ROBOTIKIDS RECOMMENDATIONS

RobotiKids

For Association Anoual

Erin Gowaski, Hannah Jaworski,
Nathan Kumar, Josh Palmer

WPI

ROBOTIKIDS - ROBOTICS CURRICULUM FOR MIDDLE SCHOOL STUDENTS
PROGRAM OVERVIEW FOR ANOUAL 2022

Content for Recommendations

Thank you and Future Aspirations

The team wants to express how thankful we are to have been able to work on this project and for the support and encouragement of Association Anoual throughout the entire process. It has been an extremely rewarding experience that we have grown very passionate about. We hope this program will be able to reach and impact students in Morocco and ignite their interest in STEM and possibly future endeavors. We would love to see RobotiKids grow and become a program that Association Anoual can use as a foundation to implement into a full scale program or to be introduced into schools for even greater outreach. Here are our recommendations that we have organized from our construction of the program and how we believe it will best be run.

Breakdown of the Manuals

Lesson Manual

A detailed lesson manual was developed to operate as the main component of guidance for facilitating the Robotikids program. It was organized into seven main lesson plans: an introductory lesson, four technical lessons with the topics of coding, movement and turning, sensors, arms and joints and then two lessons delegated to the project explanation and demonstration. The lessons are created in a manner that allows them to be stacked or spread that best suits the teacher’s

ideal lesson layout. They also are versatile and although they are created around VEX IQ kits, they can be taught with other robotics kits and deliver the same lesson and skills. The lesson manual is equipped with a timeline and outline of a recommended order of lessons, discussion and activities. Further detailed information is included that explains activities, provides discussion points, additional resources, recommendations and lesson material.

Technical Manual

Supplemental material that is directly relevant to VEX IQ robotics was compiled and explained through the technical manual. It provides an explanation on how to use the online platforms, coding examples and insight into the hardware. There are examples of the bots that can be constructed as well. This resource is intended to provide more structure and clear instruction to the facilitator with VEX robotics by providing a knowledge base. It is expected to be used in tandem with the lesson manual because the lessons align and correlate.

Examples covered in the Lesson Manual and the Technical Manual are not exhausted; there are extensive other possibilities that are available through the platform and with exploration of the robot. We recommend becoming as familiar with VEX as possible which will assist with implementing, facilitating and building RobotiKids.

Mentor Training

It would be highly beneficial to have at least one main facilitator of RobotiKids that is well-versed in VEX and the program. All mentors should be comfortable with pertinent STEM fields (especially coding) prior to assisting facilitating this program. We predict that it would be best if mentors could return for multiple iterations of the program, so they become more acquainted and also can help train new mentors that may not be as familiar with VEX. We have created a form to gauge a mentor's willingness to participate in the running of this program. The lesson manual and technical manual should be administered to the mentors beforehand and they should review all the material and become acquainted with the online platform, code and robotic functions.

After reviewing the material individually, a session should be held with all participating mentors to debrief any questions and also train how to work with middle school children. This bootcamp should prepare them for how to efficiently work with students and support them properly along with problem solving techniques. Given Association Anoual has conducted many youth programs, we had envisioned a bootcamp that operated similarly to one that already exists, particularly one like Digigirlz. Mentors should be there for guidance and know how to complete all of the tasks but not take over for the students when they have questions. We recommend having a ratio of one mentor per two or three students.

Final Project Suggestions

The final project and presentation is a critical component of RobotiKids. It is the motivation for the other lessons to lead up to a project where the students can demonstrate their knowledge and practice working on a team. Ideally, the project is worked on in a team; the team will have planned, built and executed both the code and construction of a robot to complete a task framed in the form of a real life problem. The final project should include a presentation or pitch that allows them to explain their ideas and methods that will tie in entrepreneurship and interpersonal elements.

We recommend not limiting the program to a single final project but rather have it change with each iteration. This will help to identify areas of the lessons that need improvement and also drive the program in the entrepreneurial front by addressing multiple possible real-life problems.

Example Problem:

> A recommended problem can be framed as a beach clean-up and removal of trash. This includes having an arena setup with different types of trash of different color, objects to avoid and walls that obstruct. Trash should be picked up and removed accordingly. Variations are welcomed and can alter the difficulty of the project. Students should execute this by creating a robot with code and test out its functionality. It can be made into a competition with different parameters, like what robot can remove the most trash or do it the quickest. The preparation

process should include mapping a plan with the engineering design process to address the problem. The presentation portion should include preparing a presentation to showcase their process and decisions and pitch what their robot is capable of.

Timing:

After conducting our field evaluation, we concluded that a full scale completion of the robot and code would require multiple days of work. The construction of the code and robot with a series of tests to ensure it works properly would not be feasible in the allotted time of the original lesson plan. This, in addition to preparing their pitch, would be a time consuming process and require extensive guidance from mentors. If a full scale final project with a fully operational robot and code, was to be implemented, two to three days of build time will be necessary. We recommend striving for this in future iterations of RobotiKids as it would leave a profound impact on the youth. This can be done by adding work days in between lessons 6 and 7.

If more work days are not feasible at the time, one solution could be to scale back the presented problem. For example, using the color sensor is one of the most time-consuming and difficult tasks so this element could be removed and replaced with line-following instead. Here, students would code their robot to follow a line and identify trash that was placed on it, this would eliminate the need of a search pattern and other more difficult coding. Another option that would work with the original seven-lesson plan is to shift to take on a more entrepreneurial standpoint. The project could be presented as if it were to be executed, but instead, have the students focus on the process they would go through if they were to create a functional robot. This includes mapping out their engineering design process, highlighting what key features from the lessons that they would include, how they would do this, why, and an explanation of why their robot is the best. It should be framed as a startup that is pitching to their investor. This version of the final project would be able to run in the time frame of the original lesson plan. Given Association Anoual's passion for entrepreneurship,

this was recommended to implement tactics and strategies from other programs to instill the importance of entrepreneurship into their lives and continue to grow in these areas.

Essential elements need to be considered and outlined before executing the entire lesson plan including having a predetermined set of standards. These can be changed iteration to iteration, but a well defined project will make a difference in the outcome. Ensure to specify exactly how to handle practice times, where field elements will be placed, allowed human interaction zones, when the official runs will begin and how many trials are allowed. These are not exhaustive limitations and standards, but rather guiding parameters to consider.

Regardless of the chosen final project, it is incredibly important that the students feel successful in their final project demo. Given that they have put in an abundant amount of time and faced challenges, this should be a rewarding experience that encourages them to pursue STEM further.

Benchmarking Success and Future Assessment

To continue to improve the program and work towards expanding, it is important to benchmark success and continue to note where changes should be implemented by taking record of what works and doesn't work. We recommend having both students and mentors fill out a survey before and after the program. This survey should include their perception of robotics and STEM fields but also ask for opinions on the program. In addition to taking record of these feedback surveys, we recommend holding both mentee and mentor focus groups and recording opinions and feedback through these semi-structured meetings. These should be hosted to see from another perspective what went well, what didn't and areas of improvement. In the beginning stages of the program, it would be beneficial to record observations in real time and have mentors do the same so successes and struggles can be noted and adjusted accordingly. The team predicts that having a structured written format in addition to the notes written from the surveys, focus groups and observations would be helpful. A rubric would offer a standard to guide with and can be used to assess student success. A similar rubric can

also be formatted to gather data on students' feelings towards the program to supplement the pre and post program survey.

Rubric Template :

Category	10	5	2	Score
Scientific and Problem Solving Skills	Understood and exercised multiple ways to address a problem	Exercised some ways to address a problem	Did not understand or grasp different ways to tackle a problem	
Interpersonal, communication and teamwork skills	Worked with multiple people, communicated efficiently, understood and worked with different perspectives	Somewhat worked well in teams and attempted to communicate well with different perspectives	Did not work with other people or communicate with others for their perspectives	
Engagement and Interest	Was interested and engaged in the curriculum at all times	Somewhat was interested in the lesson and activities	Was not engaged with what was being taught or the activities	
Technical Understanding	Understood and could apply the lessons and material	Understood some lessons and material	Did not understand any lessons or material	
Engineering Design Process and Entrepreneurial Use	Used the design process when faced with a problem and to help create their pitch	Attempted to use the engineering design process to guide their plan and pitch	Disregarded the engineering design process and made no plan for their pitch	
Presentation Skills	Effectively communicated their results and logic	Attempted to somewhat communicate their results and logic	Did not communicate or present their results and logic	
Final Project Execution	Worked towards a functioning robot that addressed the task, designed and presented appropriately	Partly completed a final robot and part of a presentation with their design and pitch	Made little to no progress on their final project and did not execute their pitch or logic	

Expanding RobotiKids

The seven lesson plan format that was constructed and tested by the team of developers was organized with the intention that it would be versatile to the teacher and easily implemented into a variety of forms. We envisioned that this would help Association Anoual implement RobotiKids in a form that was most conducive to their desired structure. Since it is in early stages and developed into this format, we recommend deciding and creating a standard for RobotiKids, whether it be an after school program, a summer camp, an implementation of lessons delivered to schools or extended into a long term program. This will help to solidify the program and ensure it has a solid foundation and vision going forward. Additionally, we highly recommend the use of VEX IQ kits for the most seamless operation of this program. If it were to expand, it would be necessary that participating students have access to kits so investing in more kits or creating a schedule that allows students the most access to the kits is essential. We hope RobotiKids will become an engaging program that is impactful to the youth and naturally draws the attention of Morocco. In order to assist this, we believe promotion on social media and advertising would be greatly beneficial to the program's growth in the future.

Leaving an Impact

Our hope for the project is that students will not be discouraged by this program but rather use it as a testament for what they are able to accomplish. We urge that with the conclusion of the program students will know that they can continue to learn and be curious about STEM fields. We recommend providing ways to continue to get involved in STEM education and robotics through other programs and recommending robotic competitions. In addition, students should be encouraged to continue to code on VEX VR and explore their passions. Given Association Anoual's passion for entrepreneurship, we recommend implementing tactics and strategies that are used in other programs to instill the importance of entrepreneurship into their lives and give them outlets to continue to grow in these areas.