**Math Appendix E: Technology Standards**

**Grades 9-12**

The Lindenwold Public Schools believe that technology is most effective when it is part of the learning experience throughout all courses and grades, wherever possible and appropriate. Our teachers aim to help students consider how to select, use, and recommend technologies to accomplish specific objectives and goals related to the curriculum. Our status as a Google Apps school gives all stakeholders regular and consistent opportunities to use Google tools as part of our instruction, assessment, collaboration, and documentation practices.

| **Standard** | 8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge | | |
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| **Strand** | A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations | | |
| **Grade Level bands** | **Content Statement Students will:** | **Indicator** | **Indicator** |
| **9-12** | Understand and use technology systems. | 8.1.12.A.1 | Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources. |
| Select and use applications effectively | 8.1.12.A.2 | Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review. |
| 8.1.12.A.3 | Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue. |
| 8.1.12.A.4 | Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results. |
| 8.1.12.A.5 | Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results |
| **Key activities:**   * Introduction to and use of computers/Chromebooks * Introduction to and use of Google suite of tools including Search, Docs, Sheets, Forms, Sites, Maps, YouTube, and Photos * Introduction to Smartboard and tools that go along with it * Introduction to ELMO document camera * Utilizing Google tools to establish portfolios that reflect student products and address ongoing transition planning | | | |

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| **Strand** | B. Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology. | | |
| **Grade Level bands** | **Content Statement Students will:** | **Indicator** | **Indicator** |
| **9-12** | Apply existing knowledge to generate new ideas, products, or processes.  Create original works as a means of personal or group expression. | 8.1.12.B.2 | Apply previous content knowledge by creating and piloting a digital learning game or tutorial. |
| **Key Activities:**   * Students use Google suite of tools to engage in collaborative creation using photos, words, artistic expressions, etc. | | | |

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| **Strand** | C. Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. | | |
| **Grade Level bands** | **Content Statement Students will:** | **Indicator** | **Indicator** |
| **9-12** | Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.  Communicate information and ideas to multiple audiences using a variety of media and formats.  Develop cultural understanding and global awareness by engaging with learners of other cultures.  Contribute to project teams to produce original works or solve problems. | 8.1.12.C.1 | Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community. |
| **Key Activities:**   * Use Skype to partner with classrooms abroad and engage in discussion * Use collaborative and/or competitive interactive digital games for learning * Use Twitter to follow global trends and learn about other cultures and related events around the world | | | |

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| **Strand** | D. Digital Citizenship: Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. | | |
| **Grade Level bands** | **Content Statement Students will:** | **Indicator** | **Indicator** |
| **9-12** | Advocate and practice safe, legal, and responsible use of information and technology. | 8.1.12.D.1 | Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work. |
| Demonstrate personal responsibility for lifelong learning. | 8.1.12.D.2 | Evaluate consequences of unauthorized electronic access (e.g., hacking) and disclosure, and on dissemination of personal information |
| 8.1.12.D.3 | Compare and contrast policies on filtering and censorship both locally and globally |
| Exhibit leadership for digital citizenship. | 8.1.12.D.4 | Research and understand the positive and negative impact of one’s digital footprint. |
| 8.1.12.D.5 | Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address personal, social, lifelong learning, and career needs |
| **Key Activities:**   * Lessons on using online materials and considerations for cutting, pasting, re-mixing, and appropriating content for classroom use | | | |

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| **Strand** | Strand E: Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information. | | |
| **Grade Level bands** | **Content Statement Students will:** | **Indicator** | **Indicator** |
| **9-12** | Plan strategies to guide inquiry  Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.  Evaluate and select information sources and digital tools based on the appropriateness for specific tasks. | 8.1.12.E.1 | Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources. |
| 8.1.12.E.2 | Research and evaluate the impact on society of the unethical use of digital tools and present your research to peers. |
| **Key Activities:**   * Students use Google suite of tools to engage in research and collaborative and independent problem exploration in the math context | | | |

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| **Strand** | F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. | | |
| **Grade Level bands** | **Content Statement Students will:** | **Indicator** | **Indicator** |
| **9-12** | Identify and define authentic problems  and significant questions for investigation.  Plan and manage activities to develop a solution or complete a project.  Collect and analyze data to identify solutions and/or make informed decisions.  Use multiple processes and diverse perspectives to explore alternative solutions. | 8.1.12.F.1 | Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs. |
| **Key Activities**   * Students use Google suite of tools to guide thinking about problems and how to solve them * Lessons on the scientific process and use of digital tools to facilitate the collection, organization, analysis, and sharing of data and findings * Ongoing use of assistive technology and developing an understanding of which types of accommodations are most effective | | | |

| **Standard** | 8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment. | | |
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| **Strand** | A. The Nature of Technology: Creativity and Innovation Technology systems impact every aspect of the world in which we live. | | |
| **Grade Level bands** | **Content Statement Students will:** | **Indicator** | **Indicator** |
| **9-12** | The characteristics and scope of technology | 8.2.12.A.1 | Propose an innovation to meet future demands supported by an analysis of the potential full costs, benefits, trade-offs and risks, related to the use of the innovation. |
| The core concepts of  technology. | 8.2.12.A.2 | Analyze a current technology and the resources used, to identify the trade-offs in terms of availability, cost, desirability and waste |
| 8.2.12.A.3 | Research and present information on an existing technological product that has been  repurposed for a different function. |
| **Key Activities**   * Manipulatives in math lessons provide opportunity to design, plan, develop, and use objects for a purpose (understanding abstract math) * Understanding of math principles connected to local community and design of key features like parks, roads, etc. | | | |

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| **Strand** | B. Technology and Society: Knowledge and understanding of human, cultural and societal values are fundamental when designing technological systems and products in the global society. | | |
| **Grade Level bands** | **Content Statement Students will:** | **Indicator** | **Indicator** |
| **9-12** | The cultural, social, economic and political effects of technology. | 8.2.8.B.1 | Research and analyze the impact of the design constraints (specifications and limits) for a product or technology driven by a cultural, social, economic or political need and publish for review. |
| The effects of technology on the environment. | 8.2.8.B.2 | Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation and maintenance of a chosen product |
| The role of society in the development and use of technology. | 8.2.8.B.3 | Analyze ethical and unethical practices around intellectual property rights as influenced by human wants and/or needs. |
| The role of society in the development and use of technology. | 8.2.8.B.4 | Investigate a technology used in a given period of history, e.g., stone age, industrial  revolution or information age, and identify their impact and how they may have  changed to meet human needs and wants. |
| 8.2.8.B.5 | Research the historical tensions between environmental and economic considerations as  driven by human needs and wants in the development of a technological product, and  present the competing viewpoints to peers for review. |
| Key Activities:   * Considerations of limitations of technology in its use to achieve curricular aims (e.g., pros and cons of print materials vs. digital materials) * Students use Google suite of tools to engage in research and collaborative and independent problem exploration | | | |

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| **Strand** | C. Design: The design process is a systematic approach to solving problems. | | |
| **Grade Level bands** | **Content Statement Students will:** | **Indicator** | **Indicator** |
| **9-12** | The attributes of design. | 8.2.8.C.1 | Explain how open source technologies follow the design process |
| 8.2.8.C.2 | Analyze a product and how it has changed or might change over time to meet human needs and wants |
| The application of  engineering design. | 8.2.8.C.3 | Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors engineering (ergonomics). |
| 8.2.8.C.4 | Explain and identify interdependent systems and their functions |
| 8.2.8.C.5 | Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled. |
| The role of troubleshooting, research and development, invention and innovation and experimentation in problem solving. | 8.2.8.C.6 | Research an existing product, reverse engineer and redesign it to improve form and  function. |
| 8.2.8.C.7 | Use a design process to devise a technological product or system that addresses a global problem, provide research, identify trade-offs and constraints, and document the process through drawings that include data and materials. |
| **Key Activities**   * Use Google suite of tools to collaborate and build solutions for problems posed within curricula * Discussion on physical limitations of technological equipment | | | |

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| **Strand** | D. Abilities for a Technological World: The designed world is the product of a design process that provides the means to convert resources into products and systems. | | |
| **Grade Level bands** | **Content Statement Students will:** | **Indicator** | **Indicator** |
| **9-12** | Apply the design process. | 8.2.8.D.1 | Design and create a prototype to solve a real world problem using a design process, identify constraints addressed during the creation of the prototype, identify trade-offs made, and present the solution for peer review |
| 8.2.8.D.2 | Write a feasibility study of a product to include: economic, market, technical, financial, and management factors, and provide recommendations for implementation. |
| Use and maintain  technological products and systems. | 8.2.8.D.3 | Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system. |
| Assess the impact of products and systems. | 8.2.8.D.4 | Assess the impacts of emerging technologies on developing countries |
| 8.2.8.D.5 | Explain how material processing impacts the quality of engineered and fabricated products |
| 8.2.8.D.6 | Synthesize data, analyze trends and draw conclusions regarding the effect of a  technology on the individual, society, or the environment and publish conclusions |
| Key Activities:   * Discussion on physical limitations of technological equipment | | | |

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| **Strand** | E. Computational Thinking: Programming: Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge. | | |
| **Grade Level bands** | **Content Statement Students will:** | **Indicator** | **Indicator** |
| **9-12** | Computational thinking and computer programming as tools used in design and engineering. | 8.2.8.E.1 | Demonstrate an understanding of the problem-solving capacity of computers in our  world. |
| 8.2.8.E.2 | Analyze the relationships between internal and external computer components. |
| 8.2.8.E.3 | Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games). |
| 8.2.8.E.4 | Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements). |
| **Key Activities**   * Lessons on math processes and building familiarity with equations (algorithms) * Technology-enhanced lessons on vocabulary for technical conversation (e.g., concepts like “vector” illustrated) * Protocols for guiding student self-directedness with classroom procedures and academic critical thinking * Non-fiction texts on role of computers and technology in society | | | |