Growing with KIBO – Alignment with ISTE Standards for Students (2016)

Implementing KIBO robotics as part of an integrated, STEAM-based curriculum in early childhood supports many of the ISTE standards indicators. KIBO curriculum is based on three intertwined threads: the engineering design process, computational thinking, and an arts-based curricular integration component. The curriculum emphasizes roles-based group work and collaboration, structured around the Positive Technological Development framework developed by KinderLab co-founder Dr. Marina Bers. The following alignment statements refer to those standards most directly addressed by the lessons and pedagogy in our *Growing with KIBO* curriculum. However, educators can design educational experiences with KIBO to support *all* of the ISTE standards indicators using our curriculum as the foundation.

The ISTE Standards Indicator text in this table is drawn from the ISTE Standards for Students, revised 2016, available at https://www.iste.org/standards/for-students.

References

- Bers, M. (2012). *Designing digital experiences for positive youth development: From playpen to playground*. Cary, NC: Oxford.
- International Society for Technology in Education (2016). *ISTE Standards for Students*. Retrieved from iste.org.

1. Empowered Learner
Students leverage technology to take an active role in choosing, achieving and demonstrating competency in their learning goals, informed by the learning sciences.

ISTE Standards Indicator	***Growing with KIBO* Alignment Statement**
1a. Students articulate and set personal learning goals, develop strategies leveraging technology to achieve them and reflect on the learning process itself to improve learning outcomes.	*Not a primary focus*
1b. Students build networks and customize their learning environments in ways that support the learning process.	*Not a primary focus*
1c. Students use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways.	Growing with KIBO is built on the model of "digital fluency," or the ability to express oneself with technological tools. Through cross-curricular projects, Growing with KIBO allows children to incorporate coding and building into explorations of other subjects of interest, using technology to "show what they know" just as they might by speaking, writing, or creating art.
1d. Students understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.	Growing with KIBO includes specific instruction in the functions of KIBO's different parts. By design, children can add and remove components to KIBO. They choose the capabilities of their robot based on the capabilities they need it to have to address the problem at hand. This experience empowers students to see themselves as designers of technological solutions.

2. Digital Citizen
Students recognize the rights, responsibilities and opportunities of living, learning and working in an interconnected digital world, and they act and model in ways that are safe, legal and ethical.

ISTE Standards Indicator	***Growing with KIBO* Alignment Statement**
2a. Students cultivate and manage their digital identity and reputation and are aware of the permanence of their actions in the digital world.	*Not a primary focus*
2b. Students engage in positive, safe, legal and ethical behavior when using technology, including social interactions online or when using networked devices.	Growing with KIBO is deeply informed by Dr. Marina Bers' Positive Technological Development pedagogy, as expressed in her 2012 book *Designing Digital Experiences for Positive Youth Development*. Teachers and students are encouraged to experiment with "what if" questions and potential consequences as they use technology, and to provoke examination of values and exploration of character traits while working with robotics. Although there is no online component to KIBO work, responsible use of technology (such as taking good care of devices and sharing limited resources) is a focus.
2c. Students demonstrate an understanding of and respect for the rights and obligations of using and sharing intellectual property.	Students are encouraged to recognize the contributions and collaborations with other students through acknowledgement of idea-sharing at circle discussions. These sharing relationships are made concrete through artifacts like "collaboration webs" – diagrams that show which classmates helped each student with their project. The sharing of ideas is framed as a natural part of the engineering process.
2d. Students manage their personal data to maintain digital privacy and security and are aware of data-collection technology used to track their navigation online.	*Not a primary focus*

3. Knowledge Constructor
Students critically curate a variety of resources using digital tools to construct knowledge, produce creative artifacts and make meaningful learning experiences for themselves and others.

ISTE Standards Indicator	***Growing with KIBO* Alignment Statement**
3a. Students plan and employ effective research strategies to locate information and other resources for their intellectual or creative pursuits.	*Not a primary focus*
3b. Students evaluate the accuracy, perspective, credibility and relevance of information, media, data or other resources.	*Not a primary focus*
3c. Students curate information from digital resources using a variety of tools and methods to create collections of artifacts that demonstrate meaningful connections or conclusions.	Growing with KIBO's integrated, cross-curricular projects -- such as creating robotic animals within ecosystems and programming robotic dancers representing different cultures -- allow students many opportunities to incorporate research and connection-making. Students do not use KIBO to perform research, but they can work with library/media specialists to gather information, examples, and context to support their creations.
3d. Students build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions.	Creating personally meaningful projects is a cornerstone of Growing with KIBO's constructivist pedagogy. Many individual lessons and longer projects in the curriculum involve connections to students' wider communities and real world challenges. Discussion of these community relationships is an explicit component of these projects. For example, one integrated project asks students to create robotic helpers based on "real life heroes" such as public servants, doctors, and teachers.

4. Innovative Designer
Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions.

ISTE Standards Indicator	***Growing with KIBO* Alignment Statement**
4a. Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.	Student work with building and programming the KIBO robot and designing their solutions is structured using the Engineering Design Process, with students learning to ASK, IMAGINE, PLAN, BUILD, TEST+IMPROVE, and SHARE their constructions. Students are introduced to the steps of the Engineering Design Process early in the curriculum, and they use these steps and the associated vocabulary throughout their project work.
4b. Students select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.	*Not a primary focus*
4c. Students develop, test and refine prototypes as part of a cyclical design process.	The TEST+IMPROVE step of the Engineering Design Process receives a special focus throughout the curriculum. Students are encouraged to test their "finished" projects early, identify aspects of their work that do not function according to their plan, seek feedback from peers on possible improvements, and implement their changes. "Engineering circles" – regular whole-class meetings set aside for this sharing and feedback gathering – reinforce these behaviors.
4d. Students exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems.	Perseverance is a key social-emotional learning goal in Growing with KIBO. Students are taught that engineers do not expect things to work correctly the first time. "Failure" is merely an opportunity to refine the design or think about new ways to address a challenge. Open ended problems are the norm in Growing with KIBO, as the principle of "digital fluency" means that the primary goal of all of the lessons is personal expression.

5. Computational Thinker
Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.

ISTE Standards Indicator	***Growing with KIBO* Alignment Statement**
5a. Students formulate problem definitions suited for technology- assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.	Students create of algorithms to solve problems and express ideas throughout their work with KIBO. Students practice sequencing techniques as they program KIBO; using these techniques, students gain experience in framing the original problems in ways that can be addressed through a sequenced algorithm.
5b. Students collect data or identify relevant data sets, use digital tools to analyze them, and represent data in various ways to facilitate problem-solving and decision-making.	Students use robotics as a tool for modeling and representation. Linking to the concept of "digital fluency," students use programs to express, explore, and represent cross-curricular knowledge. For example, students program KIBO to move specific distances in the context of modeling arithmetic operations on a number line.
5c. Students break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem-solving.	Students are encouraged during several lessons to apply decomposition techniques to simplify more complex problems. Working collaboratively, students break problems down into parts, then design solutions to those individual parts: for example, programming each leg of a maze-navigation program separately.
5d. Students understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.	Development of computational thinking, sequencing skills, decomposition, and algorithmic thinking are benefits of working with KIBO's tangible, screen-free coding language. Programming a robot allows children's work with computational thinking to impact the physical world, bringing a concrete element to computational thinking which is especially helpful in early childhood.

6. Creative Communicator

Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats and digital media appropriate to their goals.

ISTE Standards Indicator	***Growing with KIBO* Alignment Statement**
6a. Students choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.	Growing with KIBO is designed to increase students' "digital fluency" by giving them a strong foundation in expressive robotics and coding. As students progress through their technological education, they will gain familiarity with other tools and their palette of available expressive tools will increase from this foundation.
6b. Students create original works or responsibly repurpose or remix digital resources into new creations.	Students are encouraged to recognize the contributions and collaborations with other students through acknowledgement of idea-sharing at circle discussions. These sharing relationships are made concrete through artifacts like "collaboration webs" – diagrams that show which classmates helped each student with their project. The sharing of ideas is framed as a natural part of the engineering process.
6c. Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.	In early childhood education, coding is most effective when it is paired with concrete, hands-on work in the physical world. Robotics involves designing, building, constructing, and decorating in addition to coding; students create with both digital tools (code) and physical ones. The expressive constructions their build with KIBO, combined with the behaviors created with algorithms and code, serve as a visualization tool for children to share their ideas.
6d. Students publish or present content that customizes the message and medium for their intended audiences.	Sharing work is an important aspect of the Constructivist pedagogy in Growing with KIBO. Sharing work allows students to perceive the impact that their expressive work has on their peers and community. Each project in Growing with KIBO culminates in a project showcase. The SHARE step of the Engineering Design Process contextualizes the act of sharing within the overall cycle.

7. Global Collaborator

Students use digital tools to broaden their perspectives and enrich their learning by collaborating with others and working effectively in teams locally and globally.

ISTE Standards Indicator	***Growing with KIBO* Alignment Statement**
7a. Students use digital tools to connect with learners from a variety of backgrounds and cultures, engaging with them in ways that broaden mutual understanding and learning.	*Not a primary focus: there is no online component or computer-mediated communication in students' work with KIBO.*
7b. Students use collaborative technologies to work with others, including peers, experts or community members, to examine issues and problems from multiple viewpoints.	*Not a primary focus: Although small-group collaboration is a key aspect of Growing with KIBO's pedagogy, collaborative technologies per se are not used.*
7c. Students contribute constructively to project teams, assuming various roles and responsibilities to work effectively toward a common goal.	Students contribute constructively to project teams, assuming various roles and responsibilities to work effectively toward a common goal." Working with KIBO, children have the opportunity to take on different roles in the engineering process, such as builder, coder, scanner, and tester. Students are also asked to reflect and share at "technology circles" during the process. These techniques are based in the research of KinderLab co-founder Dr. Marina Bers, who established a framework for positive youth development through working with technology.
7d. Students explore local and global issues and use collaborative technologies to work with others to investigate solutions.	*Not a primary focus*