involves identifying new foods and organizes them in an interactive game; and
- *Eat-And-Move-O-Matic* is an app for children ages 9–11 that teaches the relationship between caloric intake and the food(s) eaten, using two dials that students manipulate to see how food choices relate to exercise needed to burn off these calories. The app includes a pedometer to keep track of the number of steps taken throughout a workout or day, and a calorie and diet tracker that keeps a record of calories eaten in a day or week.

Digital Games

Various health campaigns have focused on digital games. The Games for Health organization hosts an annual conference on educational games that promote nutrition, exercise and healthy living. Learn to be Healthy has an online catalogue of OER materials (searchable by topic and grade level) for health and nutrition games in the classroom. Digital games offer a variety of means to beneficially influence health including: increasing exercise by requiring physical activity to advance through the game; increasing health-related knowledge and exposure to modeling of healthy behaviors; and providing opportunities to practice skills pertaining to a healthy lifestyle (Kato 2010), including goal-setting and goal-directed planning (Thompson et al., 2012; Thompson et al., 2010). Additionally, games that intrinsically motivate have the potential to aid in sustaining effects by encouraging repeated and longer durations of game play (Sitzmann 2011; Wouters et al., 2013).

In K–12 schools, Nintendo Wii Fit, *Dance Dance Revolution* and other exergames (i.e., simulated sports and dance games which involve physical activity) have been integrated into school Physical Education programs as a way to encourage student exercise (Krisberg, 2012). Studies have found young children's and adolescents' use of exergames to be beneficial for increasing physical exercise, and to effectively impact weight and body mass index when game play was incorporated into a structured wellness intervention program (Christison & Khan, 2012; Maddison, Mhurchu, Jull et al., 2012; Staiano, Abraham & Calvert, 2012 and 2013; Trost, Sundal, Foster et al., 2014). Importantly, these beneficial impacts were found only in the context of structured use, and not when exergames were merely available to children for unstructured use at home (Baranowski, Abdelsamad, Baranowski, Threlkeld & Cook, 2012).

A recent meta-analysis conducted by DeSmet et al. (2014), which includes findings from studies that involved children and adolescents, examined the impact of digital games designed to promote healthy lifestyle behaviors by providing educational health information. DeSmet et al.'s meta-analysis (2014) included rigorous studies of games targeted to a variety of health domains (i.e., mental health promotion, diet and physical activity, social behavior, and health maintenance), and provides evidence that digital gameplay can increase health and nutrition-related knowledge and promote health-related lifestyles. Specifically, serious games were found to have small but positive effects on health-related behaviors, as well as behavioral determinants: knowledge, attitudes and intentions to change behaviors (DeSmet et al., 2014). Additionally, the theoretical basis of games and the tailoring of games to player characteristics were found to significantly moderate game effectiveness on behavioral determinants. Games tailored both to players' socio-demographic context (e.g. age, gender) and behavioral change needs (e.g. risk factors, current behaviors and knowledge) had a larger effect size (DeSmet et al., 2014), as did games informed by empirically grounded theory (e.g., Health Belief Model, Social Cognitive Theory, Theory of Planned Behavior, Elaboration Likelihood Model, Transportation Theory, and Cognitive Behavioral Therapy). Finally, the meta-analysis underscores the need for further research: outcomes were inconsistent between the various studies conducted in different health domains, highlighting the need for further research on specific game mechanics and strategies for effective outcomes (DeSmet et al., 2014).

Recent literature reviews on digital games and learning suggest a range of possible applications for digital games and digital media play to improve nutrition and wellness among audiences of all ages (Baranowski et al., 2015; Klopfer, Osterweil & Salen, 2009; Thai, Lowenstein, Ching, & Rejeski, 2009). In a 2009 review of learning and digital media play, Klopfer, Osterweil, & Salen (2009) categorized different learning domains for which digital media play offers potential benefits, and outlined a series of relevant design principles. Based on research findings from studies of digital media that involve play (including games and social media), the review suggests the potential for digital media play to promote wellness by promoting social adjustment (increased peer interactions) and increasing motivation (for reading and problem-solving), as well as by increasing health literacy, skills, and self-efficacy (i.e., greater understanding of the importance of healthy lifestyle behaviors, better self-care skills, and greater self-confidence to carry out healthy lifestyle behaviors and self-care skills (Klopfer, Osterweil & Salen, 2009).

Thai, Lowenstein, Ching and Rejeski (2009) reviewed research on the educational potential of digital games to increase health and nutrition knowledge and change long-term behavior among school-age children. Some of the games in the study included: *Dance, Dance Revolution*, which focuses on exercise; *Color Me Hungry,* which focuses on healthy food choices (choosing fruits and vegetables); and *Germinator,* which focuses on hygiene. The authors concluded, based on the research reviewed, that games have the potential to increase knowledge and change behaviors (Thai et al., 2009).

Rigorous empirical research has also been conducted on the extent to which digital games can motivate behavioral changes in health and nutrition. Baranowski et al., (2003) conducted research using psychoeducational multimedia training (PEMT) on a group of fourth grade students. The game, Squire's Quest, targets fruit and vegetable intake. The game established intentions for healthy eating and goal setting as a part of a behavior change process. The participants in the experimental group engaged in goal setting and the game also included the planning of an intentional implementation of their goal as part of the game. The fruit and vegetable intake of children involved in the planning activities was significantly greater than the control group who did not engage in these planning activities as part of game play. Baranowski et al. (2003) asserted that, based on their research, "PEMT games can induce dietary behavior change among elementary school children."

In a recent review of rigorous, empirical research concerning the effectiveness of digital gaming to promote health among children and adolescents, Baranowski et al. (2015) present evidence that digital gaming has been effective in achieving beneficial impacts across a wide range of health domains. Across numerous studies representing a range of health domains, digital games were found to effectively impact behavioral precursors, behavioral outcomes, and also health outcomes among children and adolescents (although effects were weaker in this latter category). Importantly, as relates to nutrition education, the literature review presents evidence of digital games' effectiveness for increasing nutrition and health-related awareness and knowledge, and promoting healthy behaviors and behavioral change among young children and adolescents (Baranowski et al., 2015). Additional research is needed to determine the most effective game design for enabling behavioral change through games geared towards healthy eating habits (Baranowski et al., 2015).

Exercise Trackers

Exercise trackers (digital devices designed to track physical activity) are worn on the body (typically around the wrist) and often linked to a personal account and website where the users obtain ongoing feedback on their daily exercise (e.g., number of steps taken and calories burned; Hallett, 2013). Sqords, Fit Bits, JawBones and Amiigos are all examples of exercise trackers used by students. For example, students at an Arlington, Virginia school register their Sqords with a school computer to track their activity levels during and after physical education classes (Hallet, 2013).

Social Media

Social media and social networking are increasingly recognized as effective tools for teaching and learning (Crane, 2012). According to Crane (2012), some of the most utilized social media and networking tools are blogs, wikis, podcasts, Skype, Facebook and Twitter. One major advantage for students who use social media is real-time collaboration which allows them to communicate anytime and from anywhere. There are also many ways that Twitter can be incorporated into the classroom. Students can tweet what they have learned from the day, teachers can tweet about good behavior, and students can collaborate to create stories. Additionally, Twitter can be utilized for classroom polls, homework reminders, and questions about material learned in class (DeLoatch, 2015).

An example of using Facebook in the classroom is a history project devised by a teacher in Maryland. The students involved in this project each selected a historical figure, then used their personal Facebook pages to create a fan page for the person they selected. This included uploading pictures of the person and his/her family, and posting status updates about the person in order to create a chronological history (Crane, 2012).

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Uses of Technology by School Nutrition Professionals

Digital displays. Digital screens used to display educational information and videos about food, nutrition, physical activity and general wellness are now present in clinics, doctors' offices and schools, among other settings. In school cafeterias, digital displays are used to display school lunch menus; provide nutrition information, including nutrition labeling for school lunch items; and to promote foods. Additionally, digital displays are used in schools to communicate news about wellness and nutrition related programs and events, including (but not limited to) the USDA Farm to School Program and The Department of Defense Fresh Fruits & Vegetables Program, summer programs, and community garden programs (Birkett, 2015).

Research suggests that the use of digital displays to feature healthy foods and provide nutrition information may beneficially impact both children's health literacy and their dietary choices in school. Visibility and prominence of food has been found to increase desire, purchase and consumption (Volkow et al, 2002; Wansink 2004). Digital displays provide an optimal medium to increase visibility of healthy foods, as well as to promote the appeal and health benefits of foods, two factors that were found to positively influence children's food choices in a qualitative study of 7th and 10th grade students (Neumark-Sztainer, Story, Perry, & Casey, 1999). Additionally, research involving high school students (conducted in six schools in Pennsylvania) found that posting nutrition information at the point of sale in school cafeterias was associated with greater perception of food quality and higher ratings of satisfaction (Cranage, Conklin, & Lambert, 2006). Researchers also concluded that providing students with healthy menu options together with nutrition information to help them make healthier food choices, can increase students' feelings of empowerment and self-determination (Cranage, Conklin, & Lambert, 2006), which are important motivational precursors to behavioral change (Van der Bill & Shortridge-Baggett, 2002).

Digital interactive school lunch menus. Nutrislice provides a technology platform for interactive school lunch menus which enables students and their parents to access school menus and nutrition information through a mobile app, and which also enables schools to post menus and nutrition information on digital displays. Research on Nutrislice's interactive school lunch menu found that both parents and their children were more willing to purchase a school lunch when nutritional information was available. The use of interactive digital lunch menus to provide nutrition information and menu labeling has the potential to help parents and children better understand the value of school lunches (Hanks, Craig, Just, & McNeeley, 2015), as well as to help parents monitor their children's food choices and encourage the selection of healthier menu items (Tandon et al., 2011; Tandon, Wright, Zhou, Rogers, & Christakis, 2010).

Implications for FNS

- FNS will be well served to use OER websites and social media for increasing awareness and distributing digital materials on health and nutrition. These platforms would increase visibility and encourage engagement.

- Digital screens in public school cafeterias could also be used by FNS to display new digital materials and/or general health and nutrition information. However, materials presented on a screen would need to be updated and made relevant in order to reduce habituation.

- There are many resources for health and nutrition education currently available online. These health and nutrition education resources are often shared on social media or through OER websites. The creative uses of online resources depend on educators' and students' interests, as well as the visibility, accessibility, and relevance of the materials. Video in itself is a relatively passive medium, but it can be an entertaining way to communicate important health and nutrition information.

I. Research on the Effectiveness of Educational Technology Tools, Programs and Pedagogy

Key Points – Summary

- Educators and students reported benefits (including engagement, reflection, interactive learning experiences, and connections to others), from blended learning programs that fused online and face-to-face instruction.
- Teachers indicated several benefits of integrating digital technology into their classrooms, including an increased ability to incorporate instructional strategies for different learning styles and needs.
- Professional development is essential to keep pace with rapid changes in technology.
- Additional research is needed in K–12 schools regarding effective learning through educational technology.

The literature review findings on effectiveness research are best understood in historical context. Interest in scientific evidence-based assessments of educational effectiveness received widespread attention as a result of the No Child Left Behind (NCLB) Act of 2002. NCLB required states to provide yearly evidence of school success using student performance outcome as evidence. Under NCLB, The U.S. Department of Education Institute of Education Science (IES) identified scientific evidence-based random control trials (RCTs) as the only evaluation method that yielded "'strong evidence" in assessing the effectiveness of educational interventions (Cohen, 2012).

Research focused specifically on the effectiveness of educational technology, specifically, has roots in the 40-year history of research on educational television. The research literature on the effects of television is robust. Research findings have provided evidence of the educational effectiveness of television on children's cognitive skills, social-emotional development and knowledge acquisition (Wartella et al., 2016).

As computers and other technologies were introduced and used for education, research expanded to assess educational impact. In 2005, the use of scientific evidence-based assessment of educational technology was required by the U.S. Department of Education as a component of the Ready to Learn Media Grant (RTL). RTL grant recipients were encouraged to use random control trial (RCTs) evaluations on federally funded media to assess educational effectiveness. Assessments provided evidence of positive effects of online, interactive educational content on children's early literacy acquisition (Fisch, 2016).

The literature on educational technology is now maturing. Inquiry utilizes a range of methodologies, and descriptive assessments of effectiveness using RCT designs comprise one of many types of studies. Researchers have investigated the contextual factors that engender or inhibit learning and technology use (Blackwell, Lauricella, & Wartella, 2014), the use of educational media and technology with underserved populations (Johnson, Steven, Lovitts, Lowenstein, & Rodriguez, 2016), and the role of formative research in the development of educational technology products and content (Cohen, Hadley, & Marcial, 2016).

There are inherent challenges in assessing the effectiveness of educational technology. Research findings indicate that the effectiveness of educational technology on student learning is highly dependent on the context and that findings are not applicable outside the original conditions. Additionally, technology-based learning is often domain-specific. Studies on interactive educational games indicate that student acquired skills and knowledge is not transferred or applied outside the digital experience. The psychological mechanism required for knowledge transfer across domains is an ongoing topic of research (Blumberg, 2014).

In 2010, the U.S. Department of Education reviewed evidence-based research literature from 1996 through 2008 on the effects of educational technology on student outcomes. Findings indicated that students engaged in online learning blended with face-to-face instruction scored higher compared to students engaged in exclusively face-to-face or online instruction (U.S. Department of Education, 2010a).

In other studies, educators and students reported benefits from blended learning programs that fuse online and face-to-face instruction. These benefits include higher student engagement, increased ability to reflect on learning, opportunity for hands-on learning experiences and interactive lessons (i.e., simulations, projects, etc.), and connections to other students, schools or countries through online groups. Additionally, students exhibited an increased comfort with using technology over time and improved their skills in meaningful ways. It should be stressed, however, that the achievement of these benefits is contingent on the provision of adequate teacher and student technical and professional support with these educational technology programs (Costley, 2014; Fletcher, 2012; Ng'ambi, 2013).

More research is needed in K–12 schools regarding effective learning through educational technology. As new educational models are created for integrating digital technology into classrooms, new research methods are needed to assess effectiveness. Clarifying the techniques and approaches used, the context(s) of use, and the methods of assessment are necessary in order to inform educational technology practices.

Implications for FNS

- Research provides evidence of the effectiveness of educational technology on student learning. However, educational effectiveness is linked to the learning context, and findings from evaluations are difficult to apply to other settings. Research has provided directions regarding optimal contexts for learning.
- A combination of online instruction or digital learning tools with face-to-face classroom experience (blended learning) is an optimal configuration for effective and interactive learning experiences. Students also benefit from hands-on learning experiences and interactive lessons.
- Professional development and support for teachers implementing FNS health and nutrition materials are an essential element for creating optimal learning contexts for all students in all situations.

J. Market Leaders in Educational Technology

Key Points – Summary

- Market-leader textbook publishers have developed adaptive, online learning programs, and are converting textbooks into digital content and formats for classroom use.
- New education technology companies have entered the market with innovative product offerings ranging from online courses to learning management systems, with content and lesson plans available across disciplines and grade levels.
- Many education technology startups respond to important market needs (such as the increased adaptation of print materials to digital formats), while receiving early support from technology incubators (e.g., Kaplan's EdTech Accelerator).

The educational technology market has been expanding from 2010 to 2015. Ambient Insight's forecast and analysis report for this period valued the educational technology market at $18.2 billion in 2010, with an annual growth rate of 5.9% and overall revenues for 2015 estimated at $24.2 billion. The annual market growth rate for the K–12 market was reported as higher, at 16.8%, mostly due to the increased adaptation of print materials to online formats, among other factors (Adkins, 2011). However, a more recent analysis and forecast report (Adkins, 2016) indicates that revenue has leveled, with growth rates and revenues projected to drop over the next five years. According to Winters and Wan (2016) at EdSurge, funding for education technology for the first quarter of 2016 has dipped. Nevertheless, they view the industry as healthy.

Educational technology content producers include a dynamic mix ranging from large education market-leaders to small tech startups. The three market-leader textbook publishers, Pearson, Houghton Mifflin Harcourt (HMH) and McGraw-Hill, are the largest educational technology companies in the U.S. These companies have developed their own adaptive, online learning programs while actively converting textbooks into digital content and formats for classroom use. The digital products developed are focused primarily on core subject areas (math, language arts and science) and aligned with Common Core State Standards, with little representation of health and nutrition.

Pearson has several core adaptive learning products/systems: *SuccessMaker*, *English Learning Systems* and *Realidades*. These systems provide formative assessment and student performance feedback to teachers. Pearson also offers a customizable, online science text for teachers. Pearson's health professional education program is web-based, featuring animation and videos on topics like anatomy and physiology, and is designed for post-secondary education and adult healthcare professionals.

HMH has also focused on personalized learning programs, as well as K–12 education products that promote continuity between home and school learning. HMH recently acquired Scholastic's educational technology properties, including R*ead180* and *Math180*. HMH publishes the hard-copy textbooks, *Lifetime Health* and *Decisions for Health*, and does not currently offer health related technology products.

McGraw-Hill Education's digital platform for K–12, ConnectED, features adaptive, online instructional materials and formative assessments that provide feedback to teachers. Through its School Education Group, McGraw-Hill has invested in developing educational apps designed to support classroom learning, including one for ConnectED, *Bluster!* (vocabulary builder), *Grammar Wonderland* (English grammar), *My Video Tutor* (mathematics), and *¡Asi lo digo!* (Spanish).

In addition to these major educational technology companies, new education technology companies have entered the market with innovative product offerings. *Forbes* identified six companies as "leading the way in EdTech" (Hendricks, 2014). Although the companies listed are dated by two years, the criteria for inclusion represent important market trends. The companies are:

- *Knewton,* a provider of adaptive personalized learning technology (a supplier to both *Pearson* and *Google*);
- *iTutor Group,* an online language learning platform that uses algorithms and predictive analytics to optimally match students with teachers and language courses;
- *2U,* which partners with universities to support efforts to add online degree programs to university offerings;
- *Blackboard,* which established one of the first LMS and supports teachers with online tools and analytics identifying student strengths and areas of need;
- *General Assembly,* which provides online courses on digital and Internet development (e.g., coding HTML, content marketing, data analysis and user experience design); and
- *Coursera,* a provider of MOOCs that offer higher-education certificate programs.

Forbes also identified the following as companies to watch in the educational technology sector for their growth and potential (Hyder, 2014):

- *Kaltura,* an open-source video platform that enables educational institutions to bring video into various aspects of school life, from the classroom to admissions;
- *AltSchool,* which provides a technology-based educational experience with personalized weekly curricula for each student;
- Tynker, which offers gamification of lessons and introduces children to the basics of logical programming. ("New! Tynker Classroom Introduced at ISTE2014 | Tynker Blog," n.d.);
- *Udemy,* an online marketplace for learning that enables anyone with knowledge and skills to become a digital teacher; and
- *Khan Academy,* which began as a provider of algebra instruction and now provides courses in computer programming, art history, classical music, medicine and specific topics relevant to health like metabolism, digestion, and nutrition.

In 2015, *Entrepreneur* magazine highlighted 5 of the 10 start up or early stage educational technology firms that were selected to pitch to leaders in the venture capital and educational communities during *National Education Week* (Newton, 2015). These included:

- *DreamUp,* which enables students to design their own science experiments that will be conducted by actual astronauts in space;
- *Junior Explorers,* which creates monthly subscription-based online adventures for children. Students can visit a virtual ecosystem where they solve challenges and save animals digitally;
- *CoachTube,* an online in-depth training forum that provides coaches for topics ranging from hitting a curve ball to swinging a golf club;
- *Open Online Academy*, which enables students from all over the world to gain certification in engineering, city planning, design and architecture; and
- *Core Learning Exchange,* which provides content and lesson plans with a feature enabling teachers to buy and sell teaching tools.

Many start-ups receive early support from technology incubators. Notably, Kaplan's EdTech Accelerator has created an intense immersion program for a selected group of startups (Burton, 2014), including:

- *Branching Minds,* an online tool to help identify, understand and adapt to students' cognitive strengths and weaknesses while tracking and reporting data across grade levels and classes;
- *Cognotion,* which teaches students language and career skills through storytelling, using online video narratives, gamification features, live simulations and social media tools;
- *CreatorBox,* which helps children ages 7–12 develop their creativity and practical science, technology, engineering and math (STEM) skills through a monthly series of building projects;
- *Grockit,* an online tool that uses adaptive learning, peer-to-peer learning, and game-like motivational features to help students prepare for standardized assessments (acquired by Kaplan in 2013);
- *Lea(R)n,* which runs cost-effective pre-clinical and clinical trials to validate emerging education technologies' impact on learning outcomes; and
- *reKode Education,* which teaches computer coding skills to children and young adults, including those with learning challenges and disabilities.

The products developed by these education technology startups respond to important market needs. As evidenced by the list of educational technology companies included above, the market remains an active one, where innovation and adaptability are key.

Implications for FNS

- The initial period of rapid expansion in the educational technology industry has ended, indicating a maturing market.
- Traditional market-leader textbook publishers are highly committed to expanding and cementing their footprint and leadership in the digital space. Concomitantly, many smaller educational technology companies and start-ups are seeking to establish themselves with innovative product offerings.
- Online learning programs incorporating formative assessment as a product feature are current must-haves for educational digital products. Formative assessment is defined as ongoing performance feedback to students, teachers and parents. Formative assessments are perceived as a critical component for achieving personalized learning.
- There is a dearth of Common Core-aligned K–12 digital content for students and teachers focused on nutrition and health.

K. Summary of Results and Future Trends in Educational Technology

Literature Review Results

The overall results are comprised of the collected findings from 10 subject-area literature reviews. The subject-area findings and strategic implications for FNS are provided throughout. The subject areas, and the corresponding literature reviews, are distinct and identifiable and represent independent domains. They are also highly interconnected and interdependent. Taken together, the overall literature review provides a description and understanding of educational technology in U.S public schools, as well as an evidence-based foundation for FNS strategic planning and decision-making.

The review highlights that the unprecedented rate of change in product, content and use is foundational for understanding both the opportunities and challenges presented by educational technology. The opportunities for educational reach, cost-effectiveness, student engagement, and access to information and knowledge are unprecedented. The challenges for educators are equally daunting, including inequality in broadband and device ownership and access as well as significant variations in use at the local level. In this context, both the results of the literature review and future trends are presented.

The identification of future trends reported emerged from an analysis of the data, information and findings derived from multiple sources representing a wide variety of perspectives. Three overarching dynamics and variables form the foundation for identifying trends in educational technology: 1) access to high speed broadband Internet; 2) school ownership of technologies and devices to access the Internet; and 3) use of technology and Internet access in schools and classrooms and the availability and quality of digital tools and content.

Broadband access at public schools

The first foundational trend is school-based, high-speed broadband Internet access. As indicated earlier, the national direction, as promoted by the federal ConnectED initiative, is towards a universal presence of educational technology and broadband Internet in schools. Findings indicate that the availability of broadband Internet access in public schools will increase, but that broadband access in homes is inhibited by costs. There has been an increase in the exclusive use of smartphones and mobile device cellular service for Internet connectivity, particularly in low-income households. The rising incidence of smartphone and mobile device reliance and dependence in low-income households implies that FNS digital educational materials accessed online may encounter barriers for home use by the population that is its priority to reach.

School ownership of technology

The second foundational trend is for higher ownership and access to technology in schools. However, there are no indications about uniformity in the types of technology schools will acquire. Similarly, the hardware-to-student ratio will most likely increase overall, and significant variations in access and use will continue at a local level.

Use of quality digital tools and content

Standardized testing will continue. Teachers' time and efforts will be focused on core academics and preparing students for standardized testing, leaving them with little time for non-core subjects like nutrition and health. As more schools transition to online standardized assessment, technology devices and connectivity will be less available for other use at school.

In this context, the trend in usage of educational technology will continue to be towards more student-centered, personalized and adaptive learning. These types of practice require interactivity in both the materials students are consuming and in teachers' instructional practice. In other words, both the digital content and teachers have to be responsive to individual students' needs.

The prevalence of current approaches for integrating educational technology (e.g., blended learning, flipped classrooms, project-based learning, etc.) will increase. However, the ability to engage in certain models such as blended learning or flipped classrooms may be hampered by low levels of Internet access in some homes. Social media and online communities will continue to be important for communication between teachers, parents and students, as well as with classrooms in other countries.

The already substantial body of technologies and digital media platforms focused on nutrition, health and fitness education will continue to grow, and more sophisticated feedback mechanisms will be expected. In this crowded marketplace, FNS requires visibility and product differentiation.

As educational technology matures and use increases, the number of evidence-based evaluations of educational effectiveness will grow. School and district-wide adoption of technology-based educational interventions will increasingly require rigorous evaluation studies of student outcomes.

Trends in the educational technology industry point to increased growth in the overall category of interactive, adaptive and personalized learning. The continued development of new digital learning products and learning programs by market leaders (including Pearson, McGraw-Hill and Houghton Mifflin Harcourt) will drive expectations for sophisticated digital products. Formative assessment will be increasingly integrated into these interactive, adaptive learning tools, providing teachers and students with immediate performance feedback.

Findings from the literature review reveal a landscape where many U.S. households – especially those with lower incomes – do not have home broadband Internet access, even though the majority of Americans live in a region where it is available. Non-broadband households are increasingly relying on smartphones for Internet connection. Findings also indicate that U.S. public schools have, or will soon have broadband Internet access. Currently there is a wide variation at the local school level in the quality of Internet connectivity and available technology. Regardless, public schools and school libraries are key entry points for FNS materials to reach students who do not have access to technology at home. Additionally, many school librarians are certified Media Specialists and responsible for finding and acquiring digital resources for their schools. FNS should consider enlisting school librarians as advocates for its mission and educational materials and programs.

Teacher, parent, and student attitudes towards educational technology are positive and provide FNS with the opportunity to leverage student digital engagement for learning. More research is urgently needed on effective technology-based learning in K–12 public schools. Teachers are using and experimenting with a wide range of digital tools and content (e.g., applications, web-based platforms, etc.), and implementing new practices and instructional strategies (e.g., flipped classrooms, project-based learning).

In the context of digital content convergence accessed via mobile devices and smartphones, combined with the realities of the variations in school device ownership, FNS should consider developing its educational materials for multiple device access. Mobile touchscreen and tablet devices offer intuitive use by children in kindergarten and early grades, as well as tweens and adolescents.

Technology is increasingly used in education for teacher communications with students and their families. Digital communication platforms, including social media, offer FNS the opportunity to provide short form nutrition and health messaging and also establish its presence and relationships with students, families and communities. Teachers are currently incorporating a variety of technologies (including websites, videos, games and apps, and exercise trackers) for nutrition, health and fitness monitoring and education. FNS should consider raising its profile in these areas. Additionally, consider increasing FNS's presence in teacher social media groups and online communities by providing resources and support. Increasing FNS's presence on these platforms would increase visibility and encourage engagement.

Educational technology companies and publishers are creating a variety of digital content and tools for teachers and students that align with Common Core standards and incorporate personalized, adaptive learning and ongoing formative assessments. In the current environment, aligning ancillary educational materials with core academic curriculum has become a more complex and in-depth exercise. Teachers will increasingly require evidence of educational effectiveness.

CHAPTER IV
FORMATIVE RESEARCH AND PRIORITIZED RECOMMENDATIONS

This chapter details findings from the formative research conducted under Task 2 of the Team Nutrition Educational Technology Environmental Scan, as well as prioritized recommendations based on the formative research and literature review from Chapter III. This section begins with findings from focus group interviews conducted with K–12 teachers and librarians, examining their experiences and perceptions of educational technology. It is important to consider the findings in the context of the characteristics of the sample recruited for the focus groups: K-12 teachers from all seven FNS regions, most of whom teach at schools where more than 33% of the students qualify for free or reduced-price lunch. Findings from the online survey with K–12 health educators and interviews with state educational technology directors are subsequently reported.

A. Focus Group Interviews with K–12 Public School Teachers

Use of Technology in Teaching in K–12 Schools

Teachers' use of technology to support classroom instruction. Teachers reported regular use of technology to support their classroom instruction and agreed that the interactivity technology offers enhances student engagement.

> *"I go to anything interactive that kids can manipulate. That keeps them engaged, involved."* (OK elementary school teacher)

> *"They're more engaged [with technology] than [with] flashcards or the alternative. It's just more interesting to them because that's what they've grown up with."* (DE elementary school teacher)

Some of the teachers reported using programs (e.g., Language Live English language arts intervention, Class Dojo) with game-like components such as earning points, customizable avatars, and a controlled (within classroom) social media component. They noted that these features enhanced student engagement.

> *"They can earn points and there's a leaderboard so you can be the top scorer of the day or the week."* (NY middle school teacher)

Teachers also reported using interactive whiteboards (e.g., Promethean, SMART, ENO) to introduce lessons, pull up interactive problems and exercises for students to solve (e.g., arranging the bones of a virtual human skeleton), show videos and presentations, and access additional lesson resources.

"Almost all of my lessons are on the SMART Board." (DE elementary school teacher)

"I use the SMART Board daily for the science part of the FOSS[1] curriculum. It has interactive materials on it." (OK elementary school teacher)

Teachers frequently used document cameras with the interactive whiteboards. Document cameras magnify and project the images of actual, three-dimensional objects, providing all students in the classroom with an unobstructed view.

"We put animals under it – fish, frogs. You are using it when you have a class of 26 and there is no room for everyone to see it directly." (OK elementary school teacher)

Showing videos was another popular strategy for enhancing instruction. Many teachers referenced using videos from YouTube and Discovery Education to help introduce new concepts, reinforce lessons and make topics more relevant and relatable.

"I've used YouTube [videos] for teaching math concepts that have step-by-step, slow diagrams for new content area for the kids." (NM elementary school teacher)

"It's a good push into a lesson to get them started and teach them a little bit about what they're about to learn." (FL middle school teacher)

"YouTube is big in every [subject]. I pretty much use it every day. ... Just pulling up one or two videos to back up your lesson." (NJ middle school teacher)

A few teachers also mentioned using Kahoot!, an online game-based learning platform, to create learning games for their students or to access existing games created by other teachers. Kahoot! also provides students with opportunities to create their own games.

"You can create online assessments. I use my ELMO [document camera] and put Kahoot! up, and we create a game out of it. We'll do girls versus boys, and it's just review questions, and they really enjoy it." (IN elementary school teacher)

Many teachers utilized behavior management systems like Class Dojo and Seesaw to track student progress and behavior, assign or take away points, post assignments and generate reports for parents.

"[In Class Dojo] every kid has an avatar. You give them points and you can post on the [ENO] Board. Then from my phone I can give them points so they can see if they're doing what they're supposed to be doing and getting points for it." (NY middle school teacher)

"[With Seesaw], I go in or the kids go in, upload pictures, videos. I took pictures of their writing. It's similar to a social media thing – parents, grandparents, they can see their [child's] work. I put a video of a book we read and shared it so they could go home and watch it with a parent." (OK elementary school teacher)

[1] FOSS (Full Option Science System) is a science curriculum for grades K–8 that incorporates the Next Generation Science Standards (NGSS).

Finally, teachers and students used office productivity tools like Microsoft PowerPoint and Google Docs, along with Internet searches, as a regular part of their classroom practice.

> *"I use PowerPoint and [a] document cam every day. PowerPoint to get class started – that's where I post the 'Do Now,' the activity they do right when they come in, and their agenda."* (NY middle school teacher)

> *"[I] have kids go on Google and get images and make their own type of PowerPoint."* (KY middle school teacher)

Teachers' use of technology to communicate with families. Communication between schools and families is important for students' academic success. Establishing this communication is difficult and technology can be an important tool for parent-teacher communication. While many of the teachers stated that most of their students' parents own mobile phones, not all have Internet access or computers at home. As such, many teachers reported using their mobile phones to call or text parents when they needed to communicate with them. Teachers often give parents and caregivers their personal phone numbers.

Other ways teachers and schools used technology to communicate with parents included email; school websites and Facebook pages; class Facebook pages; school grade books; the school nurse's site (for health-related communications); learning platforms such as Genesis, Moodle, Google Classroom, Seesaw and PowerSchool, which allow parents to access their children's class from home and can send notifications to parents who register; Remind 101, a texting application that enables teachers to send and receive text messages from groups of parents and students and chat with each other without divulging their mobile phone numbers; Class Dojo, a popular behavior management/communication tool and application where students and teachers can post content for parents, and parents can respond; weekly or monthly digital newsletters created and published by teachers using Shutterfly, a photo application; and "robo" calls (automated phone systems that call and leave messages for parents).

According to many of the teachers, the use of software that proactively reaches out to parents is a more successful method of engagement than asking parents to register for access to a site and expecting them to log in. Additionally, many teachers pointed out that parental communication with teachers often declines after the early years of elementary school. Teachers reported that many parents are unresponsive to invitations to participate in informational programs at their children's schools and that many do not attend parent-teacher conferences. In some cases, some teachers found that technology can help spur parental engagement.

> *"I found that when my students were actually doing the engagement on the Seesaw, that's when parents decided to join. At first I had about half of them, but then students realized that their parents were seeing it. It had to come from the student. The students had to go home and say, "Mom, I want you to get this. "* (NM elementary school teacher)

Teachers' use of technology to find and share instructional materials. Teachers reported using several strategies to find instructional materials. The two most widely mentioned strategies were: using Internet search engines and informal exchanges with colleagues. Table 4.1 below lists the online destinations teachers frequented when looking for teaching resources.

Table 4.1

Websites Used by Teachers to Find Teaching Resources

Website	Description
BrainPOP https://www.brainpop.com/	A website offering animated movies, learning games, interactive quizzes, primary source activities and concept mapping across a variety of subjects.
Discovery Education http://www.discoveryeducation.com/	A digital service that offers digital content, interactive lessons, real-time assessment, virtual experiences, classroom contests and challenges, and professional development.
Edutopia http://www.edutopia.org/	A website and online community whose goal is to increase knowledge, sharing, and adoption of what works in K–12 education.
Flocabulary https://www.flocabulary.com/	A web-based learning program for all grades and subjects that uses educational hip-hop music to engage students, develop core literacy skills and supplement instruction across the curriculum.
Membeam http://membean.com/	A website that offers guided, multimodal vocabulary instruction.
Noredink https://www.noredink.com/	A website created by a teacher for students to practice grammar using interactive exercises.
Cicero http://cicerosystems.com/history	A subscription website for history and social studies teaching resources.
PE Central http://www.pecentral.org/	A website that provides information about developmentally appropriate physical education practices and programs.
Smart Exchange http://www.exchange.smarttech.com/	A website with lesson plans and resources for SMART boards.
Spark http://www.sparkpe.org/	A website that offers evidence-based physical activity and nutrition programs that provide curriculum, staff development, follow-up support and equipment to K–12 teachers.
Newsela https://newsela.com/	A service that provides news articles at five different reading levels and uses “embedded assessments” to track student progress.
Starfall https://www.starfall.com	A free public website for Pre-K to 2nd grade that uses phonics to teach reading using interactive games and drills.
Teachers Pay Teachers https://www.teacherspayteachers.com/	An online marketplace where teachers sell (or share for free) their original lesson plans and other course materials to other teachers.
Pinterest https://www.pinterest.com/	A web site that allows users to create “boards” with content taken from the Pinterest site, Google Images or other websites.
YouTube https://www.youtube.com/	A free video-sharing website with content on a myriad of topics.

Some teachers also reported using social media networks (such as Twitter, Instagram, Pinterest and Facebook) to follow education leaders and education-oriented websites. Many teachers reported that they share information about educational technology with each other informally. One teacher mentioned belonging to a group of teachers in his district who are interested in technology and who share information about new materials in an online folder.

Teachers also mentioned finding instructional materials via formal professional development programs through which they receive free subscriptions to websites that distribute content on their subject areas.

> *"I was a member of a Teaching American History Grant. ... Now [as] part of that grant we were given a subscription to a website called 'CICERO,' which is normally a $400 to $500 a year subscription, to teach American History. I was given a lifetime membership to this."* (FL middle school teacher)

According to some of the teachers, their districts have created their own digital libraries with source material, curriculum guides and lesson plans that are aligned to state standards. Other districts simply publish the standards, and teachers have to plan lessons using a variety of sources, including those listed above.

Teachers' use of technology for health and nutrition education. Physical education teachers and other teachers who teach lessons related to health and nutrition reported incorporating some technology during these classes. Some teachers were interested in the concept of tracking students' health and physical behaviors, but did not have the type of personal technology (e.g., FitBits) that would facilitate such tracking. (Teachers from one elementary school reported using FitBits themselves outside of school and challenging each other, but this did not extend to students.)

> *"If there was a kid version [of FitBit], it would just be phenomenal."* (NM elementary school teacher)

Other teachers asked students to use apps on their phones to track what they were eating, and pedometers to track their steps. Some teachers reported instructing their students to use phone apps (such as ChooseMyPlate.gov, MyPlate Calorie Tracker on Livestrong.com, MyFitnessPal and SuperTracker) to have students track their daily calorie intake. According to the report of one teacher, students varied in their response to this type of activity.

> *"For some, it's super effective. They get interested in it, and you can look at it at any point in the day. Others, most of them, will put it in last minute before I ask them to write their summary or to look at their phone and see what they've input in the week. It's hit and miss. It depends on the kids and their interest level in nutrition and physical activity."* (CO high school teacher)

Another teacher described how the competitive aspect of keeping track might motivate and interest some children.

> *"Kids love to keep track. Kids love to be competitive. There's so much you could do. You could graph things, you could easily have math lessons based on it. But I could see it drive other kids' behavior if their friends got whatever amount of steps, and they want to. It's all about competition."* (CA elementary school teacher)

Additional ways in which teachers incorporated technology into health and nutrition lessons included showing instructional videos from YouTube, BrainPOP or Discovery Education's health curriculum, as well as using videos from GoNoodle to give students a quick, physically active break during class. One high school teacher asked her students to follow items related to healthy motivation, workout plans or nutrition on social media sites like Instagram and Facebook. Some teachers had students perform nutrition-related research online. For example, in preparation for a class tasting, students researched fruits and vegetables; for a presentation on different countries, students researched food and culture. A few teachers used the Nintendo Wii Fit in class.

Schools' use of technology to promote foods available at school cafeterias. Time constraints and emphasis on discussing technology use in the classroom limited coverage of this topic in most of the focus groups. On those occasions when it was addressed, use of technology for this purpose was basic. Teachers reported the cafeteria menu being posted on the school website, with paper copies also available. In one case, teachers reported that a television station announces the school district's lunch menu on the local news every day.

Schools' use of technology for teacher training. Findings indicate that a significant proportion of these teachers' training is informal, and that training is often driven by teachers themselves, rather than by the schools. Teachers reported using technology to communicate with each other for their own professional development purposes.

> *"We have been using Google Docs a lot. We use Google Docs to communicate with one another. We have recently started doing professional development where we may have a study guide on a particular book that we're reading and we'll post notes and, more or less have a conversation online based on what our opinions are, how we feel the book is flowing. Which allows us to have a wider variety of resources at our fingertips, because not all of us are going to read ten books over the summer. Whereas we can, you know, glance through a summary of a book."* (IN physical education teacher)

Teachers who sought out professional development opportunities often found them online.

> *"I am getting ready to do a coding class that is offered online. The initial class for coding is free; then if you want to follow up and do more coding, you have to pay."* (CA elementary school teacher)

Several teachers mentioned using Google Classroom's digital professional development through modules that are given to the schools.

> *"Google has representatives that set up modules that we (the teachers who have been trained) come back and present to the school and everybody works through the modules and things like that. But sometimes they do go so fast that … It's getting time to implement and play with it; that is the problem."* (IN physical education teacher)

Some teachers also reported that their school might implement new programs using a short period of face-to-face training. The programs themselves often have digital components that enable teachers to either train other teachers or learn independently.

> *"The online guide has teacher tools, and everything is centralized and online... She and I are coaching teachers as well. If we're working with a first grade teacher in science, I can pull up her curriculum on my computer and read what we're going to work on, without bothering her and getting the book."* (CA elementary school teacher)

Many districts conduct in-person professional development, with participants usually using some form of technology (e.g., computers) during training sessions. However, many teachers, especially those teaching health and physical education, noted that these trainings often are not targeted to their specific needs or subject areas.

Disparities and Differences in the Use of Technology by K–12 Schools

Within this particular sample of teachers, more similarities than differences were found across the various focus groups (and thus schools and locales) regarding the use of technology.

Barriers and facilitators to using technology. Teachers reported several barriers to using technology in the classroom. Among the more common ones were:

- Not having enough devices available:

  > *"We don't have enough laptop computers for the district's requirements."* (FL middle school teacher)

- Devices that don't work:

  > *"The computers in my classroom, some days only two computers out of five would be working."* (IN elementary school teacher)

- Lack of access to devices or Internet at home on the part of some students:

  > *"There's a handful of kids who go home and don't have access to the Internet. They only can use their computers at school."* (CO high school teacher)

- Wi-Fi connectivity issues:
  All the teachers reported that their schools had Internet access and Wi-Fi. However, the quality of the connectivity varied, with some teachers reporting a good connection, and others reporting problems resulting from network overload, especially during testing periods.

  > *"Online access is no issue. We used to have access points in the hallways. Now every classroom is an Internet access point. We upgraded this past summer. It's good for testing all kids simultaneously."* (NJ middle school teacher)

"[Internet access] is supposed to be continuous but it's a short bandwidth. When a lot of people are using it, there are problems." (AZ high school teacher)

"[The Wi-Fi] typically runs very slow by the end of the day." (NY middle school teacher)

"When our school does testing, it seems like the whole district is doing it. So we always have [the Wi-Fi] stalling and they have to start it again." (CO high school teacher)

"Sometimes the Wi-Fi is slow; sometimes there is no Wi-Fi." (CT high school teacher)

- Technology taking too long:

  "You often need to restart [the computers]. ... Often, the kids are sitting there for 15 minutes waiting for the computer to restart." (DE elementary school teacher)

- Having to monitor students' technology usage, along with the behavioral issues that ensue when students stray from the task at hand:

  "I have no access to computers whatsoever so I do have to rely on BYOD and I feel like I deal with a lot more behavioral issues because you will walk by them and they're doing what they're supposed to, but the minute they'll just swipe that screen and be on something totally different and essentially not using their class time to what you want them to." (FL middle school teacher)

Other barriers mentioned included:

- Having old devices:

  "Our old computers are an issue as far as trying to utilize them efficiently during class time." (FL middle school teacher)

- Having to deal with the logistics around computer/laptop/tablet carts:

  "Sometimes what steers me away from using technology...is that the logistics of accessing a computer cart, where you come in and it's like, 'No, so and so has that cart.' ... It's a little frustrating, the accessibility." (FL middle school teacher)

- The inconvenience of having to deal with blocked sites. Teachers acknowledged that some online websites need to be blocked. However, in some cases, they felt the blocking was unwarranted and hindered them from planning a lesson or using a good resource with their students.

- Not having a dedicated technical support person at the school, which often leads to long wait times for the problem to get fixed. Teachers also expressed frustration at not having administrative privileges that would allow them to fix some of the simpler technical issues that arise:

  "I have to put in a work order just in order to get sound on a laptop." (NM elementary school teacher)

Beyond addressing these barriers, teachers' use of technology in the classroom could also be facilitated by providing ongoing professional development that demonstrates how to teach with technology, and by appropriating adequate time to for teachers to explore and learn how to use a new technology:

> *"We gave the students this awesome tool, but we don't provide the necessary training for the teachers that... I don't even know what the training looks like, because it's so individualized and specific for each teacher, based on content area. It really would be a massive undertaking to offer professional development that would be adequate for the majority of teachers district-wide. Teachers have been left on their own to figure out, 'How am I going to integrate this new technology into my classroom?' It's frustrating at times."* (CO high school teacher)

> *"We need more time, zoomed in time, to figure out how to use these programs in depth. How do I really use these programs?"* (OK elementary school teacher)

> *"I just need more time. I could do it, I am ok with jumping in and trying to figure it out. It's just when and how am I going to do it?"* (IN elementary school teacher)

Differences in school use and access to technology across rural, urban and suburban settings. Participants from schools across all settings reported having access to a range of technologies in their schools. More similarities than differences emerged. Only a few schools in the sample have one-to-one programs. Most schools have laptop or iPad carts or some devices (whether desktops, laptops or iPads) in classrooms. Most teachers across all settings reported having interactive whiteboards. Document cameras, which were frequently used with the interactive whiteboards, were also common. All the schools have Wi-Fi, with most teachers across the various settings reporting some issues with Wi-Fi connectivity, especially around testing times. A few schools in each setting allow students to use their mobile phones in the classroom. Additionally, some teachers reported bending the rules and allowing students to use their phones, especially when Wi-Fi connectivity issues arose.

The types of technology usage also reflected consistency across school settings. All teachers reported having their students watch videos, whether for instructional purposes (e.g., Discovery Education, YouTube), as an informal assessment (e.g., BrainPOP) or as a quick brain break (e.g., GoNoodle). Another common use was having students access educational websites and apps as part of gathering information for research projects, practicing skills, or building upon existing knowledge. Most teachers reported using technology for lesson planning and for communicating with parents. In some cases, teacher-parent communication took place through behavior management/communications tools such as Class Dojo or Seesaw. The reported use of these types of systems was not as high among teachers in suburban schools. Finally, a few teachers in each setting reported using technology (e.g., SuperTracker, pedometers) to track students' health-related and physical activity behaviors.

Attitudes and Experiences About Using Technology to Assist with Classroom Teaching

Most teachers reported positive attitudes toward and experiences with various forms of technology, which they found to be useful in keeping students engaged. However, health and physical education teachers reported facing more issues regarding access to adequate technology and professional development than did classroom teachers. The perceived disparity was identified as an important concern by many health teachers, and was also reported by them in more general discussions of the use of technology in the classroom and for professional development.

Health and physical education teachers. As mentioned previously, the health and physical education teachers who participated in the focus groups regularly incorporate technology in their lessons. Examples cited included using MyFitnessPal and SuperTracker to track food consumption and physical activity, as well as websites such as kidshealth.org/teens and healthteacher.com, iPads, and pedometers. However, some teachers cautioned that technology has limits.

> *"Technology won't let you get a sense of what foods taste like, and if they try something three times, studies have shown that kids are more likely to acquire a taste and improve their diet."* (NY health teacher)

Overall, these teachers expressed the concern physical education and health, because they are not core academic subjects included in standardized tests, are not assigned the same level of importance when it comes to resource allocation. Many noted that the technology devices they were provided tended to be older models that were handed down from classroom teachers of core academic subjects, after their older devices had been upgraded to newer versions.

> *"Classroom teachers are getting updated [technology], and then you're asked if you want their old stuff."* (IN physical education teacher)

> *"Yeah, we get a lot of the leftovers."* (LA health and physical education teacher)

Similarly, several health and physical education teachers stated that they did not have the same level of access to the technology trainings or professional development offered by their school board or district because preference was given to classroom teachers.

> *"You have to fight for your place. They let classroom teachers know about [professional development] things first."* (LA health and physical education teacher)

Many also agreed that professional development opportunities specific to health and nutrition offered by their board or district were rare. Again, these tended to focus on core academic subjects, with health and physical education teachers forced to seek out relevant professional development opportunities on their own.

> *"I feel like sources are very scarce, and I feel like I have to attend a conference like [SHAPE] to get what I need."* (KY physical education and health teacher)

Core subject classroom teachers. While many teachers reported that they are not completely comfortable with technology, they agreed that without it students would be less engaged and less motivated. In addition to this beneficial impact on students, teachers reported that using technology helped them to keep class materials organized and accessible, and to communicate with their students.

Learning platforms such as Moodle and Google Classroom make it possible for students to access homework assignments and class materials anytime, anywhere. Teachers reported that these tools help them track assignments and provide rapid responses to student assessments.

> *"It's easy to keep track of homework and grade assignments right there through your computer. The kids can get almost instant feedback, especially on tests and quizzes. It helps to keep me organized, and when kids miss, you can always say: 'Go check the Moodle calendar and it will tell you exactly what we did that day."* (CO high school teacher)

In addition to facilitating their organizational and administrative tasks, teachers reported that technology can enable students to instantly follow a line of inquiry and encourage their scientific curiosity.

> *"I have an honors Earth Science class and we were doing something in astronomy, and the kids started freaking out about asteroids hitting the earth and that type of thing. They got online and they started looking at how close asteroids have come, how often meteorites have hit. Then they were looking at when the next meteor shower was. I saw two or three of them, and all of a sudden, [they said], 'Oh wait! I found blah-blah-blah.' Those kids were on track, looking up extra information. I was impressed."* (CO high school teacher)

Many teachers appreciated the convenience of having videos easily available (e.g., via YouTube) to enhance their lessons and help them convey complex information simply.

> *"You can find a three-minute video on YouTube that is worth your entire semester from what they can gain from it."* (FL middle school teacher)

Teachers explained that, in many cases, videos were not simply shown to students, but were used as a springboard for class discussion or to help students understand a complex problem or issue.

> *"We have been studying butterflies… I showed them a couple of really cool things. I showed them time-lapse photography of the process of going from caterpillar to chrysalis to butterfly, and they loved that!"* (CA, elementary school teacher)

Some of the elementary school teachers viewed devices with touchscreens as advantageous to kindergarten and first graders because their ease of use facilitates the test-taking process. One teacher reported a positive impact on students' test results.

> *"The PreK to 1st, we do find test scores are better if they can touch the screen versus tapping the mouse because they are learning how not to be so impulsive with the clicking. We get better test results if we use SMART Boards or iPads."* (OK elementary school teacher)

Student and parent access to technology outside of school. Most teachers reported that student and parent access to technology outside of school tended to be low and consisted mainly of cell phones.

> *"It's a high poverty area... Most of those parents have a smartphone. Most of them do not have a computer anymore because they've really gone to tablets and phones."* (NM elementary school teacher)

> *"We still have families here who don't have a computer. ... They all have cell phones, but they don't have any computers."* (DE elementary school teacher)

> *"A lot of parents have phones, but no computers."* (OK elementary school teacher)

> *"Our parents don't have internet access at home. ... They don't have a laptop."* (IN elementary school teacher)

School Processes and Policies Governing the Use of Technology at School

Many teachers noted that both teachers and students have to sign agreements with their school at the beginning of the school year which detail what is considered acceptable technology usage.

Policies on mobile electronic devices allowed in classrooms. A few teachers reported that their schools had or were going to institute, a "bring your own device" (BYOD) policy. Others reported that their schools currently do not allow students to bring their own mobile electronic devices to school. However, the policy on having cell phones in the classroom seems to be changing. Some teachers explained that their schools allow students to bring their phones to class but that, if the devices are used inappropriately, they are taken away either for the duration of the class or even for a few days. Other teachers reported that students are allowed to bring their phones but must keep them in their backpacks during class. In addition, some teachers admitted to unofficially allowing students to use their cell phones in class because of the multiple functions they serve (e.g., camera, audio recorder, more reliable Internet connection). Several teachers noted that this movement towards allowing cell phones in schools was due in part to the limited number of devices, Wi-Fi connectivity issues, and the concerns of some parents (who rely on cell phones to stay in touch with their children throughout the day, especially in emergency situations).

Policies on Internet filters. All the teachers reported that their schools use filters to block access to certain websites deemed inappropriate by the school district. Social media sites such as Facebook, Twitter, Instagram and Pinterest, along with gaming sites are typically blocked. Many teachers noted that YouTube, which used to be blocked, is now accessible to teachers and sometimes also to their students directly. With teachers' high use of videos as a teaching resource, this is not a surprising development.

> *"This is the first year that [students] have [been able to access YouTube, because [the district] felt that there's a lot of educationally relevant things on there."* (DE elementary school teacher)

Some health and physical education teachers mentioned that many of the sites they try to access are blocked. While teachers can typically request that a specific site be unblocked, some teachers expressed frustration about the process.

> *"I would have to go to the school board and ask them to unblock it and sometimes it is not worth it. By the time I get it, I would be past that lesson."* (LA physical education teacher)

Many teachers also mentioned that students often find a way to get around the filters and access the blocked sites.

Decision-makers regarding the types of technology allowed in the classroom. According to the teachers, decisions about technology in the classroom are made at the district level, with some districts allowing schools more flexibility than others, as evidenced by the range of policies on mobile phones stated previously. Although concerns remain about technology being a distraction in the classroom, its educational potential has begun to outweigh these concerns. For instance, if students can use their mobile phones to do research, as calculators or to participate in multiple-choice games in class, they become valuable educational tools. The challenge for teachers is to discourage non-relevant uses of technological devices that students are allowed to use for educational purposes.

Problems can also arise when teachers want to show film clips, play music or use other media that are available through sites that are blocked.

> *"The other day I wanted a sunflower pattern. I had to print it at home because they blocked the site here at school."* (KY, middle school teacher)

The process of getting access approval varied, with some schools requiring formal requests submitted in writing to the district, which usually meant a lengthier approval wait time, while others simply required approval from the school's designated technology person.

Decision-making processes governing technology acquisition. Most teachers reported that purchases of new classroom software have to go through the school's media specialist or technology coordinator, who is often also the school librarian. The request is then brought to a district-level meeting.

> *"There has to be justification for a program. You can download stuff on your computer, but if it's something that's not something that you could just download yourself, something that costs money, it has to go through the district. It has to be okayed by someone in technology."* (DE, elementary school teacher)

Similarly, teachers reported that decisions about purchasing hardware are made by the districts, since such purchases typically require large amounts of capital outlay that must be approved. Many teachers reported that they could request technology grants for hardware for a specific educational purpose.

Schools' Technological Capabilities and Equipment

Hardware available and accessible in schools and classrooms. Teachers reported a variety of devices being used in classrooms. Those mentioned most frequently included interactive whiteboards, document cameras, laptop computers, desktop computers and iPads.

Most of the teachers did not work in schools where every student has a device, and most agreed that this would be the ideal situation. Many of the schools where they taught have mobile carts with laptops or iPads that circulate around the school. Teachers are required to sign up to use the cart at particular times, and the devices are not always available. Teachers from a small number of schools reported that they were currently in the process of transitioning to a one device per student (one to one) model. Many teachers saw this as a trend in the near future. As previously stated, although mobile phones were initially prohibited in most classrooms, teachers reported that many districts are changing their policies to allow students to use them for educational purposes in class.

Some teachers reported that their computer labs were beginning to be replaced by the availability of computers in the classroom. According to these teachers, computers were often kept in one part of the classroom and used by small groups of students in rotation with other activities.

Other hardware identified by teachers included projectors, iPods, speakers, clickers, pedometers, camcorders, the Wii, netbooks and Apple TV.

Software available and accessible in schools and classrooms. In this report, software refers to any applications or programs that are housed or accessed via the hardware. Teachers reported using a wide variety of software with their students. The most frequently mentioned included: YouTube (for videos), PowerPoint (for student presentations), Google's suite of productivity tools such as Google Classroom, Drive, Docs (for classroom collaboration and sharing), Seesaw (for student driven digital portfolios), GoNoodle (for short, desk-side physical activities), Class Dojo (for classroom management), Starfall (for learning to read) and Discovery Education (for digital textbooks and standards-aligned curricular resources).

> *"…they log into their Google classroom. I don't give paper worksheets. It's all online, so it's already assigned to them. They already have their name on their worksheet. They just answer the questions, type it all in, hit submit, I get it, I just grade it online. We do all our projects online too. So on a daily basis, we use technology."* (AZ high school teacher)

> *"We do a lot of SMART Board. Some of our textbooks have supplemental instructions that you can use, and they'll have an exercise that you can pull up for the whole class to see. Maybe a video to go with it, or a song... Last year, I used a lot of videos from YouTube."* (DE elementary school teacher)

> *"Sarah turned me on to GoNoodle, and I use it a lot during math testing. To break it up in between, we do GoNoodle, which gets us up and moving around, gets the brain moving. Then back to the timed tests."* (OK elementary school teacher)

Teachers' Recommendations Regarding FNS Creation of Digital Materials

Towards the conclusion of the focus group interviews, teachers were asked what advice they would give to FNS about the creation of nutrition-related digital materials for teachers. Teachers expressed that materials should:

Include interactive games. Many teachers referenced students' love of interactive games, and recommended developing a game around the topic of health and nutrition. They suggested the game be about what it is to be healthy and what one needs to do to be healthy (e.g., how many hours of sleep are needed, how many servings of fruits and vegetables a day should be eaten). They believed that their students didn't know this type of information. Teachers also suggested that the game should demonstrate the consequences of not having good habits and thus not being healthy.

> *"Maybe some time lapse thing where you could show if you don't eat healthy and brush your teeth, this is what your teeth are going to look like 10 years from now."* (CA elementary school teacher)

One teacher also noted that having a point system would be a motivating factor for students.

> *"They will work harder for it, they like to beat their highest score."* (OK elementary school teacher)

One teacher suggested that the game be self-guiding, so that students could play independently.

Include a hands-on component. While understanding that materials would be digital, several teachers still also stressed the need to have a more concrete, physical piece, something the students can handle and manipulate.

> *"I want to suggest that it also be 'hands-on," not a worksheet, but something they can manipulate in addition to the technology."* (OK elementary school teacher)

> *"Anything that kids have hands-on with, it's going to be fun. They're going to remember it. They're going to learn it, rather than a worksheet."* (CO high school teacher)

> *"[Have] some technology but other materials for active learning. We want something kids can touch and learn, not just reading materials online."* (LA middle school teacher)

Include videos. The use of short videos to enhance instruction is a prevalent and popular strategy used by many of the teachers.

Work well and be easy to use and navigate. Teachers emphasized that whatever resources were created should be free of glitches and malfunctions, and should work as intended. Resources should also be easy and straightforward to use. For example, if a login is required, the process should be simple and swift. The resources also should be well laid out so that navigating through them and finding things is easy and intuitive.

Some teachers expressed a preference for the materials to be located in one central location.

> *"Have everything included. If it's going to be like an application, have everything all in one place so you don't have to go from this app to this app to try it."* (NM elementary school teacher)

Teachers also cautioned that, should there be downloadables, the file sizes should not be excessive.

> *"It's not something that you can say, 'download this massive file."* (FL middle school teacher)

Be ready for use. The materials should be ready-made, requiring minimal prep time from teachers.

> *"They're shelf-ready so the teacher doesn't have to do any extra planning. It's, 'here it is, teach this."* (OH middle school teacher)

> *"It must come ready for me to use. I cannot- I have no time to make one more thing."* (OK elementary school teacher)

Fit into existing curricula, and standards. The materials should fit in with and be easily integrated into the existing curriculum of core subjects (e.g., English Language Arts).

> *"I don't have time to go into a health and nutrition piece. I agree it's important. It needs to be woven in with math, science or reading – it must be integrated."* (OK elementary school teacher)

> *"We can pull our own materials in ELA as long as you're still teaching whatever the concept is...Health stuff can be incorporated into that too, depending on what you're studying."* (DE elementary school teacher)

Additionally, teachers were adamant that all the materials they use have to be tied to standards.

> *"If it's not a standard, I have no time for it."* (OK elementary school teacher)

> *"Get it aligned with our standards so you know where exactly it would fit in with your lessons/instruction."* (CA elementary school teacher)

Teachers of health and physical education expressed that teachers of core subjects need to receive training on how to incorporate health/nutrition content into their curricula. Several core subject teachers also brought this up independently.

Be very flexible. Teachers expressed the need for materials to be flexible in several ways. They wanted materials that can be accessed and used across a variety of devices, such as interactive white boards, computers, tablets, and phones. As such, they felt that Internet-based resources would work best. They also wanted materials that could be used with both individuals and groups. The materials should also be available for a range of reading levels, to accommodate varying levels of reading ability, and in additional languages, especially Spanish.

B. Survey Research with K–12 Health Educators

The following section details findings from the Environmental Scan Teachers of Health Education Survey.

Technology in the Classroom

Videos and Internet are the most frequently used technologies by these K–12 health educators.

Teachers were asked to indicate which of 16 technologies and/or digital pedagogies they use with their students. Teachers provided an average of 5.6 responses (range = 0-13). The most common responses were: "showing videos to your class" (n=52, 85.2%), "website visits" (n=43, 70.5%), "Internet searches" (n=41, 67.2%) and "YouTube" (n=41, 67.2%). Interestingly, the four most common responses can be collapsed into two categories – Video Use and General Internet Use. Nearly all of the teachers reported either "YouTube" or "showing videos to your class" (n=56, 91.8%), and most teachers reported either "website visits" or "Internet searches" (n=51, 83.6%). Conversely, only one teacher reported using e-books or videoconferencing technology with their students.

Table 4.2

Technologies and/or Digital Pedagogies Teachers Reported Using in the Classroom

Technology Used	Response %	Response Count
Showing videos to your class	85.2	52
Website visits	70.5	43
Internet searches	67.2	41
YouTube	67.2	41
Music	42.6	26
Word processors/desktop publishing	41.0	25
Online lessons	37.7	23
Smart Board/interactive white boards	32.8	20
Video creation projects/assignments	29.5	18
Downloadable PDFs	27.9	17
Touchscreen apps	18.0	11
Social Media (Facebook, Twitter, etc.)	13.1	8
Learning Management System	13.1	8
Photography and/or photo editing	9.8	6
Other	4.9	3
E-books	1.6	1
Skype or other video conferencing	1.6	1

Devices. More of the health educators in the survey use PC laptops and iOS touch screens in their classrooms.

Teachers were asked to indicate which specific devices (from a list of eight) that they used in their classrooms. The most common devices reported were PC laptops (n=27, 44.3%) and iOS touch screens (n=24, 39.3%). Chromebooks, which were not included on the list of devices on the survey, were reported by 9 teachers (14.8%). Nearly all the teachers reported using some kind of computer, including the Chromebook (n=55, 90.2%), and most reported using some kind of touch screen (n=43, 70.5%).

Table 4.3

Frequency of Reported Use of Classroom Devices

Device	Response %	Response Count
PC Laptop	44.3	27
Touch Screen – iOS	39.3	24
PC Desktop	27.9	17
Mac Laptop	27.9	17
Touch Screen – Microsoft	24.6	15
Chromebook	14.8	9
Touch Screen – Don't Know	9.8	6
Touch Screen – Android	6.6	4
Mac Desktop	4.9	3

Teachers reported using an average of 1.98 types of devices (either a computer or touch screen) in their classroom (range = 0-4). Only one teacher in the sample reported not using either a computer or a touch screen in their classroom.

Browsers. Most of the health teachers in the survey use Chrome as their browser.

Teachers were asked to indicate which browsers they used with their students in the classroom. Teachers provided an average of 1.49 responses (range = 0-3), with the majority of teachers reportedly using Google Chrome (n=54, 88.5%).

Table 4.4

Frequency of Reported Browsers Used

Browser Type	Response %	Response Count
Chrome	88.5	54
Internet Explorer	26.2	16
Safari	29.5	18
Firefox	4.9	3

Video Players. Many of the health teachers surveyed still use DVD and VHS players.

Teachers were asked to indicate which type of video players (from a list of three) that they use in their classrooms. Teachers provided an average of 1.56 responses (range = 0-3), with the most frequent response being "DVD Player" (n=44, 72.1%). Interestingly, slightly more than half of the sample reported using online video players (n=33, 54.1%) and more than a quarter still reported using a VHS player (n=17, 27.9%).

Table 4.5

Frequency of Reported Use of Video Players

Answer Options	Response %	Response Count
DVD Player	72.1	44
Streaming/Internet Players	54.1	33
VHS Player	27.9	17
I don't know	1.6	1
Teacher Tube	1.6	1

Attitudes Towards Using Technology

The health teachers who were surveyed felt positively about technology's impact on their teaching and students' learning.

Teachers were asked to indicate their level of agreement (on a 5-point Likert-type scale from "Strongly disagree" to "Strongly agree")," with a series of 12 statements. The following chart shows both the distribution of responses and the mean rating score for each statement.

Table 4.6

Teacher Agreement with Attitudinal Statements

Statements	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Mean Rating*
The administration at this school supports the use of technology in the classroom and with students.	0.0%	1.7%	5.0%	26.7%	66.7%	4.58
Using technology to teach my students helps enhance student learning.	0.0%	1.7%	20.0%	41.7%	36.7%	4.13
Using technology to teach my students increases my productivity as a teacher.	0.0%	1.7%	20.0%	45.0%	31.7%	4.08
Using technology to teach my students enhances my effectiveness as a teacher.	0.0%	1.7%	23.3%	43.3%	30.0%	4.03
Using technology enables me to cover more material in my classes.	0.0%	0.0%	35.0%	31.7%	30.0%	3.95
I actively look for new ways to use technology to support my teaching.	0.0%	11.7%	20.0%	45.0%	23.3%	3.80
Learning to use technology is easy for me.	3.3%	10.0%	21.7%	48.3%	16.7%	3.65
There are adequate professional development opportunities for me to learn about using technology in my teaching.	1.7%	16.7%	25.0%	38.3%	18.3%	3.55
I find it easy to use technology to do what I want to do.	0.0%	13.3%	26.7%	51.7%	8.3%	3.55
I find technology easy to use.	3.3%	8.3%	31.7%	48.3%	8.3%	3.50
It is easy for me to become skillful at using technology.	1.7%	11.7%	31.7%	46.7%	8.3%	3.48
My interaction with technology does not require much effort.	0.0%	23.3%	25.0%	43.3%	6.7%	3.34

*Mean score is calculated by assigning a value of 1 to "Strongly Disagree" and increasing the value for each subsequent response on the scale up to 5 for "Strongly Agree."

Three interesting trends emerged from teachers' responses to the attitude questions.

First, the statement with which the most teachers strongly agreed was about administrative support for the use of educational technology. Two-thirds of teachers responded "Strongly Agree" and another 26.7% responded "Agree," for a mean rating 4.58.

Another trend is the high frequency of agreement among the teachers that educational technology helps students learn and teachers teach more effectively. This is evidenced by the high mean ratings observed on four statements: a) *using technology to teach my students helps enhance student learning* (mean rating=4.13); b) *using technology to teach my students increases my productivity as a teacher* (mean rating=4.08); c) *using technology to teach my students enhances my effectiveness as a teacher* (mean rating=4.03); and d) *using technology enables me to cover more materials in my class* (mean rating=3.95). These ratings were higher than all other statements, other than the statement about administrative support. Further, only one teacher responded "Disagree," and no teachers responded "Strongly Disagree" to any of these four statements.

The third overall trend observed in the data is that teachers continue to need support to learn to integrate educational technology. This is evidenced by the lower average rating of the final six statements about the ease of using educational technology and the adequacy of available professional development. Whereas no greater than 1.7% of teachers replied "Strongly Disagree" or "Disagree" to any of the questions about the efficacy of educational technology and administrative support, between 11.7% and 23.3% indicated some level of disagreement with the statements about ease of integration, adoption and understanding.

It is important to note that there is not a large difference in the average teacher rating of agreement between the highest and lowest rated statement (1.24). Further, 50% or more of the participating teachers responded "Agree" or "Strongly agree" to all of the statements. Nevertheless, the clear clustering of responses provides compelling evidence to support the trends described above.

Time with Devices

Showing videos and presenting information to students take up the bulk of the time teachers spend using technology.

Teachers were asked to enter the approximate number of hours each week they spend using educational technology to complete four specific tasks (see Table 4.7 below). Teachers reported spending the most time using technology to show videos and present information (mean=6.11, SD=8.23). These responses support the survey findings discussed above.

Table 4.7

Average Weekly Hours Spent Using Technology for Select Tasks

Task	*M*	*SD*	*Mdn*	*Min*	*Max*
I use electronic devices to show or demonstrate information in class.	6.11	8.23	3	0	35
Students use electronic devices to complete class work.	2.31	4.01	1	0	20
I use emails, websites, or social media to communicate with parents/caregivers.	2.11	2.45	1	0	10
I use emails, websites, or social media to communicate with students.	1.96	3.41	1	0	20

There was considerable variation in teachers' responses to these questions, as evidenced by the wide range of hours reported and the large standard deviations as compared to the mean scores. For example, some teachers reported spending 0 or 1 hour per week using devices "to show or demonstrate information," while others said they spent 25 or 35 hours. While the majority of teachers reported in previous sections that educational technology is available and they believe in its potential to improve learning, the median number of hours spent per week on these four tasks was between one to three hours. The discrepancy between availability and potential vs. actual classroom use may be related to the earlier finding that professional development and support is still needed to align teachers' attitudes and beliefs about educational technology with their teaching practice.

Technology Use for Health Education

Teachers most commonly use videos and websites or apps tracking food consumption or physical activity to help students implement changes in their eating and physical habits.

Scarcity of devices, time constraints and unreliable Internet connection were the barriers cited most by teachers as barriers for using technology in the service of health education.

Teachers were asked two open-ended questions about their experience using educational technology.

The first question required teachers to indicate three ways in which they use technology *to help kids change their eating and physical activity habits*. The two most common responses were videos (n=17, 31.4%) and websites or apps that track students eating or physical activity (n=15, 27.8%). Six teachers also mentioned MyPlate materials or ChooseMyPlate.gov (11.1%), and one teacher referred to the food pyramid.

Teachers were also asked to identify *three barriers to using education technology to teach health education.* While teachers provided a range of responses, the three most common were: access to enough devices for their students (n=17, 31.4%), time to use technology (n=12, 22.2%) and consistent internet connectivity (n=12, 22.2%).

C. Interviews with State Educational Technology Directors

Seven individual interviews were conducted with six officials at the state level and one superintendent at the district level to supplement the data collected from teachers. Interviews were conducted with individuals from California, Connecticut, Iowa, New Jersey, Oklahoma, Texas and Wisconsin. State educational technology specialists are responsible for providing recommendations regarding the acquisition and use of various forms of technology in public schools. State governments set policies, but they do not make decisions about technology purchases or specific types of technology use at the district level. District superintendents are responsible for district technology plans, which are usually formulated in consultation with teachers, technology specialists and other district-level stakeholders. These plans must be approved by school boards, who allocate the funds necessary to purchase technology, both hardware and software.

Findings from these interviews are generally consistent with those from the focus groups and surveys.

States' Educational Technology Policies

State technology specialists confirmed that technology policies are decided by the school district. Since schools are operated on a district level, separate from state rule, it is the responsibility of school districts to decide how to implement state curriculum standards and assessments. For example, New Jersey's state technology plan includes a specific technology standard that all students must be proficient in technology by eighth grade. Schools decide how to fulfill and meet those standards established at the district level.

How Technology Purchasing Decisions Are Made

Funds for the purchase of technology come from several sources:

- The federal government funds some technology purchases under ESEA (Elementary and Secondary Education Act) and IDEA (Individuals with Disabilities Education Act);
- State governments allocate funding to school districts, and some offer competitive funding to encourage the use of digital resources;
- School districts fund technology through property taxes; and
- State and local grants

Final decisions regarding technology purchases are made at the district level. Before the district school board makes a decision, designated school personnel meet to discuss how best to proceed with a technology plan. The team responsible for designing the technology plan typically includes a principal, the superintendent, a few teachers and a technology specialist. This team then communicates the school's needs to the school board, and the school board determines how to proceed.

Types of Technology Available in Schools

State educational technology specialists noted the growing presence of Chromebooks, especially in middle schools, as a more affordable alternative to MacBooks and other mainstream laptops. They also highlighted iPads as beneficial for elementary school students because iPads don't require a mouse, trackpad or keyboard. Oklahoma's Howe School District has implemented a three-to-one iPad to student ratio in elementary school, a provision that will allow younger students to work with technology before they enter middle school.

Challenges of Technology Integration

The educational technology specialists identified some common challenges to the integration of technology in schools. These included:

- A wide range of bandwidth capabilities. In some rural districts (e.g., rural districts in Iowa and Wisconsin), the broadband connection is not as strong as it is in metro areas. Connectivity issues generate technical problems for schools and aggravation for students, teachers and administrators.
- Lack of funding. Technology is a huge cost for schools. Schools need to establish refurbishment plans in order to keep all of the technology and Internet connections up-to-date. Professional development and teacher training in technology are also expenditures for schools.
- Lack of equity in technology. Equity issues identified by the participants include: access to technological devices, broadband, amount of time students have access to technology, teachers' abilities and comfort levels with technology in the classroom and the provision of rich learning experiences.
- Steep technology learning curve. Some teachers are very interested in technology, use it in their classroom, and are eager to learn more ways in which they can integrate different platforms and programs to engage their students. Others are intimidated by or uncomfortable with technology, and less likely to use it in the classroom.
- Integration of technology across subjects is inconsistent and disjointed. Teachers need to be able to combine technology and curriculum in a sensible, effective manner. Additional resources and training for teachers are needed to equip teachers to more effectively integrate technology and curriculum.

Successful Uses of Educational Technology

State educational technology specialists were asked to describe examples they had seen of successful implementations of educational technology that they had personally observed. Examples identified by the participants included:

- Student-centered approaches – which engage students and enable creativity and expression. For example, a teacher can assign students a task and allow them to complete the project with whatever software program they choose, as long as they meet the criteria.
- Blended formats – where classes are taught partially online and partially in-person. Students have the benefit of learning on their own devices or in the classroom with a teacher.
- Customizable software programs – which allow teachers to develop curriculum individually and personally. Specific programs, like Discovery Education and Atomic Learning, enable teachers to pick and choose different features that they want to incorporate in the classroom. These programs provide lesson plans, short videos (5-6 minutes long at the maximum), and other interactive features that can bring a real-world element inside the classroom to students.
- Maker movements and initiatives (inside and outside the classroom) – which interest and attract students. The Makerspace movement allows students to be creative without academic and educational pressures[2]. In Wisconsin, one district created student training squads and student technological support teams to help with technical issues that arise within the classroom. This makes students feel that technology has an important role to play in their educational experience inside and outside of the classroom.
- One-to-one programs – which promote flexibility. Students can work away from their desks in a more collaborative fashion when they each are provided with a device. One-to-one technology encourages student-centered learning and creative thinking within the classroom.

[2] Makerspaces are defined as "gathering places for tools, projects, mentors and expertise" ("Makerspace-Playbook-Feb-2013.pdf," n.d.).

D. Conclusions from Formative Research Findings

Findings from the formative research confirm that technology is an integral part of students' and teachers' daily classroom experiences. All the teachers who participated in this study reported using some technology in their classrooms. All their schools were equipped with Wi-Fi, and most teachers (across urban, suburban and rural settings) reported encountering Wi-Fi connectivity issues, especially during state testing periods. Teachers agreed that using technology, especially interactive technology, increases student engagement, enabling students to become active participants in their learning and more accurately reflecting the practices they inhabit in the world outside school.

Teachers reported using a variety of technologies – including interactive whiteboards, document cameras, laptop and desktop computers, tablets, learning and behavior management systems, game-based learning platforms, and, of course, Internet – to enrich the instruction they provide to students. Some teachers who participated in the survey reported that they still use DVD or VHS players to show videos. More similarities than differences were found across schools and settings regarding the use of technology, and teachers from all schools and settings identified similar barriers and facilitators to the use of technology in school.

Technology also plays a role in teachers' communication with students' families, making it easier to keep them connected and apprised of what their children are doing in school. However, many teachers stated that maintaining this home-school connection remains challenging, especially in the higher grades. Many teachers reported that their students' parents rely exclusively on mobile phones for digital communication – and do not have access to computers or Internet at home.

Teachers expressed a need for more professional development around the use of technology and how to best incorporate it into their instructional practice. Additionally, teachers responsible for health and physical education reported having fewer professional development opportunities available to them than do core subject teachers. Findings indicate that health and physical education teachers face specific challenges with regard to technology. Since they are not teaching core subjects, and there are no standardized assessments for measuring achievement, health and physical education are not a priority for funding by districts. These teachers reported that they have less access to technology than core subject teachers. Further, the technology that is allocated to them is often outdated, having been passed down from core subject classroom teachers, who received new devices.

Interviews with state- and district-level educational technology specialists confirmed that decisions regarding technology purchase and use occur at the district level. Challenges to the successful integration of educational technology in school remain and include: bandwidth capabilities, funding, costs, issues of equity around devices, broadband, students' time with technology, teachers' abilities and comfort levels with technology and the provision of rich learning experiences. They also acknowledged that the learning curve for technology may be steeper for some teachers, and that the integration of technology into all classrooms subjects is inconsistent and disjointed.

E. Prioritized Recommendations

Introduction

The findings from both the Environmental Scan literature review and formative research are complementary and aligned. These combined findings provide a comprehensive and cohesive description and understanding of educational technology in U.S. public schools. Importantly, the Environmental Scan findings provide clear implications for FNS.

Recommendations are organized in four categories emerging from the research. These categories include: recommendations for the distribution and delivery of FNS technology-based educational materials; recommendations for developing effective FNS materials aligned with school educational technology use; recommendations for the marketing of FNS materials; and recommendations to increase the use of FNS materials. The recommendations are offered as a directional resource for use in FNS decision-making and strategic planning.

Category 1: Recommendations for the Distribution and Delivery of FNS Technology-Based Educational Materials

These recommendations are based on findings on technology access in schools and in households with school-age children.

Align strategies for distribution with the context of technology access in schools and households with school-age children.

To ensure access and reach among school-age children, as well as other target audiences:

- Target distribution of FNS materials to environments that provide school-age children access to digital technology outside of the home: specifically, schools and/or school libraries.
    - Target teachers, students and librarians as primary user groups.
    - Target teachers as the gatekeepers to reach students.

Align strategies for design and delivery with the context of technology access in schools and households with school-age children.

To ensure access to materials, whether materials are intended for distribution *in school, or out of school:*

- Design materials to be accessible, and usable, across the full range of Internet-connected devices.
    - Ensure that digital materials are accessible across the full range of devices: computers, tablets and smartphones.
    - Optimize design for cross-platform (iOS and Android) mobile access.

To ensure access to materials intended for use *in classrooms:*

- Ensure that materials are usable without an Internet connection.
    - Provide materials in formats that do not require Internet connectivity or streaming for use.
    - Materials disseminated online for classroom use should be downloadable to enable offline use.
- Provide materials in formats that teachers can access on a dedicated classroom computer and use for display on an interactive whiteboard or digital projector.

To ensure access to materials intended for use *outside of classrooms:*

- Ensure that materials are accessible, and usable, in the context of constrained technology access.
    - Optimize design for mobile delivery, access and use.
    - Optimize design to support access and use with constrained Internet access, including limited connectivity and limited mobile (cellular) data capacity.

Category 2: Recommendations for Developing FNS Material Aligned with Educational Technology Use in Schools

These recommendations are based on findings on the use of technology for instruction and communication; findings on teacher/student preferred and expected educational digital content; and findings on academic curricula and nutrition education.

Develop materials that are easily adaptable for teachers' flexible use in a variety of learning contexts.

- Develop stand-alone lessons and activities in both short formats (15 minutes or under) and longer lesson formats.
- Develop materials for use on interactive whiteboards.
- Provide materials in document formats commonly used by teachers for class presentations and assignments (or design materials to be easily converted into these formats).
    - For student assignments: Microsoft Word and Google Doc.
    - For class presentations: Microsoft PowerPoint, Google Slides and Prezi.

- Develop a catalogue of FNS digital materials including offerings that can be integrated into a variety of instructional strategies.

    - Provide materials that can be directly applied, or easily adapted to: project-based; collaborative; constructivist; hands-on; and game-based learning activities.
    - Include offerings in a variety of forms, particularly those that are most engaging for students and most predominant in the current landscape: Interactive lessons, apps, interactive infographics, video and games.

Strategically align materials with current technology integration, learning models and technology-based pedagogical approaches including nutrition education.

- Leverage the use of in school and cafeteria digital screens and monitors.

    - To provide nutrition and health information and short form educational material to increase reach and frequency of exposure.
    - Consider combining with materials that can be used in conjunction with tools used to track, rate, etc.

- Leverage current practices for digital communications between schools, teachers, parents, educators, and students via text-messaging platforms (e.g., *Remind*) and/or digital notification platforms (e.g., *SchoolMessenger*) that provide a bridge between school and home, in order to extend the reach and impact of FNS materials for learning about health and nutrition.
    - Platforms that reach younger children such as *READY4!* and *ReadyRosie* could integrate early childhood FNS materials.

- Strategically align materials with the most applicable current technology-based learning models and pedagogical approaches.

    - Blended learning:
        - A combination of student direct use of online instruction or digital learning tools, with teacher mediated classroom experience, blended learning is an optimal configuration for effective and interactive learning experiences.
    - Materials that provide teachers with performance feedback are becoming the standard.
        - Develop instructional materials that include formative assessment, as a product feature, to provide performance feedback to students, teachers and parents.

Category 3: Recommendations for Marketing FNS Materials.

These recommendations are based on findings on educational technology product marketing, distribution and the need for teacher and school librarian professional development.

Raise FNS visibility in the educational community. In order to raise awareness and to attain broad distribution of FNS digital materials:

- Disseminate FNS materials on OER and other resource websites for teachers and librarians.
  - Disseminate digital materials on popular OER websites used by educators, e.g., Khan Academy, Peer-to-Peer University, Institute for the Study of Knowledge Management in Education (ISKME), Open Education Consortium, and The Orange Grove.
- Apply current marketing search optimization practices to increase discoverability of online materials.
  - Cross-post health and nutrition materials under the variety of relevant resource categories featured on a given resource website (e.g., post materials under "science" categories as well as "health" categories).
  - Conduct keyword research to identify and apply the actual keywords that audiences enter into search engines to find content that represents FNS digital materials.
- Increase FNS participation and promote FNS materials at conferences that are relevant to teachers, librarians, and the education technology community.
  - Showcase, present, and promote FNS materials at conferences for teachers and librarians, including: the American Educational Research Association (AERA); American Library Association (ALA); Early Education and Technology for Children (EETC); International Society for Technology in Education (ISTE); and the National Association for the Education of Young People (NAEYP).
  - Present at conferences, including panels, workshops, poster sessions, and in the resource areas.
- Increase FNS social media participation and presence.
  - Promote the availability and use of FNS digital resources on social media platforms used by educators and students (e.g., Blogs, Facebook, Twitter, Pinterest and Instagram).
  - Include hashtags (the label used in posts or tweets on social network sites to create searchable and clickable links with a specific theme or content, e.g., #TeamNutrition or #myplate) when posting content on Facebook, Twitter, and Instagram.
  - Create an online bulletin board (similar to Pinterest) and/or a listserv where teachers can share innovative uses of FNS digital materials, post comments and ask questions.
  - Apply social media listening strategies to track teachers' reactions, questions and new ideas for health and nutrition education.

Category 4: Recommendations for Increasing Teachers' and School Librarians' Use of FNS Materials

Align materials with core curricula.

- Create materials that can be assimilated into the curricula of core subject classes and align with Common Core standards.
  - Develop FNS educational materials including science and math educators as core members of the production team to ensure effective alignment and integration with core curriculum.

Ensure that materials are easy to use.

- Create materials that are both intuitive to use and usable "out of the box" (i.e., that require minimal advance preparation).
  - Include user testing throughout the product development cycle to ensure ease of use, as well as usability across various devices.

Provide professional development for teachers and librarians on the use of FNS digital material.

- Train teachers and librarians to access and integrate FNS digital resources into their core curricula teaching.
  - Provide in-person training workshops at educational conferences.
  - Provide virtual training workshops in the form of webinars, that are easily recorded and archived for distribution on the FNS website, and/or social media channels, YouTube, and other sites frequented by teachers searching for resources.
  - Produce demonstration videos.
  - Invite educators to submit videos showcasing their use of FNS materials.

CHAPTER V
RECOMMENDATIONS AND COST ESTIMATES FOR THE CONVERSION OF SELECTED TEAM NUTRITION MATERIALS

The prior chapters present the findings and implications of the environmental scan literature review and formative research as well as prioritized recommendations. The environmental scan provides a comprehensive understanding of the external environment of educational technology in U.S. public schools. The environmental scan is designed as a resource to inform FNS decision-makers on the overall development of technology-based nutrition education.

This chapter provides recommendations, specifically, for converting select existing Team Nutrition materials to formats consistent with the effective use of feasible and accessible educational technology delivery mechanisms identified in the findings of the literature review and formative research. An outline of cost estimates for the recommended conversions is included. The select existing Team Nutrition materials include *Serving Up MyPlate: A Yummy Curriculum and Nutrition Voyage: The Quest to Be Our Best Curriculum.*

The chapter is organized in three sections. Section A. provides overall recommendations for the delivery and conversion of the existing materials. Section B. provides recommendations for the conversion of selected lessons from *MyPlate* and *Nutrition Voyage,* provided as examples. Section C. provides outlined cost estimates for conversion.

A. Recommendations for the Delivery and Conversion of the Select Team Nutrition Materials

As stated, the recommendations are aligned with the findings of the literature review and formative research presented in Chapter III and IV of the report. Recommendations, by definition, are characterized by the application of knowledge and insight to novel situations. Several key overall findings provide strategic guidance for recommendations.

These key findings and implications include, but are not limited to, the following. The existing common technology resources available across classrooms include a computer and a whiteboard for classroom projection. However, additional educational technology use is common, although the technology available and the level of student access varies considerably at the local level. In addition to a classroom computer and whiteboard, classroom educational technology use is widespread and characterized by the use of the full range of technology and devices and the range of availability for student access. Therefore, to ensure effectiveness and access, the recommendations for *MyPlate* and *Nutrition Voyage* curricula conversion include the development of digital materials that are compatible for use with whiteboards and across the entire range of Internet-capable computing devices (i.e., smartphones, tablets, computers, and laptops).

Additionally, it is recommended that material be designed for a variety of student configurations, including whole class, small groups and individual settings. Developing material that satisfies these criteria significantly increases access and educational impact.

The conversion of content to digital interactive forms, educationally appropriate to specific learning goals and activities, is critical in order to fully leverage student involvement and the educational opportunities of technology.

Responding to educators' needs for adaptable and flexible material ensures access and increases impact. For example, incorporating mini-lessons, defined as short lessons of 10-15 minutes, focused on a single learning objective or skill will increase teachers' ability to implement and weave FNS content into existing curricula.

The following recommendations are provided to maximize FNS material use, access, and educational impact and effectiveness. Recommendations have been determined to meet the requirements for developmental appropriateness. Additionally, recommendations have been vetted by educational technology product designers and are deemed feasible and cost-effective.

Digital Conversion of *MyPlate* and *Nutrition Voyage*

Description of select Team Nutrition materials. *Serving Up MyPlate: A Yummy Curriculum (MyPlate) and Nutrition Voyage: The Quest to Be Our Best Curriculum (Nutrition Voyage)* provide students with the opportunity to learn about healthy eating, nutritious foods and the benefits of exercise. The existing FNS activities are engaging and inquiry-based. The curricula provide students with opportunities to work collaboratively and develop a day-to-day understanding about food, nutrition and exercise choices. Additionally, *the MyPlate and Nutrition Voyage* curricula provide teachers with classroom materials that assist with integrating nutrition education into Math, Science, English Language Arts and Health.

Serving Up MyPlate is comprised of three levels organized by grade:

- *Level 1 includes grades 1-2;*
- *Level 2 includes grades 3-4; and*
- *Level 3 includes grades 5-6.*

Nutrition Voyage is comprised of two levels organized by grade:

- *Grade 7 includes Trek 1, Trek 2, Trek 3; and*
- *Grade 8 includes Trek 1, Trek 2, Trek 3.*

Requirements for educational technology delivery mechanisms. The following technical requirements ensure the feasible and effective delivery of the digitally converted select FNS materials. These requirements are organized in two categories, including: the minimal technical requirements for delivery mechanisms to support the basic and common uses of classroom educational technologies; and the technical requirements for delivery mechanisms that afford flexible integration across the full range of classroom access to educational technology.

The minimal technical requirements for delivery mechanisms to support the basic and common uses of classroom educational technologies. These requirements include the following.

- Ensure that digital materials are converted for use on DLP and LCD projectors, interactive whiteboards, desktop and laptop computers.

- Ensure access to materials in learning contexts with limited Internet access.
  - Provide files that can be downloaded and stored locally on devices for "offline" use; and/or
  - Ensure that materials designed for online use do not require streaming of data-rich content (such as video).
  - Current FNS select curricula include student materials that are embedded in the PDF documents available for teachers online. Provide separate "standalone" materials for student activities, i.e., separate versions of digital materials formatted for direct access and use by students. This will ensure that digitally converted student activities: (1) may be easily adapted for teachers' flexible use in a variety of learning contexts; (2) may be easily integrated into a variety of instructional strategies; and (3) are available in a form that minimizes time and preparation burdens for teachers

The technical requirements for delivery mechanisms that afford flexible integration across the full range of classroom access to educational technology. These requirements include the following.

- Provide distinct sets of materials for each primary user group (i.e., for teachers and for students).

- Ensure ease of viewing and use across the range of screen sizes (i.e., smartphone, tablet, laptop, Chromebook, desktop computer, etc.).

- Ensure compatibility and ease of use across the various platforms and devices that may be available (e.g., Android and iOS mobile devices; Mac and PC desktop and laptop computers; notebooks and Chromebooks).

Recommendations for digital conversion of select FNS materials. Environmental scan findings identify recommendations for the digital conversion of three categories of FNS curriculum material consistent with the most effective, feasible and accessible educational technology delivery mechanisms. These recommendations include: the conversion of student handouts to interactive digital formats, the creation of an FNS video database, and the expanded use interactive games and activities. Findings indicate that interactivity promotes higher levels of student engagement. Additionally, increased interactivity is necessary for effective constructivist and collaborative learning. The following recommendations manifest these important findings.

Convert student handouts to interactive digital formats. The two select FNS curricula currently provide teachers with 24 handouts for student use: 17 handouts in *MyPlate* and 7 handouts in *Nutrition Voyage*. These handouts are embedded within the PDF documents provided for teachers. Teachers print and distribute the handouts to their students for use during lessons and activities.

Recommendations for conversion include the following.

- Convert the existing content-rich handouts to digital and interactive formats for student activity.
- Convert handouts to web-based interactive templates that may include questionnaire-like forms, drop-down lists, text fields for answers, interactive diagrams and illustrations.
    - These web-based, digital interactive templates would afford teachers flexible and adaptable use across the range of instructional strategies and available technologies. Teachers may adapt these web-based resources for use on a whiteboard for whole group instruction and/or use on devices for student individual or small group use.

Create an FNS video database. Findings indicate that teachers commonly and effectively use video for educational purposes, including; introducing new concepts; reinforcing content; and making topics relevant and relatable for students.

Recommendations for expanding the use of video include the following.

- Create an educational video library (video hub with a content management system) for *MyPlate* and *Nutrition Voyage* curricula with the working title *"FNS Video Vault."* An excellent example of a video library prototype is the format used for NBC Learn (http://www.nbclearn.com/portal/site/k-12). Teachers can incorporate these videos into various lessons to supplement instruction and enhance student learning. Some videos could function as virtual field trips, replacing expensive and time-consuming trips for schools and communities.
- The video library may include videos from the following sources:
    - Existing videos from FNS or external sources.
    - Videos created and submitted by students and teachers (following established criteria).
    - Videos developed by FNS on various educational topics, such as the benefits of healthy dietary choices and physical activity, cultural foods and culinary practices, food distribution from U.S. farms to grocery stores and farmers' markets, etc.

The two following examples illustrate how video can be integrated to supplement the select FNS curricula. The selected FNS materials described below include *MyPlate* Lesson 3: "Decisions, Decisions" for grades 5 and 6; and *Nutrition Voyage* Trek 3: "From Farm to You" for grade 8.

- *Ad Awareness:* Lesson 3, "Decisions, Decisions," for grades 5 and 6, teaches students the different techniques used by companies to sell their products and promote their ideas. Teachers can show students examples of advertisements that display these different techniques as preparation for the public service announcement activity students will complete that promotes healthy food choices and eating habits.

- *What foods do I like to eat? Where do these foods come from?:* Grade 8 Trek 3, "From Farm to You" incorporates lessons and activities about local agriculture and seasonality of fruits and vegetables. Teachers can show students videos about food processing and distribution at local farms, grocery stores and farmers markets. These videos engender further awareness, appreciation and knowledge for their food, inspiring better food choices and reduction in food waste.

Expand and amplify the use of interactive games. Findings indicate that teachers use interactive games to promote students' healthy food choices and engagement in physical activity. Additionally, findings indicate that gamification, the process of transforming knowledge acquisition into a game-like competition, is an effective pedagogical approach.

Currently, non-digital games are integrated throughout the *MyPlate* and *Nutrition Voyage* curricula. *Musical Food Groups,* a game similar to musical chairs, is included as a follow-up activity in Lesson 1, "Fun with Food Groups" for grades 1 and 2. Additionally, *Quiz Show* is a game to teach students in grades 5 and 6 about *MyPlate* and healthy eating habits.

The FNS select materials also include interactive games available online and/or on CD-ROM. These include *Blast Off!* Game (http://www.fns.usda.gov/tn/blast-game) and *Track & Field Fuel-Up Challenge Game* (http://www.fns.usda.gov/multimedia/games/trackandfield/index.html). These games are included as additional resources and presented as "Extra Helpings," designed to extend learning beyond the core lessons.

Recommendations for expanding and amplifying the use of interactive games include the following.

- Convert the *MyPlate Quiz Show* game to an interactive digital form modeled on the Jeopardy! and Kahoot game formats.
- Feature existing interactive digital games more prominently by including them in the "Main Course" location.
- Update lessons to integrate the *MyPlate Blast Off!* game into lessons across grade levels.

B. Recommendations for the Digital Conversion of Selected Lessons from Team Nutrition *MyPlate* and *Nutrition Voyage*

Recommendations for selected lessons

Recommendations for the digital conversion of selected lessons from *MyPlate* and *Nutrition Voyage* curricula are provided below.

"Serving Up MyPlate: A Yummy Curriculum," Level 1, Grades 1 and 2. Level 1 *MyPlate* curriculum provides inquiry-driven lessons designed to promote students' acquisition of nutrition terminology and awareness of healthy dietary practices, and to foster positive attitudes and creative thinking about healthy foods at an early age. The lessons provided in this curriculum introduce students to the five food groups through a variety of activities.

The selected activities for digital conversion of Level 1 curriculum are featured in the "Fun with Food Groups" lesson for grades 1 and 2. Activities in the "Fun with Food Groups" lesson provide students personalized learning experiences to increase their awareness of healthy foods and foster beneficial attitudes about food consumption. Digital conversion of selected activities described below contributes to the essential aims of the lesson, such as answering the questions, "What does it mean to be healthy?" and "What does it mean to eat healthy?"

Lesson: "My Food Card"

Currently, Lesson 1, "Fun with Food Groups" for grades 1 and 2, introduces students to the five food groups through a variety of activities. *The My Food Card* activity provides a handout where students write down a favorite food from each of the five food groups. Students also write their explanation for their their choice of each favorite food, and have an opportunity to draw pictures or make a collage of their favorite foods.

Recommendations:

- Convert *My Food Card* to a web-based digital interactive template
- Create an application designed for drawing such as *Doodle Buddy, Draw Free*, and/or *Kids Doodle,* affording students the opportunity to digitally draw pictures or make collages of their favorite foods.

The goal of converting this lesson is to provide students with the opportunity to have a digital hands-on and personalized learning experience.

"Serving Up MyPlate: A Yummy Curriculum," Level 2, Grades 3 and 4. Student activities in Level 2 are interactive and collaborative. Students may work together in creative ways to develop unique recipes, songs and skits. These types of activities are more meaningful than static, direct instruction style lessons and have the capacity to resonate more with students on multiple levels, including awareness and learning skills. Level 2 lessons build on previous knowledge from Level 1 lessons regarding the five food groups. Level 2 lessons also include the importance of regular exercise and healthy meals and snacks.

Lesson: "Snack of Champions"

Currently, Lesson 2, "You Be the Chef," for grades 3 and 4, continues teaching students the importance of eating a variety of foods from the five food groups. Students create a healthy, nutritious and tasty snack for athletes on the U.S. Olympic Team.

Recommendations:

- Students can complete the *Snack of Champions* activity as a class activity using an interactive whiteboard, with the teacher facilitating the discussion or using individual student devices independently or in small groups of two or three students to complete the lesson.
- Using a web-based resource, students can use a drag-and-drop feature or text fields to select the vegetable, fruit, whole grain, protein or dairy item needed for the meal and move it to the ingredients list.

This option would be ideal for students that need more guided or scaffolded learning experiences. Instructional options are important for the effective design of personalized learning experiences for students.

- Students explain how to make the recipe, why they chose the foods for the recipe, what athlete they decided to cook for and why they chose him/her.

This portion of the lesson is an open writing prompt aligned with grades 3 and 4 English Language Arts Common Core Learning Standards.

Lesson: "Food Writers"

Currently, Lesson 1, "We Are What We Eat," for grades 3 and 4, teaches students about making healthy choices, including food choices and exercise decisions. In this lesson activity, students assume the role of a professional writer for a food magazine and write an article about a new food. Students describe the food, provide ways to cook or prepare the food, and create a healthy plate that includes the food. Teachers can decide if students are to work individually or collaborate in groups of two or three students.

Recommendations:
Food Writers lends itself to several options with the integration of technology into the classroom. Using tablets, Chromebooks, laptops, desktops, or smartphones students can:

- Use the Internet to research their food and find pictures, videos, and text to help develop their news article.
- Film a "documentary" about their food using a tablet or smartphone, as available in classrooms.
- Design a digital brochure about their food using Google Apps for Education.
- Create a digital storybook about their food using the *Storykit* app.

This lesson provides opportunities for writing, reading, creativity, research and choice. Additionally, students will interact, collaborate and acquire knowledge in a personalized learning experience.

"Serving Up MyPlate: A Yummy Curriculum, Level 3, Grades 5 and 6."
Overall, Level 3 lessons help students in grades 5 and 6 become aware of advertisements and the media's impact on food choices. The activities included in this level allow students to interpret and analyze different food items from the five food groups, along with advertisements they see in their daily life, and design creative elements that help inspire individuals to eat healthy and exercise frequently.

Lesson: "Ad Awareness"
Currently, Lesson 3, "Decisions, Decisions," for grades 5 and 6, teaches students the different advertising techniques used by companies to sell their products and promote their ideas. Students create a public service announcement that promotes healthy food choices and eating habits.

Recommendations:

- Consider creating an *Ad Awareness* informational web-page hosted on the *FNS Video Vault* platform as an introduction to this lesson, providing various examples of advertising techniques, including print and video media.
- Students *will watch videos to raise their own awareness.* Students will see different types of advertisements that will further inform their performances during the lesson.

"Nutrition Voyage: The Quest to Be Our Best Curriculum, Grades 7 and 8." Overall, the *Nutrition Voyage* Curriculum for Grades 7 and 8 encourages creative thinking about food in students' schools, homes, community and the entire country. Students have the chance to work with engaging material, and much of the existing material has great potential to be adapted digitally. Lessons in *Nutrition Voyage* have a deeper connection to Math, Science, English Language Arts and Health content standards.

Lesson: Grade 7 Trek 1: "The Path to Fruits and Veggies"* and *"Reaching Produce Peak." These selected activities from Level 1 contribute to answering the essential questions of the lessons, such as *What are my current eating habits?*

Currently, *The Food Journals Lesson* guides students to keep track of their current eating and exercise habits. In this Food Journal activity, students record everything they eat and drink each day for seven days. Students keep track of the fruits and vegetables they eat at each meal using the *Reaching Produce Peak* activity, earning competition medals for including fruits and vegetables in meals and snacks.

Recommendations:

- Incorporating an interactive game, teachers can organize a school-wide competition to motivate and interest students in healthy eating choices.
- Students simultaneously keep track of the fruits and vegetables they eat at each meal using the *Reaching Produce Peak* activity, earning medals for including fruits and vegetables in meals and snacks.
- Using mobile devices (as available), students can take photographs to incorporate into their interactive journal. Students could even earn additional competition medals using *Produce Peak.*

This lesson provides students with the chance to engage and compete in a hands-on experience and record their food choices with the expectation of an increased awareness about positive health and nutrition choices.

Lesson: **Grade 8 Trek 3:** ***"From Farm to You."*** This selected activity, *Favorite Food Scavenger Hunt,* from Grade 8 Trek 3, contributes to answering the essential questions of the lessons, such as *What foods do I like to eat? Where do these foods come from? What foods grow in our area? How does this vary through the seasons?*

Currently, the lesson's culminating activity, *Favorite Food Scavenger Hunt*, asks students to list favorite fruits and vegetables, describe why these foods were selected, and determine where these foods originally came from. Students also determine how far their food selections travel from where they grow until they reach their plates.

Recommendations:

- To achieve these goals, during the introductory activity, consider having students locate content, such as information about food distribution in the U.S., using the *FNS Video Vault* or other digital sources.
- Teachers may consider using virtual field trips through a variety of media platforms including video conferencing (i.e., *Google Hangouts, Skype*) and virtual reality (i.e., *Google Expeditions*) to bring authentic experiences into the classroom.
- Teachers may also consider incorporating social media platforms (i.e., *Twitter, Facebook*) to contact and interact with professionals and experts related to the content.
- Teachers can also use the essential questions of the lesson as writing prompts or discussion points for English Language Arts standards.

This lesson and culminating activity provide important knowledge about today's world. Students can develop greater awareness, appreciation and knowledge regarding their food, inspiring better food choices and reduction in food waste. This blended learning lesson and activity provides students with the opportunity to research and choose a video with the expectation of an increased awareness about positive health and nutrition choices.

C. Cost Estimates

Costs for implementing the recommendations outlined above are dependent on multiple decisions regarding the digital platforms targeted and level of digital complexity and interactivity incorporated. As a result, costs will vary considerably. However, the following examples represent approximate professionally determined cost estimates.

Converting handouts to interactive digital formats

Three to four responsive web templates with no content management system are needed to convert 24 existing FNS student handouts to digital and interactive formats. Approximate cost: $75,000- $125,000.

FNS Video Vault video library

An educational video library consisting of a video hub with a content management system, using a working title “FNS Video Vault” and with the same quality level as the NBC Learn video library format (http://www.nbclearn.com/portal/site/k-12). Approximate cost: Minimum $250,000.

Expanding and amplifying the use of interactive games

Three levels of recommendations are provided in Section A for the use of interactive games, from simply relocating them to a more prominent online location to converting existing ones to interactive digital forms. As such, cost estimates can range accordingly, from $10,000 to over $100,000 depending on the level of interactivity and complexity of the game design.

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TEAM NUTRITION EDUCATIONAL TECHNOLOGY ENVIRONMENTAL SCAN

APPENDICES

APPENDIX A
WORKING GROUP

A Working Group of educators known for their work in educational technology and/or nutrition/health was assembled for this project for use as an informational resource.

The Working Group members included:

- Dr. Tom Baranowski, Editor-in-Chief, Games for Health Journal; Professor of Pediatrics (Behavioral Nutrition & Physical Activity), Children's Nutrition Research Center, Department of Pediatrics, Baylor College of Medicine
- Saber Khan, Director of Education Technology, Browning School
- Kevin Morrow, elementary school physical education teacher
- Dr. Janet E. Poppendieck, Policy Director, New York City Food Policy Center, Hunter College and the CUNY School of Public Health; author of "Free for All: Fixing Food in America"
- Jerry T. White, Superintendent Maine Island Schools; Technology Coordinator

An introductory phone conference was held to provide the Working Group members with an overview of the project, and discuss their experiences with nutrition and health, and educational technology. Busy, conflicting schedules precluded further meetings with the entire Working Group, so subsequent communications were conducted individually via email. Working Group members provided information and links they believed were relevant to the project. These included examples of sites and programs doing work related to nutrition and physical education, and research articles, which were incorporated into the literature review. Additionally, members were sent and provided feedback on the teacher focus group interview guidelines and survey questionnaire.

APPENDIX B
SEARCH TERMS USED FOR LITERATURE REVIEW

Table B1.

Search Terms Used for Section A: Societal Context: Access and Ownership of Internet Connectivity and Digital Technology by U.S. Households, and Section B: Digital Technology and Broadband Internet Access in U.S. Public Schools

Topic Area Terms	Search Terms
Section A: Societal Context: Access and Ownership of Internet Connectivity and Digital Technology by U.S. Households	
Availability of broadband internet service in U.S. Households	Broadband, Internet high-speed Internet ----------*in combination with*---------- Ownership, household, access, connectivity ----------*in combination with*---------- Differences, variation, variability, region, income, SES*
Ownership and use of technology by U.S. individuals, households and youth (4- to 18-year-olds)	Technology, device, portable device, mobile device, computer, laptop, desktop, tablet, e-reader, smartphone, cell phone ----------*in combination with*h---------- Use, ownership, access, availability, screen time ----------*in combination with*---------- Adults, families, household, home, children, youth, student/s, teen/s, tween, adolescent, teenager
Section B: Digital Technology and Broadband Internet Access in U.S. Public Schools	
Availability of broadband internet service in U.S. K–12 schools	School broadband, differences in school broadband, School Internet ----------*in combination with*---------- access, capacity, connectivity

*Socioeconomic Status

Table B.1
Continued

Topic Area Terms	Search Terms
Progress towards school broadband targets	School broadband targets, school network capacity ----------*in combination with*---------- progress, equity, rural, suburban, urban
Availability and use of digital devices in schools	Digital technology, educational technology, laptop, mobile phone, smart phone, tablet, smartboard, computers ----------*in combination with*---------- Availability, access, in school/s
Use of technology in schools to promote or market foods available in school cafeteria	Technology ----------in combination with---------- School lunch, school menu, school food, cafeteria, school nutrition professionals ----------in combination with---------- Market, promote, purchase, participation, student, parent, child, nutrition, healthy foods, healthy choices

Table B.2
Search Terms Used for Section C: Educational Technology in U.S. Public School Libraries

Topic Area Terms	Search Terms
Technology available in school libraries	School libraries, school media centers ----------*in combination with*---------- Technology, devices, computers, laptop, desktop, tablet, e-reader, survey, bandwidth
Role of school librarians	Public school librarians, school media specialists, educators, technology specialist ----------*in combination with*---------- Perceptions, roles, teaching, computers, survey, technology, statistics

Table B.3

Search Terms Used for Section D: Important Education Technology Policy at the Federal, State, and Local Levels

Topic Area Terms	Search Terms
Federal, state and local policies regarding K–12 broadband access and use of educational technology	Federal policy/ies, U.S. policy/ies, state policy/ies, district policy/ies ----------in combination with---------- K–12 school, school, educational ----------in combination with---------- Broadband access, broadband availability, connectivity, internet access, technology, big data
K–12 school policies on acceptable student and teacher Internet use	Policy, rules, allowed, not allowed, prohibited ----------*in combination with*---------- internet use, internet access, acceptable use ----------*in combination with*---------- Teachers, educators, students, pupils, schools, public schools, public school libraries, library, media center, school library, K–12, secondary, elementary
Decision makers on the types of technology allowed in the classroom	Policy, decision, guidelines, rules, allowed, not allowed, prohibited ----------in combination with---------- Types of technology, technology, wireless, device, electronic, cell phone, smartphone, tablet, laptop, computer, social media ----------in combination with---------- Teachers, educators, administrators, media specialist, technology specialists, librarian, schools, public schools, public school libraries, library, media center, school library, K–12, secondary, elementary
School processes on technology and social media acquisition	Policy, decision, guidelines, rules, allowed, not allowed, prohibited, process, procedure, acquisition ----------in combination with---------- Types of technology, technology, wireless, device, electronic, cell phone, smartphone, tablet, laptop, computer, social media ----------in combination with---------- Teachers, educators, administrators, media specialist, technology specialists, librarian, schools, public schools, public school libraries, library, media center, school library, K–12, secondary, elementary

Table B.4

Search Terms Used for Section E: Teacher, Parent, and Student Attitudes Towards Educational Technology

Topic Area Terms	Search Terms
Teacher, student and parent attitudes about technology in education	Teacher, student, parent ----------*in combination with*---------- Attitude/s, opinion/s, belief/s ----------*in combination with*---------- Educational technology, technology, classroom technology
Effect of professional development on teacher attitudes towards educational technology	Effect/s, Impact/s ----------*in combination with*---------- professional development, training, coaching ----------*in combination with*---------- educational technology, digital textbook/s teacher attitude/s towards technology, teacher use of technology, attitude/s education/al technology

Table B.5

Search Terms Used for Section F: Current and Emerging Educational Technology Practice, Use, and Trends in U.S. Public Schools

Topic Area Terms	Search Terms
Uses of educational technology for teaching in K–12 classrooms	Educational technology, educational technology tools, technology tools, technology ----------*in combination with*---------- Access, survey, research, implementation, teaching ----------i*in combination with*---------- Teachers, educators, librarian, media specialist, technology specialist, students, pupils, schools, public schools, public school libraries, library, media center, school library, K–12, secondary, elementary
Use of technology for communication with parents, students, and school staff	Technology, mobile phone, smart phone, text message, computer, laptop, tablet, social media ----------*in combination with*---------- communicat/e/ion, inform, contact, notify ----------*in combination with*---------- parent/s, student/s, teacher/s, school, school administration

Table B.6

Search Terms Used for Section G: Approaches to Technology Integration in Schools

Topic Area Terms	Search Terms
Technology Integration	Technology Integration, integrating technology ----------*in combination with*---------- Research, education, schools, libraries, students, communication, learning, classrooms, ----------*in combination with*---------- Devices, computers, laptop, desktop, tablet, e-reader, social media, games
Improved learning opportunities through different learning models	Learning models, learning strategies, learning opportunities, instructional methods, instructional strategies, instructional models, instructional opportunities, teaching strategies, teaching models, teaching methods, teaching opportunities ----------*in combination with*---------- Digital, interactive, programs, literacy, teaching, online, virtual ----------*in combination with*---------- Experiences, resources, programs
Organization and Analytical Tools	Education, public school, K–12, elementary, secondary, school ----------*in combination with*---------- Education technology, technology, innovation, data, analytics, data analytics ----------*in combination with*---------- Benefits, advantages, assets, improvements
Tools that assist educators in improving learning experiences for students	Tools, learning, adaptive, technology, online, web, internet, digital, hybrid, educational games, electronic games, interactive learning environment ----------*in combination with*---------- Educators, teachers, students, children, kids, K–12, elementary, secondary, school, public school ----------*in combination with*---------- Assist, aid, attitudes, perception, improving, collaboration

Table B.6
Continued

Topic Area Terms	Search Terms
How educators create a community for sharing resources	Educators, teachers, students, children, kids, K–12, elementary, secondary, school, public school, community ----------*in combination with*---------- Sharing, role, collaborating, education, benefits, classroom, context ----------*in combination with*---------- Online, social media, social network, internet, teaching aids, teaching devices

Table B.7
Search Terms Used for Section H: Current Use of Educational Technology and Media for Health and Nutrition Education

Topic Area Terms	Search Terms
Use of technology and digital media for health and fitness	Technology use, web, social media, information technology, digital media ----------*in combination with*---------- Health, health education, fitness, nutrition, health promotion ----------*in combination with*---------- Teachers, educators, students, pupils, schools, public schools, K–12, secondary, elementary
Use of technology and social media for health and fitness by educators	Technology, social media, internet, web, applications, apps ----------*in combination with*---------- Health, health education, fitness, nutrition, health promotion ----------*in combination with*---------- Teachers, educators, students, pupils, schools, public schools, public school libraries, library, media center, school library, K–12, secondary, elementary

Table B.7
Continued

Topic Area Terms	Search Terms
Research and evidence for effective health and nutrition based educational technology	Research, survey, benefits, evidence, analysis, inquiry ----------*in combination with*---------- Health, health education, nutrition education, nutrition, health instruction, nutrition instruction ----------*in combination with*---------- Technology, educational technology
Types of educational technology focused on health and nutrition	Educational technology, technology ----------*in combination with*---------- Health, health education, fitness, nutrition, health promotion ----------*in combination with*---------- Websites, devices, internet, apps, distance learning, digital games, games, video games, computers, applications, smartphones, smart devices

Table B.8

Search Terms Used for Section I: Research Studies of Effective Educational Technology Use

Topic Area Terms	Search Terms
Positive outcomes for educational technology programs	Outcomes, education, technology, programs ----------*in combination with*---------- Web, online, distance, interventions, learning, analysis, effectiveness, survey, content, benefit ----------*in combination with*---------- Educators, teachers, students, children, kids, K–12, elementary, secondary, school, public school, classroom
Approaches taken to evaluate effectiveness	Evaluate, effectiveness, educational technology programs ----------*in combination with*---------- Teaching methods, learning, technology, strategies, success, education, research, devices ----------*in combination with*---------- Educators, teachers, students, children, kids, K–12, elementary, secondary, school, public school
Additional research needed regarding effectiveness of learning through educational technology	Research, surveys, data ----------*in combination with*---------- Analysis, effectiveness, learning, educational technology, benefit ----------*in combination with*---------- Educators, teachers, students, children, kids, K–12, elementary, secondary, school, public school

Table B.9

Search Terms Used for Section J: Market Leaders in Educational Technology

Topic Area Terms	Search Terms
Emerging technology from textbook publishers	Emerging, innovate/ive/ion, new, trend/s ----------*in combination with*---------- Educational technology, digital textbook/s, adaptive learning, online course/s, distance learning, personalized learning ----------*in combination with*---------- publisher/s, vendors, market leaders, company/ies, startup/s
Lack of health and nutrition curriculum in digital format	Digital, electronic, online ----------*in combination with*---------- health, nutrition, physical education ----------*in combination with*---------- curricul/um/a, resource/s, teach/ing, education

Table B.10

Search Terms Used for Section K: Future Trends in Educational Technology

Topic Area Terms	Search Terms
Future Trends in Educational Technology	Emerging, innovate/ive/ion, new, trend/s, future ----------*in combination with*---------- Educational technology, digital education, school technology, school broadband, social media in school

APPENDIX C
INFORMATION ON SCHOOLS OF SHAPE CONFERENCE FGI PARTICIPANTS

Table C.1

Information on Schools of SHAPE Conference FGI Participants

State	FNS Region	Locale	Type of School	% of Students Eligible for NSLP[1]	*N* (FGI Participants)
Arizona	West	Rural	Elementary	83.8%	1
Indiana[2]	Mountain Plains	City, Suburban, Rural	Elementary, Middle, High	58%[3]	2
Kentucky	Southweast	Suburban	Elementary	87.2%	2
Louisiana	Southweast	City	K–12	89.8%	1
		City	Elementary	50.78%	1
		City	Middle	79.6%	1
		Rural	K–8	33%	1
Minnesota	Midwest	Town	Elementary	48.7%	1
Missouri	Mountain Plains	Rural	Elementary	48.5%	2
New York	Northeast	Suburban	High School	18.1%	1
Utah[4]	Mountain Plains	City, Suburban	Elementary, Middle, High	61.6%[5]	1
Wyoming		Town	Elementary	41%	2
TOTALS					
9 States	**4 Mountain Plains, 1 Southeast, 1 Southwest, 1 West**	**5 City, 4 Rural, 4 Suburban, 2 Town**	**8 Elementary, 3 Middle, 3 High, 1 K-8, 1 K–12**		**15**

[1] Source: National Center for Education Statistics unless otherwise noted. Retrieved from http://nces.ed.gov/globallocator/
[2] Participants reported working at various schools across the Evansville Vanderburgh school district
[3] For district. Source: Indiana Department of Education. Retrieved from http://compass.doe.in.gov/dashboard/overview.aspx?type=corp&id=7995
[4] Participant reported working for a number of schools in Salt Lake City school district
[5] For district. Source: Utah Community Data Project. Retrieved from http://weave.ucdp.utah.edu/weave.html?file=SLCSD_Lunch.weave

APPENDIX D
INFORMATION ON SCHOOLS OF FGI PARTICIPANTS AT COLORADO FOCUS GROUP FACILITY

Table D.1

Information on Schools of FGI Participants at Colorado Focus Group Facility

State	FNS Region	Locale	Type of School	% of Students Eligible for NSLP[1]	*N* (FGI Participants)
CO	Mountain Plains	City	PK–8	96.1	1
		City	Elementary	93.5	1
		City	Elementary	81.9	1
		City	High School	80.7	1
		City	K–5	72.7	1
		City	K–8	70.9	1
		City	High School	44.0	1
		Suburban	Elementary	27.3	1
		Suburban	K–12	10.6	1
TOTALS					
1 States	**1 Mountain Plains**	**7 City, 2 Suburban**	**3 Elementary, 2 High School, 1 K–5, 1 K–8, 1 K–12, 1 PK–8**		**9**

[1] Source: National Center for Education Statistics. Retrieved from http://nces.ed.gov/globallocator/

APPENDIX E

INTRODUCTION EMAIL FOR SCHOOL FOCUS GROUPS

OMB BURDEN STATEMENT: According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0584-0524. The time to complete this information collection is estimated at 30 minutes, including the time for reviewing instructions and completing the information collection.

Subject: School-Based Research Opportunity

Dear [Insert Teacher's Name],
I am writing to share an exciting research opportunity for your school. The United States Department of Agriculture, Food and Nutrition Service has contracted with the Michael Cohen Group (MCG), an educational research company, to gather feedback from teachers around the country on their teaching methods.

We are interested in visiting your school and speaking with you and other educators at your school to better understand the availability, best practices, and challenges of using technology in school. We would be holding two focus groups at your school with four to eight teachers in each group. The focus group would last 45 minutes and would take place in your school at a time that is convenient to the school and to the teachers. The school would receive a $150 facility fee for the use of a room at the school to conduct the focus group and each participating educator would receive a hot meal.

The mission of FNS is to provide children and needy families better access to food and a more healthful diet through nutrition education for children and their caregivers, and to promote school and community support for healthy eating and physical activity. The information gathered from these focus groups will be vital for understanding how technology can best support this mission in a way that is convenient and useful for teachers.

In order to host the focus group at your school, we will need your help to recruit additional teachers at your school to participate in the focus groups. It should only take about 30 minutes of your time to reach out to the teachers at your school. If you would be interested in learning more about how to do so, or if you have any further questions, please feel free to contact us by email or phone. We look forward to hearing from you.

Sincerely,
[Insert Researcher's Name]
Michael Cohen Group, LLC
375 West Broadway, Suite 502
New York, NY 10012
1 (212) 431-2252

APPENDIX F

CONSENT PACKAGE FOR SCHOOL FOCUS GROUPS

TEACHER INFORMED CONSENT FORM FOR FOCUS GROUP PARTICIPATION, AND QUESTIONNAIRE FOR PARTICIPATION IN FOCUS GROUPS

OMB BURDEN STATEMENT: According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0584-0524. The time to complete this information collection is estimated as part of the 12 minutes for the screener, including the time for reviewing instructions and completing the information.

Teacher Informed Consent Form for Focus Group Participation

STUDY TITLE: Educational Technology Environmental Scan
PROTOCOL NUMBER: XXXX
PRINCIPAL INVESTIGATOR: Marha Hadley, Ph.D.
TELEPHONE: 212-431-2252
ADDRESS: Michael Cohen Group LLC
375 West Broadway, Suite 502
New York, NY 10012

BACKGROUND AND PURPOSE:
You are invited to participate in a research study conducted by Michael Cohen Group (MCG) as part of a United States Department of Agriculture (USDA) sponsored effort to understand the landscape of technology in K–12 schools. MCG is an education research firm that specializes in children, education, and media.

We are interested in learning about how technology is currently used by K–12 teachers to help students learn and to communicate with children and their families to help develop new technologies, programs, and materials that are convenient and useful for teachers. If you participate, you will be asked about your attitudes about and experiences with educational technology.

PROCEDURES:
You will be asked to participate in a focus group interview in which you will discuss your experiences with and attitudes about educational technology, as well as the challenges, benefits, barriers, and best practices associated with using technology to help students learn and communicate with students and their families. The interview will be done in a group setting with other teachers from your school. The interview will last about 45 minutes and will take place at your school at a time that is convenient for you. About 155 teachers will participate in total across the country, about 4 per group. The interview will be audio-recorded for research purposes only.

POSSIBLE RISKS AND BENEFITS:

We do not anticipate any risks associated with being in this study. We do not promise that you will receive any benefits from this study. However, we do anticipate that most people will enjoy participating in the research process and the research will lead to the development of free teacher resources that will be developed by the USDA.

COMPENSATION:

You will not receive monetary compensation for your participation, but you will be provided with a hot meal at the time of the focus group.

PARTICIPANTS' RIGHTS:

Participation in this study is voluntary. We will not work with you unless you give your consent. You have the right to change your mind and withdraw your consent or discontinue participation at any time without any penalty or loss of the benefits to which you are otherwise entitled. You have the right to refuse to answer particular questions.

Your name, addresses, and phone numbers will only be used to contact you about this research activity. They will not be given to anyone else for other purposes. The research will be audio-recorded for research purposes only. Your name will never be used in any reports of our research findings. Your information will be kept secure and only used for research purposes, except as otherwise required by law. All data will be identified only by an ID number, not by any name.

CONTACT INFORMATION:

Questions, Concerns, or Complaints: If you have any questions, concerns or complaints about this research study, its procedures, risks and benefits, please contact the Principal Investigator, at the telephone number listed on the first page of this form.

If you have any questions or complaints about your rights as a research subject, contact:
Mail:
Study Subject Adviser
Chesapeake Research Review, Inc.
7063 Columbia Gateway Drive, Suite 110
Columbia, MD 21046 Call collect: 410-884-2900 Email: adviser@irbinfo.com

Teacher Informed Consent Form

Please complete the sections below. A copy of this form will be emailed to you for your records.

I, _____, agree to participate in this research
[your name]
project with the Michael Cohen Group. I understand that I may stop participation at any time.

_____ _____
Signature Date

_____
Phone (for research purposes only)

_____
Email Address (for research purposes only

OMB BURDEN STATEMENT: According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0584-0524. The time to complete this information collection is estimated as part of the 12 minutes for the screener, including the time for reviewing instructions and completing the information.

Questionnaire for Participation in Focus Groups

Please choose the option that best answers each question for you.

1. What grade(s) do you teach (please check at that apply)?

( ) Kindergarten
( ) First Grade
( ) 2nd Grade
( ) 3rd Grade
( ) 4th Grade
( ) 5th Grade
( ) 6th Grade
( ) 7th Grade
( ) 8th Grade
( ) 9th Grade
( ) 10th Grade
( ) 11th Grade
( ) 12th Grade

2. What subject(s) do you teach (please check at that apply)?

( ) English Language Arts
( ) Math
( ) Science
( ) Nutrition
( ) History
( ) Social Studies
( ) Foreign Language Studies
( ) Physical Education
( ) Health
( ) Professional Studies
( ) Technology
( ) Arts or Music
( ) Library/Library Science
( ) Other_____

3. How many years have you been teaching?

( ) First year
( ) 2-5 years
( ) 6-10 years
( ) 11-15 years
( ) Over 15 Years

4. Ethnicity

( ) Hispanic or Latino
( ) Not Hispanic or Latino

5. Race (select one or more)

( ) American Indian or Alaskan Native
( ) Asian
( ) Black or African American
( ) Native Hawaiian or Other Pacific Islander
( ) White

6. What is your current age?

( ) Under 25
( ) 25-34
( ) 35-44
( ) 45-54
( ) 55+

7. What is your gender?

( ) Female
( ) Male

APPENDIX G
PRINCIPAL LETTER OF AGREEMENT

OMB BURDEN STATEMENT: According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0584-0524. The time to complete this information collection is estimated at 10 minutes, including the time for reviewing instructions and completing the information collection.

<<DATE>>

Title of Study: Educational Technology Environmental Scan
Principal Investigator: Martha Hadley, Michael Cohen Group
Sponsor or Funding Agency: United States Department of Agriculture Food and Nutrition Service (USDA FNS)

Dear Dr. Hadley,

I am familiar with your research project entitled Educational Technology Environmental Scan. I understand that the Michael Cohen Group is conducting research on behalf of the United States Department of Agriculture Food and Nutrition Service. I understand that the study will involve a group of educators from my school participating in [two or three] 45-minute focus groups, and that this requires a quiet space in the school for a total of three hours within the school day.

As the principal of <<school name>>, I confirm that the school grants permission for the proposed research to be conducted with teachers in our school.

I understand that this research will be carried out following sound ethical principles and that participant involvement in this research study is strictly voluntary and provides confidentiality of research data, as described in the protocol.

Sincerely,

_____
Principal Signature

_____
Printed Name of Principal

APPENDIX H
INTRODUCTION EMAIL FOR TEACHER OF HEALTH EDUCATION SURVEY

OMB BURDEN STATEMENT: According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0584-0524. The time to complete this information collection is estimated at 5 minutes, including the time for reviewing instructions and completing the information collection

Dear [Teacher/Health Professional],

We are writing to you to let you know about an exciting research opportunity. The USDA Food and Nutrition Service (FNS) is looking for feedback from teachers of health education to help inform the development of free educational resources for teachers. If you are interested, please click the link below to be taken to an online survey where you will complete a 10-minute survey.

The information gathered from these surveys will be vital for understanding how technology can best support health and nutrition education for children in a way that is convenient and useful for teachers and schools.

You will answer questions about your experiences with and attitudes about educational technology, including what you use in your classroom to help students learn and ways you communicate with students and their families. Please know that we want to hear from you, regardless of your level of educational technology experience.

All information will be kept confidential; your name will not be associated with any of your responses. Participation is completely voluntary and you may stop at any time. Please select the link below to be taken to survey.

[INSERT LINK]

If you have any questions, please contact us at (212) 431-2252 or by emailing goshea@mcgrc.com.

Best,

[Researcher]

APPENDIX I
FLYER FOR FOCUS GROUP PARTICIPATION

USDA United States Department of Agriculture

Attachment F: Flyer for Focus Group Participation

Teacher Focus Groups

Please join us for a 45-minute group interview about educational technology.

All levels of technology experience welcome!

Free catered meal will be provided.

Three ways to sign up

Talk to	[Local teacher coordin.]
Email or call	[Researcher name] 212-XXX-XXXX xxxxxx@mcgrc.com
Visit	[Insert website]

USDA mcg carrot newyork

OMB BURDEN STATEMENT: According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0584-0524. The time to complete this information collection is estimated as part of the 12 minutes for recruitment and consent, including the time for reviewing instructions and completing the information.

APPENDIX J

SCHEDULING EMAIL FOR SCHOOL FOCUS GROUPS

OMB BURDEN STATEMENT: According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0584-0524. The time to complete this information collection is estimated as part of the 2 minutes for the screener, including the time for reviewing instructions and completing the information.

[DATE], 2016

Dear Educator,

Thank for you volunteering to participate in the focus groups at [Insert School Name] about how educators use technology to teach and communicate with their students. We're excited to hear your opinion.

Just a reminder that the group is schedule to take place on [DATE] at [TIME] and that a meal will be provided for all participants. Finally, your school will receive $150 for hosting this research.

Educator Focus Groups
Where: [location]

When: [Date] [start time] to [end time]

We look forward to meeting you,

[Researcher]

APPENDIX K

CONSENT PACKAGE FOR SHAPE CONFERENCE FOCUS GROUPS

TEACHER LETTER, TEACHER INFORMED CONSENT FORM FOR FOCUS GROUP PARTICIPATION, AND QUESTIONNAIRE FOR PARTICIPATION IN FOCUS GROUPS)

OMB BURDEN STATEMENT: According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0584-0524. The time to complete this information collection is estimated as part of the 12 minutes for the screener, including the time for reviewing instructions and completing the information.

[DATE], 2016

Dear Educator,

My name is [Researcher's Name] and I work for the Michael Cohen Group, a research firm that specializes in children, education and media.

We are currently looking for educators to share how they use technology to teach and communicate with their students. The United States Department of Agriculture (USDA) is sponsoring this effort in order to help development of new technologies, programs, and materials that will eventually be available to all teachers at no cost.

To this end, we are looking for teachers to participate in a 45-minutes focus group.

Educator Focus Groups
Where: [location]

When: [Date] [start time] to [end time]
A hot meal will be provided to all teachers that volunteer to participate.

Included with this letter you will find a consent form with additional information and a brief survey. If you would like to participate, please complete these forms and return them to the researcher.

Thank you for your consideration and we look forward to working with you.

Sincerely,

[Researcher]

OMB BURDEN STATEMENT: According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0584-0524. The time to complete this information collection is estimated as part of the 12 minutes for the screener, including the time for reviewing instructions and completing the information.

Teacher Informed Consent Form for Focus Group Participation

STUDY TITLE: Educational Technology Environmental Scan

PROTOCOL NUMBER: XXXX

PRINCIPAL INVESTIGATOR: Marha Hadley, Ph.D.

TELEPHONE: 212-431-2252

ADDRESS: Michael Cohen Group LLC
375 West Broadway, Suite 502
New York, NY 10012

BACKGROUND AND PURPOSE:
You are invited to participate in a research study conducted by Michael Cohen Group (MCG) as part of a United States Department of Agriculture (USDA) sponsored effort to understand the landscape of technology in K–12 schools. MCG is an education research firm that specializes in children, education, and media.

We are interested in learning about how technology is currently used by K–12 teachers to help students learn and to communicate with children and their families to help develop new technologies, programs, and materials that are convenient and useful for teachers. If you participate, you will be asked about your attitudes about and experiences with educational technology.

PROCEDURES:
You will be asked to participate in a focus group interview in which you will discuss your experiences with and attitudes about educational technology, as well as the challenges, benefits, barriers, and best practices associated with using technology to help students learn and communicate with students and their families. The interview will be done in a group setting with other teachers attending the SHAPE Conference. The interview will last about 45 minutes and will take place at [insert date, time and location]. About 124 teachers will participate in total across the country, about 4 per group. The interview will be audio-recorded for research purposes only.

POSSIBLE RISKS AND BENEFITS:
We do not anticipate any risks associated with being in this study. We do not promise that you will receive any benefits from this study. However, we do anticipate that most people will enjoy participating in the research process and the research will lead to the development of free teacher resources that will be developed by the USDA.

COMPENTSATION:
You will not receive monetary compensation for your participation, but you will be provided with a hot meal at the time of the focus group.

PARTICIPANTS' RIGHTS:
Participation in this study is voluntary. We will not work with you unless you give your consent. You have the right to change your mind and withdraw your consent or discontinue participation at any time without any penalty or loss of the benefits to which you are otherwise entitled. You have the right to refuse to answer particular questions.

Your name, addresses, and phone numbers will only be used to contact you about this research activity. They will not be given to anyone else for other purposes. The research may be audiotaped for research purposes only. Your name will never be used in any reports of our research findings. Your information will be kept secure and only used for research purposes, except as otherwise required by law. All data will be identified only by an ID number, not by any name.

CONTACT INFORMATION:
Questions, Concerns, or Complaints: If you have any questions, concerns or complaints about this research study, its procedures, risks and benefits, please contact the Principal Investigator, at the telephone number listed on the first page of this form.

If you have any questions or complaints about your rights as a research subject, contact:
Mail:
Study Subject Adviser
Chesapeake Research Review, Inc.
7063 Columbia Gateway Drive, Suite 110
Columbia, MD 21046
Call collect: 410-884-2900
Email: adviser@irbinfo.com

Teacher Informed Consent Form

Please complete the sections below if you agree to participate and return to the researcher. Please keep the previous pages for your records.

I, _____, agree to participate in this research
[your name]
project with the Michael Cohen Group. I understand that I may stop participation at any time.

_____ _____
Signature Date

_____
Phone (for scheduling purposes only)

OMB BURDEN STATEMENT: According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0584-0524. The time to complete this information collection is estimated as part of the 12 minutes for the screener, including the time for reviewing instructions and completing the information.

Questionnaire for Participation in Focus Groups

Please choose the option that best answers each question for you.

8. What grade(s) do you teach (please check at that apply)?

( ) Kindergarten
( ) First Grade
( ) 2nd Grade
( ) 3rd Grade
( ) 4th Grade
( ) 5th Grade
( ) 6th Grade
( ) 7th Grade
( ) 8th Grade
( ) 9th Grade
( ) 10th Grade
( ) 11th Grade
( ) 12th Grade

9. What subject(s) do you teach (please check at that apply)?

( ) English Language Arts
( ) Math
( ) Science
( ) Nutrition
( ) History
( ) Social Studies
( ) Foreign Language Studies
( ) Physical Education
( ) Health
( ) Professional Studies
( ) Technology
( ) Arts or Music
( ) Other_____

10. How many years have you been teaching?

( ) First year
( ) 2-5 years
( ) 6-10 years
( ) 11-15 years
( ) Over 15 Years

11. Does your school participate in the National School Lunch Program?

( ) Yes
( ) No

12. Ethnicity

( ) Hispanic or Latino
( ) Not Hispanic or Latino

13. Race (select one or more)

( ) American Indian or Alaskan Native
( ) Asian
( ) Black or African American
( ) Native Hawaiian or Other Pacific Islander
( ) White

14. What is your current age?

( ) Under 25
( ) 25-34
( ) 35-44
( ) 45-54
( ) 55+

15. What is your gender?

( ) Female
( ) Male

APPENDIX L
RECRUITMENT SCREENER

FNS TEACHER FGIS

Recruitment Screener

Location: tbd

Date & Time: tbd
- 45 minutes each group, 8 for 6 to show

GROUPS:
45-minute groups: 6-8 adults for each group
Recruit 8 for 6 to show (but will take 8 if all show)

Specifications:
- All recruits must be currently working as K–12 teachers in public schools
- 50% of schools' students must qualify for free/reduced lunch
- Standard security—none who work for or have family members that work for producers, developers or marketers of websites, video gaming, digital apps, computer services, publishing, or educational media.
- 6 months past participation; none who have ever participated in research concerned with children's educational toys, media products, or materials of any type

---

Respondent's name: _____
Phone: _____
E-mail: _____

Respondent's gender: ( ) Female ( ) Male

Hello, my name is _____; I'm calling on behalf of The Michael Cohen Group, an educational research firm that specializes in children and media. Their clients include Nickelodeon, the Girl Scouts, National Geographic, and Scholastic.

I'd like to assure you that this call is strictly for research purposes - I am not attempting to sell you anything now, and you will not be solicited at any time in the future. You previously indicated that you would be interested in participating in a research interview, and I'm organizing a series of such interviews for the Michael Cohen Group. Researchers will be speaking with adults about the use of educational technology in the classroom, and they would like to consider including your opinions. Do you have a few moments to answer a brief preliminary questionnaire to determine if you qualify for this study? You don't have to answer any question you don't want to answer.

If you qualify and participate, at the conclusion of the research interview you will receive:
Participant- $50.00 cash
Thank you. I appreciate your taking the time to speak with me.

1. To begin, do you, or does any member of your household or immediate family, currently work in or study (or ever worked in or studied) any of the following. I may simply need to ask a follow-up question. (PLEASE TERMINATE IF YES TO ANY OF THE FOLLOWING)

( ) Marketing or Marketing Research
( ) Advertising or Public Relations
( ) Publishing or the Media in any format – including TV, radio, print and the Internet
( ) Interactive digital technology such as video games, website or app development
( ) Development, manufacturing, distribution, wholesale/retail of children's educational toys or media products of any type
( ) Any entertainment business-related industry

2a. Are you currently employed?

( ) Yes (occupation)_____;
name of school _____
( ) No

To qualify, they must currently work as a K–12 teacher in a public school. If they don't, thank and terminate.

2b. If you are married, or currently living with a spouse / partner, is s/he currently employed?

( ) Yes (occupation_____;
type of company_____
( ) No

**RECRUITER'S NOTE: CHECK AGAINST SECURITY CONCERNS.

3a. Have you ever participated in a market research focus group or research interview before?

( ) Yes (Proceed to 3b)

( ) No (Skip to 4)

3b. When was the most recent time you participated in a focus group or research interview?

( ) Within the past 6 months (Terminate)

( ) More than 6 months ago (Proceed to 3c)

3c. Within the past year, have you participated in a focus group or research interview concerning:

( ) Children's educational products or materials of any kind (Thank and terminate)

I'd like to learn a little bit about the school where you work.

4. Is the school where you teach a

( ) public school

( ) private school (Thank and terminate)

( ) charter school

5. What grade levels does your school have?

( ) Elementary (K-5/6)

( ) Middle / Intermediate (6/7-8)

( ) Junior high (7-9)

( ) High school (9-12)

( ) K–12

( ) Other (please specify): _____

6. About what percentage of the students at your school would you say qualify for free/reduced lunch?

( ) less than 50% (thank and terminate)

( ) more than 50%

( ) about 50%

( ) Not sure/IDK (don't read as option but mark if said and hold. Check with project director)

7. What subject area(s) do you teach?

( ) English Language Arts

( ) Science

( ) Math

( ) Social Studies

( ) Art

( ) Foreign Language

( ) Physical Education

( ) Librarian/Media Specialist

( ) Other (please specify): _____

DEMOGRAPHICS

For research purposes it is important that we speak with a broad diversity of people. The following questions are for classification purposes only, and I can assure you that they will remain confidential.

8. What is your age?

( ) 21-29
( ) 30-39
( ) 40-49
( ) 50-59
( ) over 60

9. For how many years have you been a teacher?

( ) less than 1 year
( ) 1 – 5 years
( ) 5 – 10 years
( ) over 10 years

10. Which of the following represents the level of formal education you have completed to this point?

( ) Have completed some high school
( ) Have a high school diploma
( ) Have completed some college
( ) Have a college degree
( ) Have completed some graduate work
( ) Have a graduate degree or more

11. Under which of the following categories does your total annual household income fall?

( ) Under $20,000
( ) $20-$40,000
( ) $40,000-$50,000
( ) $50,000-$60,000
( ) $60,000-$70,000
( ) $70,000-$80,000
( ) $80,000 and above

12. Are you of Hispanic or Latino origin or descent, such as Mexican, Puerto Rican, Cuban, or some other Latin American background?

( ) Yes
( ) No

What is your race:

( ) Black
( ) Asian
( ) White
( ) Native American ( ) Other (please specify_____)

INVITATION FOR QUALIFYING RESPONDENTS:

Thank you for taking the time to answer this questionnaire. We would like to invite you to participate in the research interview. At the conclusion of the research interview, you will receive a $75.00 cash honorarium in appreciation of your participation.

The interview will last approximately 45 minutes and will be held on:

Date & time - tbd 45 minutes each group, 8 for 6 to show

Interviews will take place at: tbd

I'd like to give you an overview of the interview procedures.

A professional and experienced researcher will interview you. During the interview, your will have the opportunity to talk about your use of educational technology in the classroom. If you are not comfortable in the room, you can leave the research session at any point.

Your candid opinions, observations, and reactions are of genuine interest to our researchers and are the reason we are conducting this research. While we hope and expect that you will enjoy the interview and fully share your opinions, you should know that your participation is completely voluntary, and you will not be under any obligation to participate in any activity or answer any questions you choose not to.

How comfortable do you think you would feel in the situation I just described? And by comfortable I mean - willing to and interesting in discussing your opinions regarding the educational materials and comfortable talking about your feelings.

( ) Very comfortable
( ) Somewhat comfortable

- -

( ) Not sure (Thank and terminate)
( ) Not too comfortable (Thank and terminate)
( ) Not comfortable at all (Thank and terminate)

Thank you again. You will receive an e-mail with all the information you need in advance of the study – that is: date/time, location, contact information etc. We ask that you CONFIRM whether you will be able to join us by RESPONDING to the EMAIL. We will also call you in advance to confirm your participation.

FOR HOLDS:

Thank you for taking time to answer this questionnaire. I will give your information to the project director for this study and if s/he determines that you qualify, you will receive an e-mail with all the information you need in advance of the study – that is: date/time, location, contact information etc. We ask that you CONFIRM whether you will be able to join us by sending the EMAIL BACK to us. We will also call you in advance to confirm your participation.

**RECRUITER'S NOTE: PLEASE USE YOUR BEST JUDGMENT IN RECRUITING BRIGHT, ARTICULATE, RESPONSIVE, PERSONABLE PARTICIPANTS.

APPENDIX M
MODERATOR'S GUIDE FOR TEACHER FOCUS GROUPS

OMB BURDEN STATEMENT: According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0584-0524. The time to complete this information collection is estimated at 45 minutes, including the time for reviewing instructions and completing the information collection.

Moderator's Guide for Teacher Focus Groups

Section 1. Introduction to Focus Group (3 minutes)
Thank you so much for taking the time to talk to us today. My name is [Moderator name], and I'll be leading this focus group. Focus groups are a type of research used to gather opinions about a specific topic. Today, we are going to talk about the technology you use in your classrooms. The United States Department of Agriculture's Food and Nutrition Service is sponsoring this effort to learn more about how teachers around the country access and use educational technology in order to develop better content for teachers.

Before we get started, I want to mention a few things:

- There are no wrong answers. Our whole purpose for being here today is to hear what you think, so please speak up, especially if what you have to say is different than what someone else is saying. You may represent what a lot of other educators think.

- You don't have to answer every question but I do want to hear from everyone, so I might call on you at some point.

- Everything we talk about here is confidential. That means your individual responses will not be reported and your name will not be associated with anything you say in our reports.

- If it's ok with everybody here, we'd like to record these conversations. They will only be used to confirm our notes and allow us to revisit this conversation. Nobody but the people in this room will ever hear the recordings, and any transcriptions of this conversation will not include any names. Is that ok with everybody? (Note to moderator: If someone is uncomfortable, thank them and allow them to leave – do not stop the recording)

Does anyone have any questions before we begin?

Okay, great. First, I'm going to have everyone go around and introduce themselves. You all might know each other already, but I want to get to know you, too. Just say your first name, subject/area(s) of expertise and you're favorite activity to do with your students. I'll go first.

[Note to Moderator: allow each participant to introduce himself or herself.]

Section 2: General Attitudes and Familiarity with Technology (6 minutes)

- Well now that we know each other, let's jump right in.
  For what purpose do you regularly use technology in your classroom?
    - In general, what do you use technology for the most in your classroom most often? [Probe: assessment, administrative tasks, communication, instructional time etc.]
- What types of technology is available to you in your school? [Probe: e-backpacks, tablets, smart boards, videos/TV, internet access, projectors]
    - How easily can students access computers in your school? [Probe: Computer Labs, cart model, 1:1 environment, laptops, desktops etc.]
- Can anybody share an example of when technology helped you accomplish a successful lesson?

Now that we've heard a little from you and so that we are on the same page, when we say education technology, we're referring to any technology that helps support instruction, collaboration, preparation, communication, and/or student learning.

Section 3. Technology in Teaching (35 minutes)

3a. Technology to Support Learning

- What are some ways you use education technology to help your students learn?
    - What are some programs you think are particular effective at supporting student learning? How?
        - [Probe: social media, YouTube, content management systems, PowerPoint, Google classroom etc.]?
- What are some devices you think are particular effective at supporting student learning? How?
    - [Probe: Smart boards, Chrome Books]?
- What are some drawbacks to using education technology in the classroom? And Why?
- Tell me about the specific ways in which you use technology to facilitate reading. [Probe: eBooks, e-readers]?

- Do you use education technology for your lesson plans? How?
    - In what ways does technology help eliminate the need for paper?
    - Are certain subjects or topics more effective in an electronic format? Why?
- How does technology help enhance student's learning?
- How does technology help extend student's learning?
- What sort of educational technology use do students find most engaging? Why?
    - What sort of technology do they find least engaging?
- Are there any particular strengths or challenges to using any of these technologies you've mentioned to help students learn about health and nutrition? Why?
- Have you or a colleague ever used technology to get students to track or change a health behavior (or another behavior)?
    - What program or device worked? Why?
    - What didn't work? Why?

3b. Technology for Communication

- How do you currently use technology to communicate with your students?
    - What topics do you generally use technology to communicate about?
    - Are there particular tools you regularly use to communicate with students and their parents? [Probe: Blackboard, social media, website]
    - What is particularly effective?
    - What isn't particularly effective?
- How do you currently use technology to communicate with the families of your students? What topics do you generally use technology to communicate about?
    - Are there particular tools you regularly use to communicate with students and their parents? [Probe: Blackboard, social media, phone, website]
    - What is particularly effective?
    - What isn't particularly effective?
    - Are there particular factors you notice that make certain families more difficult to communicate with using technology?
    - How do you overcome these particular obstacles?

  How do you currently use technology to communicate with parents/caregivers about school food offerings?
    - Are there particular tools you regularly use to promote or market foods in the cafeteria, snacks bars, or kiosks?
    - What is particularly effective?
    - What isn't particularly effective?
    - Are there particular tools you regularly use to promote fundraisers?

3c. Technology Training

- Overall, how comfortable do you feel using technology in your classroom to support your teaching?
    - How did you get comfortable with this technology? Was there a formal training program or were you comfortable from your own pre-existing knowledge/ experience?
    - Why don't you feel comfortable?
    - What would you need to feel more comfortable with using technology to support student learning?
- How comfortable do you feel using technology to communicate with your students and their families?
    - How did you become comfortable using technology?
    - Why don't you feel comfortable?
    - What would you need to feel more comfortable?
- How do you feel about the amount and quality of professional development opportunities and materials available to support technology in the classroom?
    - How do you find out about PD opportunities or training information about using technology with your students?
    - Does your school provide any opportunities?
- What other training or information would you like to see
    - Is there any training that would be particularly important for health and nutrition education or communicating about health and nutrition?

3d. Technology Policy

- What are the policies in your school regarding technology use? [Probe: BYOD, YouTube and websites, social media]
    - Are there any particular sites or platforms that are not allowed? [Probe: BYOD, YouTube and websites, social media]
    - What do you think about those policies?
    - Are you aware of any recent changes in policy in this school or district?
    - Do you anticipate that any of these policies will change? If so, how?
- Are there barriers in using technology in your school? In your classroom? [Probe: time and availability, maintenance, training, internet speed]
    - Do you have reliable access to the Internet in your school?
    - Is your bandwidth sufficient?
- Are you able to choose which electronic games or lessons you can use? If no, who determines what you can use [Probe: state, district]
- Who is in charge of identifying new technologies for your classroom/school?
- What kinds of things do they/you look for when evaluating whether to adopt technology? [Probe: Time, expense, learning curve]

3e. Trends in Education Technology

- What technology do you wish you had in your classroom?
    - What keeps you from having it?
- Are there any types of technology that you would like to see used in your school? [Probe: virtual reality, big data and learning analytics and/or flipped classrooms, distance learning, social media]
- Are there any uses of technology that you've heard about that you don't think will be effective?

  Imagine your classroom and your school in 5 years. How is technology different?
    - How do you think, for better or worse, technology will be used to support learning?
    - How do you think, for better or worse, technology will be used to communicate with students and their families?

Section 5. Closing (1 Minute)

It's time for us to wrap up. Does anyone have last thoughts or ideas that you haven't been able to share yet? Okay, one last chance to make your opinion heard:

- If there was one thing FNS should know about technology to help develop effective and useful resources for teachers, what would it be?

Thank you so much for joining us today. You were very helpful.

APPENDIX N
TEACHERS OF HEALTH EDUCATION SURVEY

OMB BURDEN STATEMENT: According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0584-0524. The time to complete this information collection is estimated at 10 minutes, including the time for reviewing instructions and completing the information collection.

Teachers of Health Education Survey

1. What grade(s) do you teach (please check at that apply)?

( ) Kindergarten
( ) First Grade
( ) 2nd Grade
( ) 3rd Grade
( ) 4th Grade
( ) 5th Grade
( ) 6th Grade
( ) 7th Grade
( ) 8th Grade
( ) 9th Grade
( ) 10th Grade
( ) 11th Grade
( ) 12th Grade

2. What subject(s) do you teach (please check at that apply)?

( ) English Language Arts
( ) Math
( ) Science
( ) Nutrition
( ) History
( ) Social Studies
( ) Foreign Language Studies
( ) Physical Education
( ) Health
( ) Professional Studies
( ) Technology
( ) Arts or Music
( ) Library/Library Science
( ) Other_____

3. Please name three ways in which you use education technology to help kids change their eating and physical activity behaviors. (If you don't use technology, please explain why).

Education Technology: when we use the term education technology, we're referring to *any technology that helps support instruction, collaboration, preparation, communication, and/or student learning.*

4. Please name three barriers to using education technology to teach health education:

5. In general, approximately how many hours in a week is technology used in your teaching in the following situations:

Students use electronic devices to complete classwork _____
I use electronic devices to show or demonstrate information in class _____
I use emails, websites, or social media to communicate with students _____
I use emails, websites, or social media to communicate with parents/caregivers _____

6. Which technologies and/or digital pedagogies do you use with your students?
(check all that apply):

- ☐ Touchscreen apps
- ☐ Smart Board/interactive white boards
- ☐ Showing videos to your class
- ☐ E-books
- ☐ Skype or other video conferencing
- ☐ Downloadable PDFs
- ☐ Photography and/or photo editing
- ☐ Video creation projects/assignments
- ☐ Online lessons
- ☐ Website visits
- ☐ Word processors/desktop publishing
- ☐ Internet searches
- ☐ Music
- ☐ YouTube
- ☐ Social Media (Facebook, Twitter etc.)
- ☐ Learning Management System
- ☐ Other: (please list) _____

7. Please indicate which of the following devices are used in your classroom (check all that apply):

Touchscreen Devices:
- ☐ IOS (e.g. iPads)
- ☐ Android (e.g. Galaxy, Nexus)
- ☐ Microsoft (e.g. Surface)
- ☐ Other _____
- ☐ I don't know

Computers:
- ☐ Mac Desktop
- ☐ Mac Laptop
- ☐ PC Desktop
- ☐ PC Laptop
- ☐ Other _____

Internet browser:
- ☐ Chrome
- ☐ Internet Explorer
- ☐ Safari
- ☐ Other _____
- ☐ I don't know

Video Players:
- ☐ Streaming/Internet Players
- ☐ DVD Player
- ☐ VHS Player
- ☐ Other _____
- ☐ I don't know

8. Please read the following statements and indicate your level of agreement.	**Strongly Agree**	**Agree**	**Neither Agree nor disagree**	**Disagree**	**Strongly Disagree**
The administration at this school supports the use of technology in the classroom and with students.	☐	☐	☐	☐	☐
There are adequate professional development opportunities for me tolearn about using technology in my teaching.	☐	☐	☐	☐	☐
Using technology enables me to cover more material in my classes.	☐	☐	☐	☐	☐
Using technology to teach my students helps enhance student learning.	☐	☐	☐	☐	☐
Using technology to teach my students increases my productivity as a teacher.	☐	☐	☐	☐	☐
Using technology to teach my students enhances my effectiveness as a teacher.	☐	☐	☐	☐	☐
Learning to use technology is easy for me.	☐	☐	☐	☐	☐
I find it easy to use technology to do what I want to do.	☐	☐	☐	☐	☐
My interaction with technology does not require much effort.	☐	☐	☐	☐	☐
It is easy for me to become skillful at using technology.	☐	☐	☐	☐	☐
I find technology easy to use.	☐	☐	☐	☐	☐
I actively look for new ways to use technology to support my teaching.	☐	☐	☐	☐	☐

APPENDIX O.

CONSENT PACKAGE FOR TEACHER OF HEALTH EDUCATION SURVEY

OMB BURDEN STATEMENT: According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0584-0524. The time to complete this information collection is estimated as part of the 5 minutes for the screener, including the time for reviewing instructions and completing the information.

[DATE], 2016

Dear Educator,

Thank for you choosing to complete this brief survey about your experiences using technology to support nutrition education and promotion in your school. Before you complete this survey, please read the consent form that explains the project and provides information about your rights as a research participant.

Sincerely,

[Researcher]

OMB BURDEN STATEMENT: According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0584-0524. The time to complete this information collection is estimated as part of the 5 minutes for the screener, including the time for reviewing instructions and completing the information.

Teacher Informed Consent Form for Survey Participation

STUDY TITLE: Educational Technology Environmental Scan

PROTOCOL NUMBER: XXXX

PRINCIPAL INVESTIGATOR: Marha Hadley, Ph.D.

TELEPHONE: 212-431-2252

ADDRESS: Michael Cohen Group LLC
375 West Broadway, Suite 502
New York, NY 10012

BACKGROUND AND PURPOSE:
You are invited to participate in a research study conducted by Michael Cohen Group (MCG) as part of a United States Department of Agriculture (USDA) sponsored effort understand the landscape of technology in K–12 schools. MCG is an education research firm that specializes in children, education, and media.

We are interested in learning about how teachers of health education use technology to support nutrition education and promotion in K–12 schools, in order to develop new technologies, programs, and materials that are convenient and useful for teachers. If you agree to participate, you will be asked about your attitudes about and experiences with educational technology.

PROCEDURES:
You will be asked to answer survey questions about your experiences with and attitudes about technology, as well as the challenges, benefits, barriers, and best practices associated with using technology to support nutrition education and promotion. The survey will take about 10 minutes to complete online. About 119 teachers will participate in total across the country.

POSSIBLE RISKS AND BENEFITS:
We do not anticipate any risks associated with being in this study. We do not promise that you will receive any benefits from this study. However, we do anticipate that most people will enjoy participating in the research process and the research will eventually lead to the development of free teacher resources that will be developed by the USDA.

COMPENSATION:
You will not receive monetary compensation for your participation.

PARTICIPANTS' RIGHTS:
Participation in this study is voluntary. You do not have to complete the survey unless you give your consent. You have the right to change your mind and withdraw your consent or discontinue participation at any time without any penalty or loss of the benefits to which you are otherwise entitled. You have the right to refuse to answer particular questions.

Your name and email address will never be used in any reports of our research findings, nor will it be associated in any way with your responses. Your information will be kept secure and only used for research purposes, except as otherwise required by law. All data will be identified only by an ID number, not by any name.

CONTACT INFORMATION:
If you have any questions, concerns or complaints about this research study, its procedures, risks and benefits, please contact the Principal Investigator, at the telephone number listed on the first page of this form.

If you have any questions or complaints about your rights as a research subject, contact:
Mail:
Study Subject Adviser
Chesapeake Research Review, Inc.
7063 Columbia Gateway Drive, Suite 110
Columbia, MD 21046
Call collect: 410-884-2900
Email: adviser@irbinfo.com

CONSENT:
Based on the information provided above, please read the following statements and select whether you agree to participate in the study. If you select "Yes, I agree to participate", you will be immediately directed to the survey.

- ☐ Yes, I, agree to participate in this research project with the Michael Cohen Group. I understand that I may stop participation at any time.

- ☐ No, I do not agree to participate in this research project with the Michael Cohen Group.

APPENDIX P.

STATE EDUCATIONAL TECHNOLOGY OFFICER INTERVIEW GUIDELINE

OMB Control #0584-0524 | Expiration Date 6/30/2016

State Technology Officers Individual Interview Guideline

1. Introduction (10 -15 minutes)

a. Introduce self/researcher, background and project

i. Introduction to the topic and objectives of the interview:

"We are interested in how State Technology Officers view the current integration of educational technology in their States, as well as their assessment of the more successful methods for teaching and communicating with students and families using particular technologies, with a focus on nutrition and health.

ii. Recording and confidentiality

iii. No right or wrong answers, really want your point of view and insights.

b. Introduction of the State Technology Office or interviewee

i. Your work as an administrator and decision maker – where? How long? Background?

ii. Interests in the field of educational technology?

iii. Can you please tell us more about your job at present?

1. What are your key responsibilities?
2. What do you find rewarding?
3. What do you sometime find challenging?

iv.Your vision of how educational technology could be used to optimize learning in the future?

2. The Policy Making Process

a. Thinking about the districts and schools in your state, can you provide examples of typical educational technology presence and use? How does this vary or differ between schools or districts?

i. What do you consider optimal or best example of educational technology being used effectively in your state?

ii. What are the challenges in districts or schools that have experienced struggles with the integration and use of educational technology?

iii. How are decisions made about acquiring and using educational technology? Can individual teachers or schools make decisions on their own?

iv. What subject matter is currently taught using educational technology?

v. Can you think of examples of technology being used to teach health or nutrition? Examples? Effectiveness?

vi. Overall, what are the most successful uses of educational technology that you have seen implemented? Why?

III. Criteria used to acquire or approve educational technology

a. When new technology or changes in software programs are being considered, what is the process?

i. How are new curriculum or tools evaluated?

ii. What influences this evaluation?

iii. Are you and others approached by companies that develop educational technology programs? Can you give examples?

b. How are budgets allocated, once the policy is established?

c. Is educational technology evaluated in schools?

i. How are particular IT programs evaluated or assessed?

ii. Are they assessed in relation to student performance, engagement, teacher or student evaluations?

iii. What is the process by which it is evaluated?

iv. Who gathers this information or does the evaluation?

IV. Student assessment and IT

a. Does you district or state ever use IT systems for assessment?

i. In class assessment?

ii. Annual testing?

iii. Other?

b. If no, has the use of iT for assessment been brought up?

i. Was there willingness to consider?

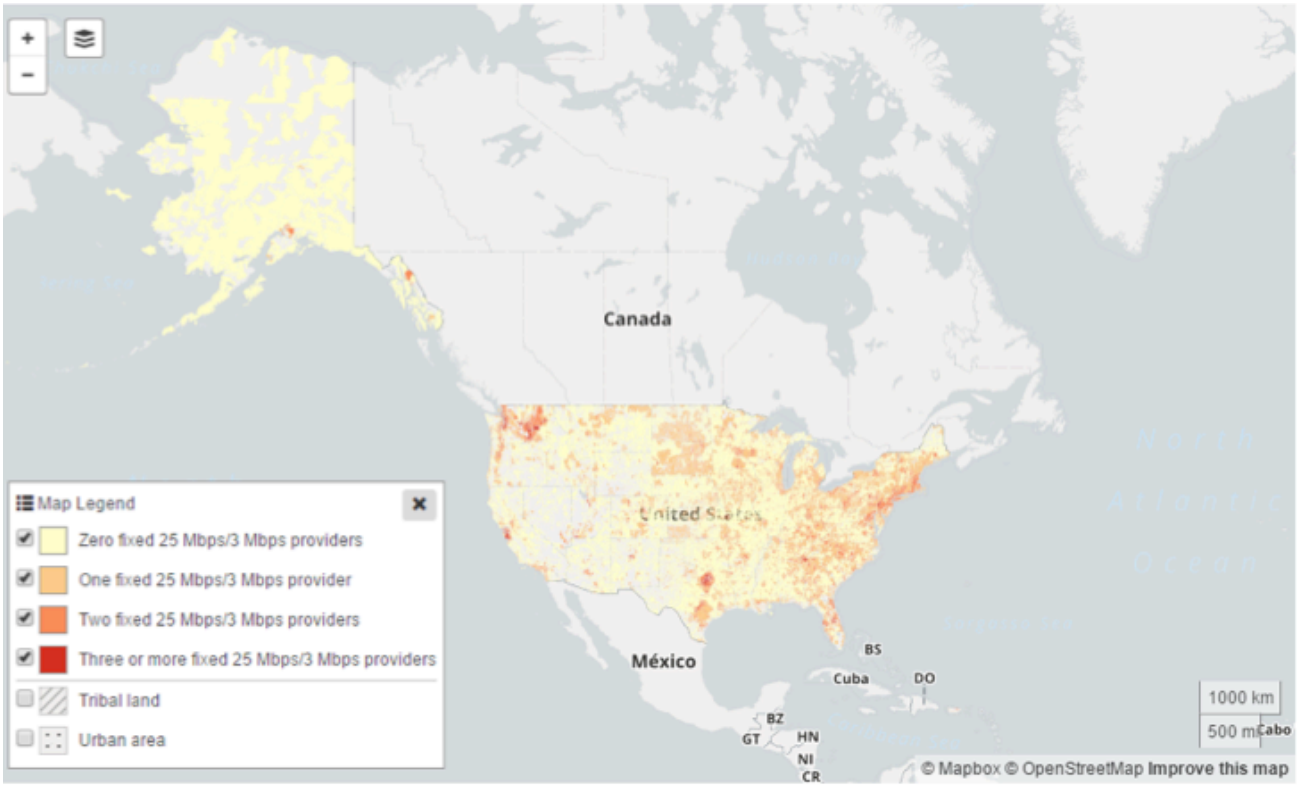
ii. Why? Why not?

V. Is there anything we have missed or not spoken about that is relevant to the policy process?

THANK YOU

APPENDIX Q.

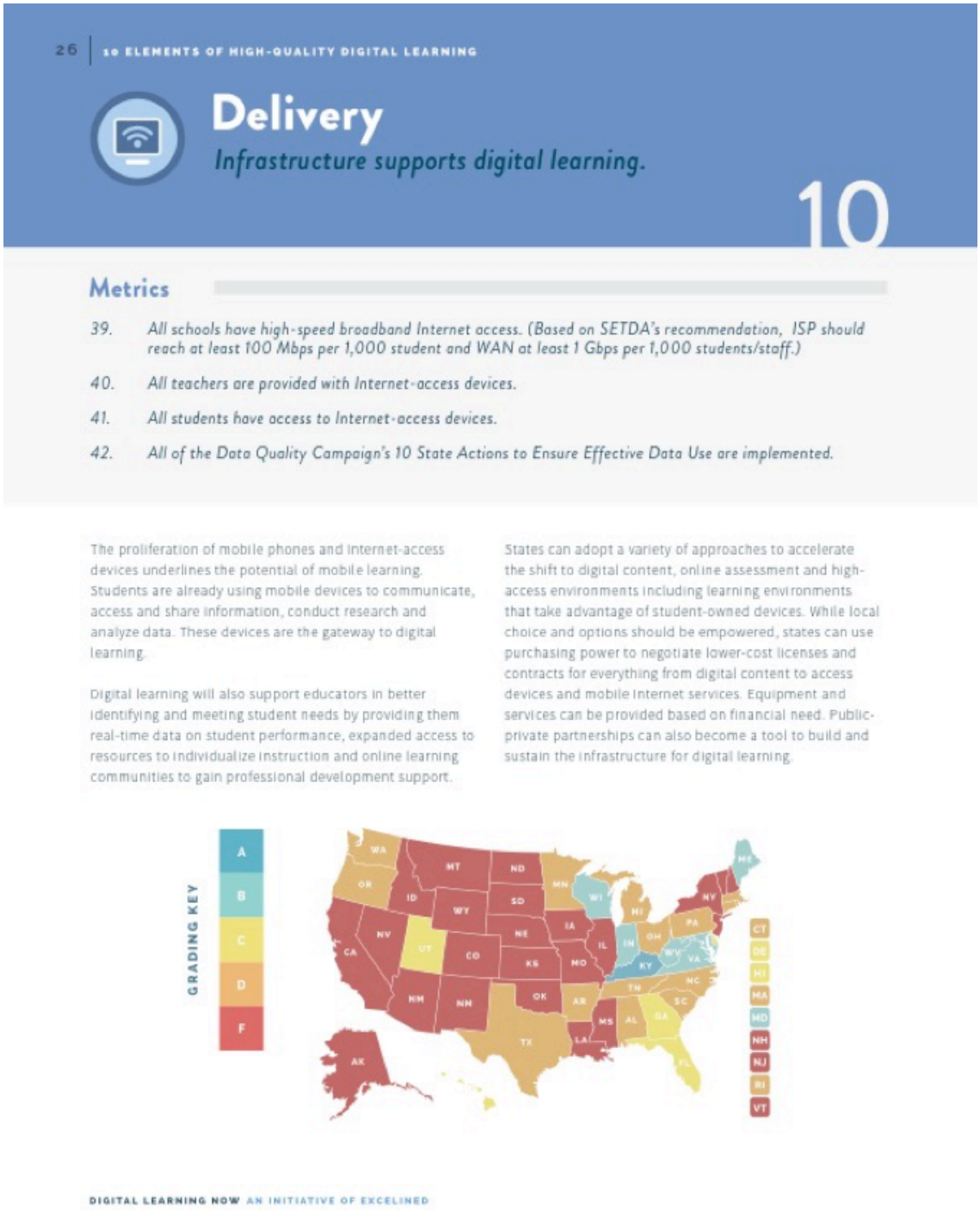
CURRENT HIGH-SPEED INTERNET SERVICE AVAILABILITY ACROSS STATES AND U.S. TERRITORIES BY GEOGRAPHIC LOCATION.



Retrieved from https://ncbroadband.gov/wp-content//uploads/2016/02/Residential-Fixed-Broadband-Providers-at-25-Mbps-3-Mbps.png

APPENDIX R.

2014 DIGITAL LEARNING REPORT CARD GRADES AWARDED TO STATES IN THE CATEGORY OF "DELIVERY," REFLECTING THE PRESENCE OF INFRASTRUCTURE TO SUPPORT DIGITAL LEARNING.



26 | 10 ELEMENTS OF HIGH-QUALITY DIGITAL LEARNING

Delivery

Infrastructure supports digital learning.

10

Metrics

39. *All schools have high-speed broadband Internet access. (Based on SETDA's recommendation, ISP should reach at least 100 Mbps per 1,000 student and WAN at least 1 Gbps per 1,000 students/staff.)*
40. *All teachers are provided with Internet-access devices.*
41. *All students have access to Internet-access devices.*
42. *All of the Data Quality Campaign's 10 State Actions to Ensure Effective Data Use are implemented.*

The proliferation of mobile phones and Internet-access devices underlines the potential of mobile learning. Students are already using mobile devices to communicate, access and share information, conduct research and analyze data. These devices are the gateway to digital learning.

Digital learning will also support educators in better identifying and meeting student needs by providing them real-time data on student performance, expanded access to resources to individualize instruction and online learning communities to gain professional development support.

States can adopt a variety of approaches to accelerate the shift to digital content, online assessment and high-access environments including learning environments that take advantage of student-owned devices. While local choice and options should be empowered, states can use purchasing power to negotiate lower-cost licenses and contracts for everything from digital content to access devices and mobile Internet services. Equipment and services can be provided based on financial need. Public-private partnerships can also become a tool to build and sustain the infrastructure for digital learning.

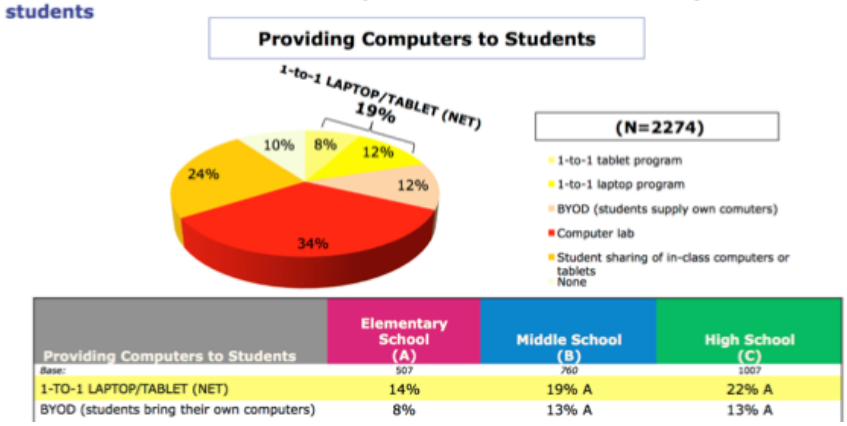
DIGITAL LEARNING NOW AN INITIATIVE OF EXCELINED

Retrieved from http://excelined.org/2014DLNReportCard/

APPENDIX S.
STUDENT ACCESS TO TECHNOLOGY

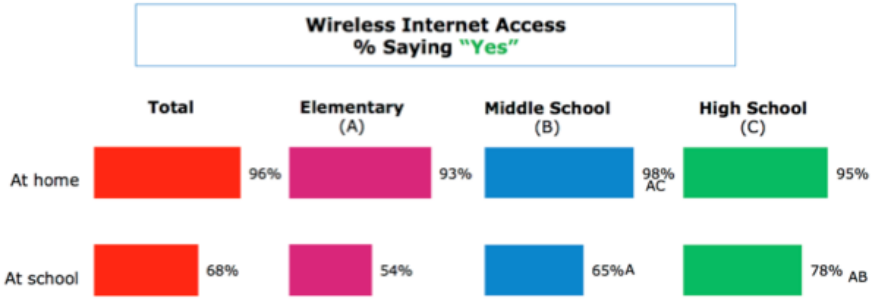
Student Mobile Device Survey 2015
(Pearson Education, 2015)

One in five students say that their school provides either a laptop or tablet on a one-to-one basis. This number drops to one in seven for elementary school students



Providing Computers to Students	Elementary School (A)	Middle School (B)	High School (C)
Base:	507	760	1007
1-TO-1 LAPTOP/TABLET (NET)	14%	19% A	22% A
BYOD (students bring their own computers)	8%	13% A	13% A

Nearly all students – across all grade levels – have Wi-Fi access to the Internet at home. Wi-Fi access at school is much lower, especially for elementary school students.



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