Creating a Middle School Makerspace in an International Baccalaureate School

Brad White
bwhite@nps.k12.va.us

Creating a Middle School Makerspace in an International Baccalaureate School

By

Bradley B. White

BS in Information Systems, Old Dominion University
2001

Presented in
partial fulfillment of the requirements for
the degree of Master of Arts in Liberal Studies
in Leadership

Hollins University
Roanoke, Virginia
May 2022

Digitally signed by Joni C Poff, Ed.D.
DN: cn=Joni C Poff, Ed.D., o, ou, email=poffjc@hollins, c=US
Date: 2021.12.06 21:37:36 -05'00'

Director of Essay: ______________________________
Dr. Joni Poff

Department: Education

Table of Contents

Introduction

The Academy for Discovery at Lakewood (ADL) is a public school in Norfolk, Virginia serving students in grades 3-8. The middle school (grades 6-8) is an International Baccalaureate (IB) Middle Years Programme (MYP) institution. The MYP curricular goal is to develop active learners who can think internationally and empathize with others. The curriculum encourages students to make connections between their studies and the real world. This helps prepare them for success in further study and in life. (International Baccalaureate, n.d. What is the MYP?) The MYP design curriculum, which will be discussed in detail in this paper, uses a hands-on approach to problem solving. It is the perfect learning environment for a dedicated makerspace. The principal of ADL approached me in March 2021 with the idea of repurposing my classroom as a makerspace lab. This paper will explore the history of the maker-centered learning pedagogy and the benefits of a dedicated classroom makerspace. It will further document the implementation of a middle school makerspace lab in a diverse urban MYP IB middle school located in Virginia.

Theoretical Frameworks and History of Makerspace

For most people, the word *maker* conjures up images of a person working with their hands, building a house, designing architecture, or creating a sculpture. A maker is anyone who makes things. And while making things in the classroom is not a new concept, the maker-centered learning model and dedicated makerspace in education are relatively new ideas. The maker movement comprises a growing culture of hands-on making, creating, designing, and innovating. The biggest hallmark of maker-centered learning is allowing students to develop a do-it-yourself mindset around a range of activities. These activities might include robotics, woodcraft, fabrication, and 3-D printing (Burke, 2014).

The modern makerspace movement is based largely on the cognitive constructivist theory of Jean Piaget. Piaget frames knowledge as a process rather than a product and posits that understanding requires that the learner actively engage in meaning-making. For Piaget, knowledge is not something that exists outside of the learner, but rather an internal construction that takes place when new information is actively assimilated and accommodated into existing knowledge. Piaget believed that our understandings of reality are constantly being revised and recreated over time based on new experiences (Langer & Killen, 2008).

The constructivist framework's recognition of the individual's role in learning, the importance of meaning-making on a personal level, and the active role of the learner make the theory relevant to modern educators. Teachers recognize the role of prior knowledge in students' learning and see students not as blank slates or empty vessels but as individuals with a variety of prior experiences, knowledge, and beliefs that they use in constructing new understanding about the world (Jones & Brader-Araje, 2002).

The primary responsibility of the teacher in a constructivist classroom is to create a collaborative problem-solving environment where students actively participate in their own learning. Rather than instructing or lecturing, the constructivist teacher becomes a facilitator of learning. The teacher makes sure he or she understands the students' prior knowledge and experiences then guides the learning activities to address and build on them (Oliver, 2000).

A natural outgrowth of Piaget's constructivist theory was the constructionist theory proposed by Seymour Papert in the 1980s when computers in classrooms were a new and innovative technology. According to Kafai (as cited in Sawyer, 2006), constructionism places an emphasis on learning through artifact construction and has three major tenets: appropriation, knowledge construction, and learning cultures. He states that in appropriation, learners internalize new knowledge and begin to identify with it. Knowledge construction is two-fold: students construct their own knowledge through a process of planning and creating meaningful artifacts. Finally, constructionism places value on a learning culture, or a sense of social cohesion around a common purpose, with the belief that social context strengthens new knowledge (Papert, 1980).

Another framework for the makerspace concept in education lies in the multi-modal learning theory proposed by Gunther Kress. Multi-modal learning posits that learners can both take in and produce knowledge in a variety of ways. Multi-modal approaches have long played a role in education. For example, the charts and graphs in a math text, the maps in a history text, or the picture of the food pyramid in a health text are all ways that students are taught to take in information through visual means. What has really changed in the last 20 years is that text, once the dominant mode for communicating knowledge, has been superseded by other communication modalities, including audio, video, still images, or combinations of these (Jewitt, 2008). Nouri (2019) found that even during self-study today's college students use different modes, including taking pictures, making audio and/or video recordings, and writing digital texts.

Multi-modal learning theory is consistent with the makerspace concept. The hands-on elements of the makerspace lab are particularly engaging for students with a kinesthetic-tactile learning style. This learning style requires that students manipulate or touch material to learn. Kinesthetic-tactile techniques can also be used in combination with visual and/or auditory study techniques to produce meaningful multi-sensory learning (Grant, 1985).

Design thinking theory is another framework supporting the makerspace movement. While the roots of the design thinking theoretical framework go back to at least the 1960s, Buchanan (1992) tied the many origins of this theory together in his article, *Wicked Problems in Design Thinking*. He discussed how, beginning during the Renaissance, various arts and sciences developed as separate disciplines, becoming more and more cut off from each other. Design thinking theory proposes to integrate these highly specialized and discrete fields of study, in order to solve modern problems more holistically (Dam & Siang, 2020).

Design thinking captures the whole cycle of innovation, including using a designer's knowledge to meet user needs, identifying the appropriate technology to use and then adapting business processes accordingly (Plattner et al., 2009). Design thinking is often used as an approach for new product development in business. Plattner et al. (2009) state that design thinking starts with labeling the 'problem space' and then uses systematic observation, questioning, brainstorming and other moderation techniques to arrive at the 'solution space,' which ends with implementation. The design thinking process approach requires communication, integration, and collaboration as it is a team approach.

The final theory that gives context to the makerspace movement is the media literacy framework. New media technologies have dramatically changed the definitions of both media and literacy. Eshet-Alkalai and Soffer (2012) state, "digital technologies (social media, multimedia and communication technologies) have penetrated almost every aspect of our lives" (p.1). These new technologies have made the media even more important and influential than ever before and have made media literacy a requirement in the modern world. The term 'new media' is generally used to refer to computer and communication technologies (Chen et. al., 2011). New media is generally digital, hyper-textual, virtual, multimodal, hybrid, interactive, automated, variable, or some combination of these (McPherson, 2008; Lister et al., 2003).

In addition to defining new media, this theoretical framework requires a new definition of literacy. As Cervi, Paredes, and Tornero (2010) suggest, the definition of literacy has expanded from the classic meaning (reading and writing), to audiovisual and digital literacy, and finally to include a more comprehensive new media literacy. Chen et al. (2011) posits that new media literacy is required to participate responsibly in modern society. Tzu-Bin et al. (2013) propose 10 indicators of new media literacy. Five of the skills are related to the intake of media include

- consuming, the technical skills to consume media content;
- understanding, obtaining literal meaning from media contents;
- analyzing, the ability to deconstruct media messages using multiple modalities;
- synthesizing, the ability to integrate media content one's own viewpoints;
- evaluating, the ability to question, critique, and challenge the credibility of media messages.

An additional set of five skills is related to creating media content. This set of skills includes

- prosuming; having the technical skills needed to produce/create media contents;
- distributing, the ability to spread or share information;
- producing, the ability to duplicate or mix media contents, such as mixing images and audio materials;
- participating, the ability to effectively handle different ideas and norms within a social community, and
- creating, the ability to create media contents with socio-cultural awareness.

The media literacy framework expands the definitions of both media and literacy and adds an element of design thinking to the more traditional ink and paper mode of communication.

The five theoretical frameworks discussed here have laid the groundwork for the modern makerspace movement. Piaget's constructivist theory illustrates the importance of individual mean-making and frames the classroom teacher as a facilitator of problem-solving rather than a lecturer or content expert. Papert's constructionist approach explains that students build their own knowledge through the construction or creation of meaningful artifacts. Kress's multimodal learning theory reinforces the value of the hands-on elements of the makerspace lab. Design thinking theory captures the entire cycle of innovation, which interestingly, is very similar to IB MYP Design Cycle. The media literacy framework adds design thinking elements to learning and communication that were previously done only through printed text. It also emphasizes the need for responsible and critical participation in modern technology. The makerspace movement will build on and merge all of these theories to allow students to create, innovate, and develop technological skills that translate to career readiness (Stager, 2014).

At the heart of the maker movement is the understanding that "learning happens best when learners construct their understanding through a process of constructing things to share with others" (Donaldson, 2014, p. 1). Key to the success of the maker movement in education is the shift away from ready-made knowledge to a classroom environment that encourages exploration, creativity, innovation, and collaboration (Donaldson, 2014). Kurti et al (2014) state:

> Ultimately, the outcome of maker education and educational makerspaces leads to determination, independence and creative problem solving, and an authentic preparation for the real world through simulating real-world challenges. In short, an educational

> makerspace is less of a classroom and more of a motivational speech without words” (p. 11).

Rather than being viewed as an “alternative” way to learn, proponents believe the maker learning model is what modern learning should look like - learning with the goal of developing students who are creative, innovative, independent, and technologically literate (Stager, 2014).

In the last decade, makerspaces have gone mainstream. Museums, libraries, schools, and even private labs that allow interested makers to rent by the hour are all common locations for makerspaces. Common makerspace technologies include 3D printers and scanners, laser cutters, software, and even more traditional technologies like woodworking and metalworking. Using schools and public organizations as hosts to hands-on making is not a new idea. Quilting societies date back to the 19th century, and art and crafts flourished in public libraries in the 1930s (Oliver, 2016). Libraries and educational programs have promoted hands-on learning for many years, especially in art and media both during and after school (Oliver, 2016). Modern makerspaces vary in both size and in the activities offered. Some are housed in large storage or warehouse facilities, and some are as small as a table in the corner of a library. The advantage of a makerspace is having a place that offers tools and materials that many do not have access to, everything from power tools, to sewing machines and soldering irons, to computer-controlled laser cutters and 3D printers (Koh & Abbas, 2015). The ideas and concepts are endless, and only depend on the size of the makerspace, funding, and maker imagination.

Methodology

This action research project will document the building of a middle school makerspace lab, developing teacher professional development on the use of the makerspace lab, creating a parent flyer, writing a proposal to the Parent Teacher Association (PTA) to establish on-going support for the project, and developing a student survey. Action research, popular in school settings, is a highly collaborative activity that allows practitioners to investigate solutions to the everyday problems experienced by schools. In contrast to focusing on theoretical principles, action research focuses on real-world immediate concerns over which educators can exhibit some influence and control (Ferrance, 2000).

Action research is typically conducted by teachers with the goal of using their findings to change future teaching practices (Ferrance, 2000). Action research can be conducted by an individual teacher, as a collaboration between two or more teachers, by a school, or by a district. As Ferrance (2000) states, “Often, academic research is seen as disconnected from the daily lives of educators” (p.13). Action research, in contrast, is relevant to teachers and allows them to blend academic research with their own daily professional practice. The steps to action research are problem identification, data collection, data interpretation, action based on data, and reflection. These are addressed below.

Problem Identification

In March 2021, the principal of Academy for Discovery at Lakewood (ADL) spoke to me about the feasibility of repurposing my classroom as a makerspace lab. I was the logical choice to lead this project as I am one of two teachers in the school who teach MYP Design, and I had the largest classroom. My classroom was two classrooms combined into one to form a giant room that would be perfect to use as a makerspace. The IB curriculum really lends itself to a maker approach. The IB MYP equivalent to teaching technology is called Design, and the IB MYP Design Cycle is closely tied to the makerspace process.

MYP Design courses center around the MYP Design Cycle. MYP design focuses on a holistic design process rather than final products and solutions (International Baccalaureate. n.d., Curriculum). The MYP Design Cycle is not just used as a guide to develop a product or solution, it is also used as the criterion for teachers to grade students' work. The purpose of the Design Cycle is to teach students how to design and evaluate solutions to any problem. The MYP Design Cycle consists of four parts. The first step is Criterion A: Inquiring and Analyzing. Before the students do their research, they are given a scenario created by the instructor. During this stage, the students define the problem they are trying to solve and start to do any research they will need to accomplish this. The second step is Criterion B: Developing Ideas. In this step, students must first come up with the criteria for gauging the success of their solution. This is the step where students will brainstorm and refine ideas to resolve the problem they defined in Criterion A. The final action in Criterion B is to come up with the design specifications for the solution. Oftentimes, this is a sketch or drawing that depicts the final solution. During the third step, Criterion C: Creating the Solution, students create their solution to the problem defined in Criterion A. The research done during Criterion A and the brainstorming and idea creation during Criterion B are then used for creating the solution. This is usually the students' favorite stage and the stage most suited for a makerspace environment. Students must first develop a plan to follow to create the solution. The solution should be built according to the design specifications established in Criterion B. The final step in the MYP Design Cycle is Criterion D: Evaluating. During this phase, the students develop testing methods that will measure the success of the solution created during the previous criterion. The students also come up with ways that the solution could be improved.

While MYP Design Cycle clearly aligns with the makerspace concept, we needed more information on the specifics of a school makerspace. The first problem was how to create a physical makerspace in the school building. We needed to know what materials to include and how to structure the lab. Next, we needed to develop a means for resupplying the lab with materials on an ongoing basis. The final problem was how to introduce teachers to the makerspace concept and get them to use the lab.

Data Collection and Interpretation

The first thing I did at the school level was to form a team of stakeholders to plan the project. The school district did not have a makerspace classroom at any middle school yet, so there was no district-wide template. Our team is composed of a 6th grade Science teacher, a 6th grade Social Studies teacher, the school's instructional technology resource teacher, and me.

Our initial data on makerspace implementation came from research on the makerspace movement and from researching the equipment and the layout of the lab. The team was able to visit several local makerspace labs, including those at private businesses and a local university. Our full team was able to attend a free workshop at Old Dominion University that offered some tips on how their makerspace is set-up and managed. We were also able to tour their working makerspace to get ideas for our layout. Over the summer, our teacher group was invited to a makerspace professional development workshop presented by Old Dominion University (ODU). This workshop focused on several student engineering projects and how we could present these projects in the classroom. We also toured ODU's makerspace lab. This lab had several high-end 3D printers, laser cutters, various power tools, and several CAD workstations. The ODU makerspace is open to any ODU students that sign up. Obviously, this makerspace was above and beyond what we were building, but it was nice to see what a higher education institution was doing in the maker-centered learning environment.

Action Based on Data

Our first challenge was moving me to another classroom and totally clearing out the room so that we could start the makerspace. I was going to move to a classroom down the hall. The last week of school we recruited some of our students, and we were able to get the room completely cleared out; this also allowed students to have some buy-in to the project. As the project evolved, we also decided that we would be creating two separate makerspaces in the conjoining rooms: one for the middle school and one for the elementary school.

Our middle school makerspace has several moving white board tables, a green screen studio, two 3-D printers, several portable whiteboards, and several computer workstations. Also, the size of the classroom allows the students room to spread out and work in small groups.

Our elementary makerspace is set up a little differently. There is not as much room in this classroom because it is smaller in size. We installed several large tables, portable whiteboards, cabinets, and storage devices to hold supplies. We also set up four workstations and a teacher space with access to a large Epson whiteboard.

Once we had the room initially set up, we met to decide what sort of supplies we would need to make the lab successful. The first step was to do a school-wide inventory and see what sort of supplies the school already had. We knew we had two 3-D printers that were rarely used, so we included those. We also had access to two black and white printers and several PC workstations. Our science department donated a robotics kit they were not using. The art department donated colored paper, markers, colored pencils, fabric, hot glue guns, and other art supplies and raw materials. Our media center donated the green screen for our student studio.

We realized that stocking the makerspace would be an ongoing, never-ending task. Through our research, we came up with a list of supplies that seemed to be hallmarks of successful makerspaces and included those in a request to the PTA.

Once we exhausted our initial supply budget, we decided it would be a great idea to get the PTA at our school to buy into the makerspace lab, and hopefully, donate supplies. The planning team developed a proposal (Appendix A) to present at the next PTA meeting. We included its purpose, how it fit into the IB MYP curriculum, and a list of materials that would be needed. Additionally, a flyer (Appendix B) was created to hand out to parents.

Our next item of business was getting our staff to buy into and use the makerspace for their lessons. We did not want the space to be wasted, and we did not want it to turn into a school storage area. The team hosted several professional development seminars to introduce our staff to what a makerspace is and how it can benefit the school. We held two separate training sessions: one for our middle school teachers and one for our elementary school teachers. Our training explained what a makerspace is, informed them of the theories behind the maker movement, and gave them some ideas for lessons. I hosted the middle school training. The PowerPoint presentation used for the professional development session is included in Appendix C.

Reflection

While the PTA has not yet allocated any money for makerspace supplies, parents have been very supportive of the makerspace idea. Supplies from homes continue to flow in daily. I am on the agenda to speak about the makerspace at the January 2022 PTA meeting.

The teacher training was a success. The middle school professional development session really focused on training teachers on the MYP Design Cycle and how it can come to life in the makerspace lab. Our hope is that once the teachers understand what the maker-centered learning model is, they will be comfortable coming up with lessons of their own and, in the future, use the lab for a variety of activities and projects.

The steps in action research are cyclical, and in reflecting on the makerspace project, I realize that I need to collect additional data, specifically the thoughts and opinions of students, to determine next steps for the makerspace. I want to know if students prefer the traditional computer lab classroom or the makerspace, if they are interested in an afterschool makerspace club, if they can effectively collaborate in groups while using the makerspace, and if they enjoy using the lab. Using the responses strongly agree, agree, neutral, disagree, or strongly disagree, students will be asked to rate the following using an anonymous Google survey (Appendix D):

1. The makerspace lab environment made it easy to collaborate on a group project.
2. I liked the overall layout of the tables in the makerspace lab.
3. I was able to understand the teacher's expectations in the makerspace lab.
4. I would prefer working in the makerspace rather than a traditional classroom.
5. I would consider joining an afterschool makerspace club that utilizes the lab.

There will be a sixth drop-down response section on the survey that will ask: What projects would you like to use the makerspace for?

The student survey will be distributed, collected, and analyzed at the end of the 2021-22 school year. The results of the survey will be used to guide next steps in the continued use of the makerspace.

Conclusion

The makerspace at ADL has been a huge success. At least four teachers have used the makerspace for a classroom project so far this school year, with more teachers planning to integrate it into their lessons for the second semester. Some sample lessons have included 3D printing projects, the paper airplane project covered in the professional development PowerPoint, and a paper water tank project. Students love the lab. One student said, "I wish we were in this room every day." Another asked, "Why can't we be in here more often? It is fun to be able to build stuff!" While the PTA has not yet purchased supplies, I am on their agenda for the January meeting. We sent the flyer home with all students in early October, and many parents have already dropped off household materials in response. Next steps include the January PTA presentation, a news article about the makerspace on the school website, the student survey, and meetings with local businesses to establish partnerships to support the makerspace. Following an analysis and presentation of the student survey results, we will hold a forum with teachers to address questions, concerns, and suggestions.

While this year has served as a pilot year for our makerspace, I can see many opportunities for expansion going forward. Not only can we expand the physical materials provided, but we can also increase the use of the space. One plan for next year is to create an afterschool makers club. This will allow students to complete lengthier, self-directed projects that may or may not be tied to a school assignment. We have also discussed having engineering students from our two local universities partner with the club.

As we move toward full implementation, it is my hope that the makerspace lab will become as central to our classrooms as bookshelves and math manipulatives. Flexible thinking, problem solving, and collaboration are all 21st century skills that are actively taught through making. Providing an environment where students can create and explore new ideas is critical to instilling those skills.

References

Buchanan, R. (1992). Wicked problems in design thinking. *Design Issues*, *8*(2), 5-21.

Burke, J. J. (2014). *Makerspaces: a practical guide for librarians*. Rowman & Littlefield.

Cervi, L. M. P., Paredes, O., & Tornero, J. (2010). Current trends of media literacy in Europe: An overview. *International Journal of Digital Literacy and Digital Competence*, *1*(4), 1-9.

Chen, D.-T., Wu, J., & Wang, Y.-M. (2011). Unpacking new media literacy. *Journal on Systemics, Cybernetics and Informatics*, *9*(2), 84-88.

Dam, R. F., & Siang, T. Y. (2020). Design thinking: Get a quick overview of the history. The Interaction Design Foundation. https://www.interaction-design.org/literature/article/design-thinking-get-a-quick-overview-of-the-history.

Donaldson, J. (2014). The maker movement and the rebirth of constructionism. *Hybrid Pedagogy*. https://hybridpedagogy.org/constructionism-reborn/

Eshet-Alkalai, Y., & Soffer, O. (2012). Guest editorial - Navigating in the digital era: Digital Literacy: Socio-cultural and educational aspects. *Educational Technology & Society*, *15*(2), 1.

Ferrance, E. (2000). *Themes in education: Action research.* Brown University: Educational Alliance, 1-34.

Grant, S. M. (1985). The kinesthetic approach to teaching: Building a foundation for learning. *Journal of Learning Disabilities*, *18*(8), 455–462.

International Baccalaureate. (n.d.). *What is the MYP?*. https://www.ibo.org/programmes/middle-years-programme/what-is-the-myp/

International Baccalaureate, (n.d.). *Curriculum*. https://www.ibo.org/programmes/middle-years-programme/curriculum/

Jewitt, C. (2008). Multimodality and literacy in school classrooms. *Review of Research in Education, 241-267.*

Jones, M. Gail and Laura Brader-Araje. (2002). The impact of constructivism on education: Language, discourse, and meaning. *American Communication Journal 5*(3).

Koh, K., & Abbas, J. (2015). Competencies for information professionals in learning labs and makerspaces. *Journal of Education for Library and Information Science*, *56*(2), 114-129.

Kurti, R. S., Kurti, D. L., & Fleming, L. (2014). The philosophy of educational makerspaces: Part 1 of making an educational makerspace. *Teacher Librarian, 41*(5), 8–11.

Langer, J., & Killen, M. (2008). *Piaget, evolution, and development*. Psychology Press.

Lister, M., Dovey, J., Giddings, S., Grant, I., & Kelly, K. (2003). *New media: A critical introduction*. Routledge.

McPherson, T. (ed.) (2008). *Digital Youth, Innovation, and the Unexpected* (pp. 241-259). The MIT Press.

Nouri, J. (2019). Students multimodal literacy and design of learning during self-studies in higher education. Tech Know Learn , 24, 683–698.

Oliver, K. M. (2000). Methods for developing constructivism learning on the web. *Educational Technology, 40*(6).

Oliver, K. M. (2016). Professional development considerations for makerspace leaders, part one: Addressing “what?” and “why?”. *TechTrends*, *60*(2), 160-166.

Papert, S. (1980). *Mindstorms: Children, computers, and powerful ideas.* Basic Books, Inc.

Plattner, H., Meinel, C. & Weinberg, U. (2009). Human and ecological problem solving through radical design thinking: Analyses and development of design theory and design framework based on long-term human needs. Trondheim: Norwegian University of Science and Technology.

Sawyer, R.K. (ed.) (2006). *The Cambridge Handbook of the Learning Sciences*, pp. 35–46. Cambridge University Press.

Stager, G.S. (2014, June 10). Gary Stager's full ASCD interview about making {Web post}. Retrieved from http://stager.tv/?p=3241

Tzu-Bin Lin, Jen-Yi Li, Feng Deng, & Ling Lee. (2013). Understanding New Media Literacy: An Explorative Theoretical Framework. *Journal of Educational Technology & Society*, *16*(4), 160–170.

Appendix A

PTA Proposal

What is a makerspace?

A makerspace is a place where students have access to tools and materials to create things that interest them and that solve real or imagined problems. Imagine a room filled with tools and materials you might see in an art studio, wood shop, or computer or science lab. In the makerspace, teachers provide students with just the right amount of instruction and guidance and then allow them the freedom to explore, innovate, solve problems, and make!

Why does ADL need a makerspace?

We are so excited for this program because participating in makerspace projects is shown to teach and reinforce 21st century skills such as:

- communication, collaboration, and critical thinking
- exploration, experimentation, innovation, and problem-solving
- a growth mindset, emphasizing process over outcome
- connections between learning and the real world

The makerspace concept melds with the IB Design Cycle and the inquiry-based focus of the IB MYP. Based on a growing body of evidence, makerspace is more than just DIY building. With proper guidance, support and vision, Makerspaces are hubs of learning where students can explore and elaborate on concepts learned in classes.

What will students do in the makerspace?

Here are a few quick lesson examples from different subject areas:
In a unit on early American settlers, students can apply their knowledge by building replicas of early shelters or designing blueprints for town layouts. They could also try to grow the same food as the settlers in a garden, or build the same farming tools.
In a science unit on the solar system, students could build a Galilean telescope and then design and build their own improved model.
Keeping learning journals, students can plan out projects, record their progress, and reflect backwards and forwards on their makerspace journey, thus integrating writing across the curriculum.

What do we need for the makerspace?

Magformer Remote Control, 3 at 129.95 each

Magformer Small Power, 3 at 79.99 each

MakeyMakey Standard Kit, 3 at 49.99 each

Squishy Circuits Kit, 3 at 24.99 each

Makerbot Replicator, 1 at 2899.00

Solar Car Kit (10pk), 1 at 164.00

Kids Inventing: A Handbook, 1 at 18.99

Maker Movement Manifesto, 1 at 18.00

School Library MakerSpaces, 1 at 42.75

Invent to Learn guide to 3D printing, 1 at 20.00

PlayOsmo for iPad, 2 at 79.99 each

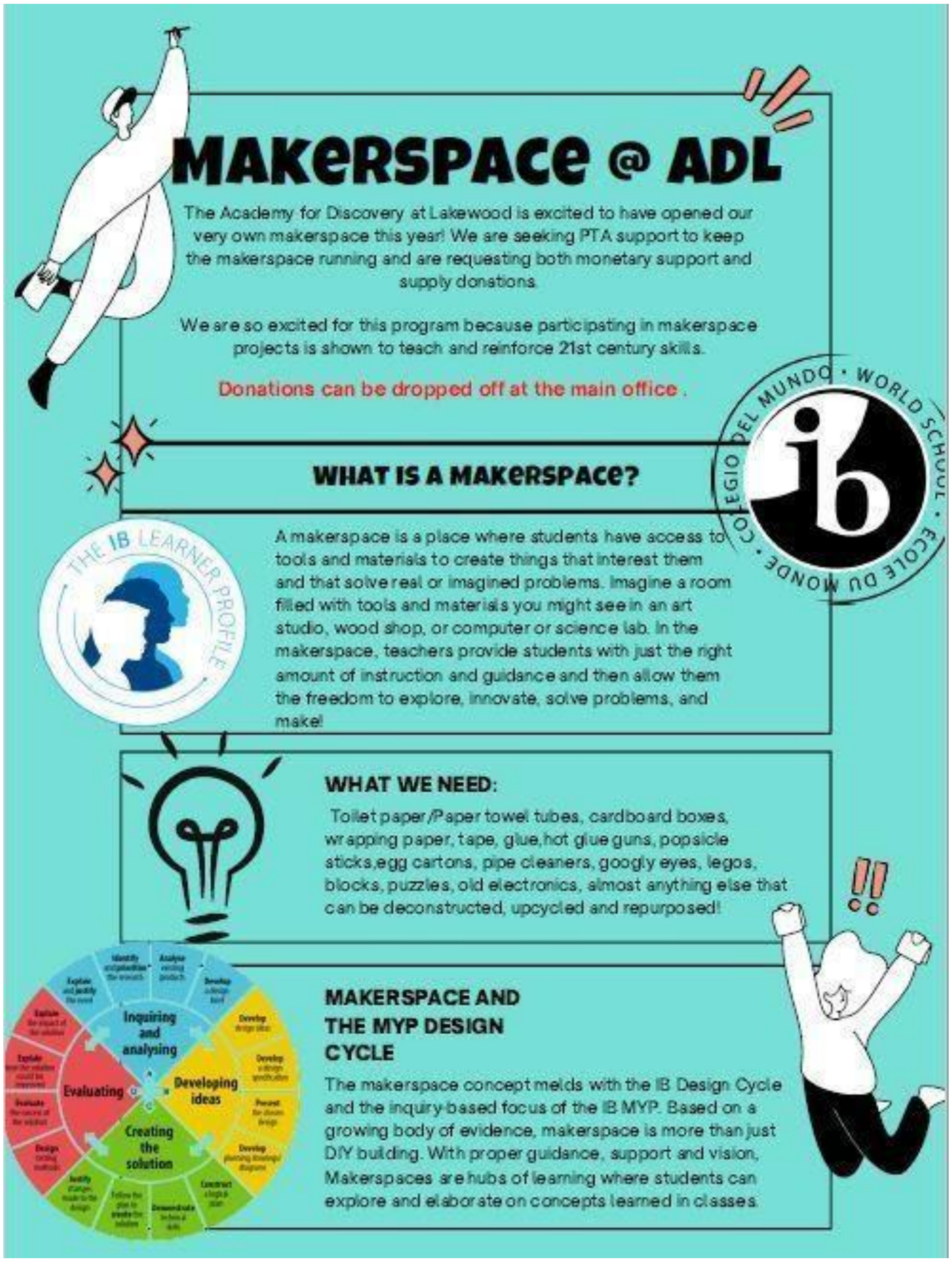
Idea Books, 40 at 5.99 each

Makerspace Robot Kit, 5 at 50.00 each

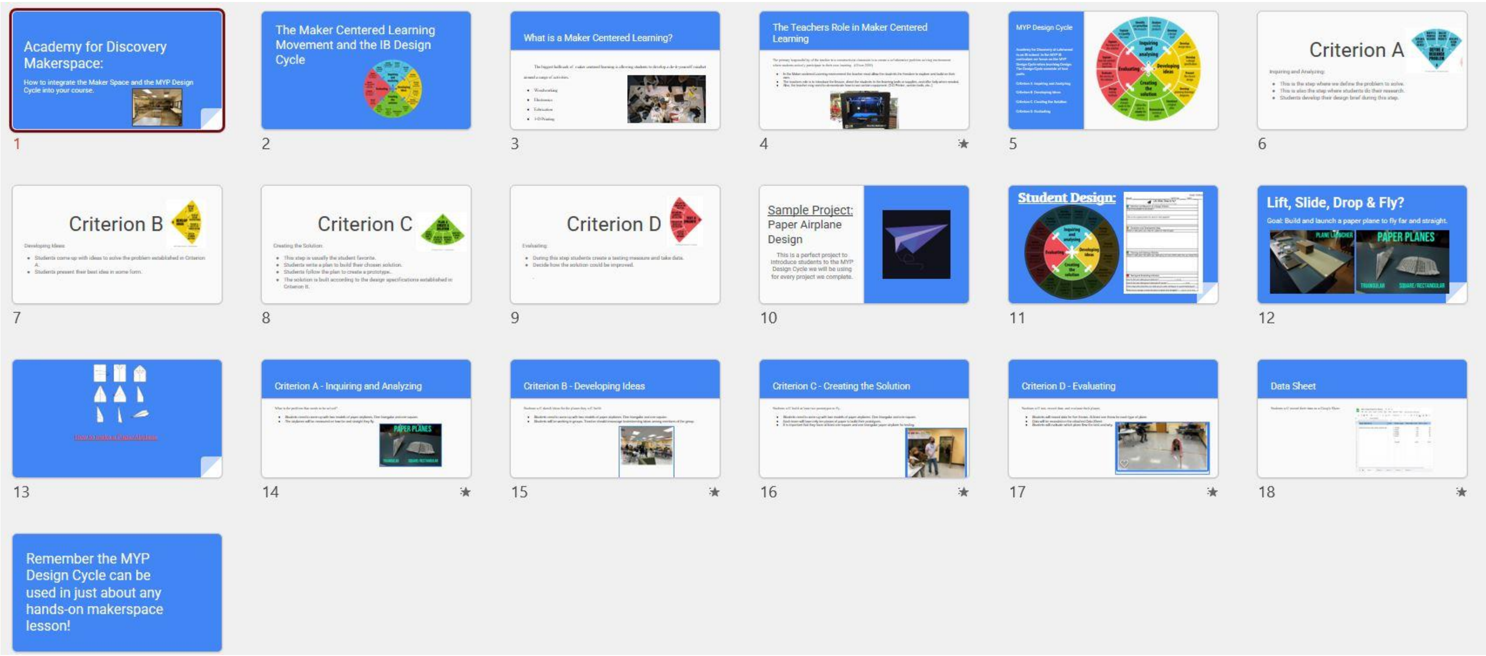
Total Cost of Requested Items: $4,672.08

In addition, we are requesting donations from parents as outlined in the attached flyer.

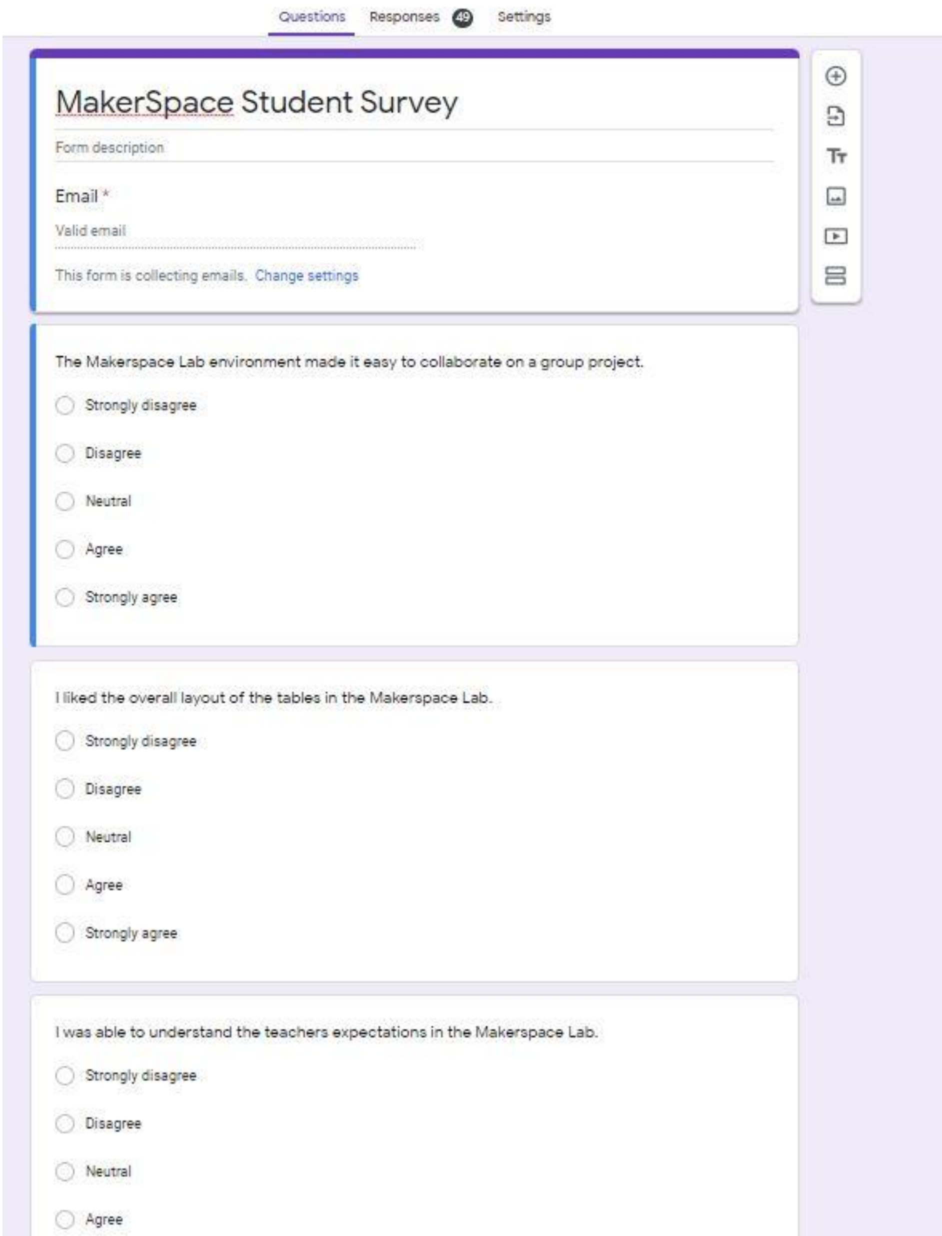
Appendix B


MAKERSPACE @ ADL
The Academy for Discovery at Lakewood is excited to have opened our very own makerspace this year! We are seeking PTA support to keep the makerspace running and are requesting both monetary support and supply donations.
We are so excited for this program because participating in makerspace projects is shown to teach and reinforce 21st century skills.
Donations can be dropped off at the main office .
COLEGIO DEL MUNDO · WORLD SCHOOL · ECOLE DU MONDE
ib
WHAT IS A MAKERSPACE?
THE IB LEARNER PROFILE
A makerspace is a place where students have access to tools and materials to create things that interest them and that solve real or imagined problems. Imagine a room filled with tools and materials you might see in an art studio, wood shop, or computer or science lab. In the makerspace, teachers provide students with just the right amount of instruction and guidance and then allow them the freedom to explore, innovate, solve problems, and make!
WHAT WE NEED:
Toilet paper/Paper towel tubes, cardboard boxes, wrapping paper, tape, glue, hot glue guns, popsicle sticks, egg cartons, pipe cleaners, googly eyes, legos, blocks, puzzles, old electronics, almost anything else that can be deconstructed, upcycled and repurposed!
Inquiring and analysing
Developing ideas
Creating the solution
Evaluating
MAKERSPACE AND THE MYP DESIGN CYCLE
The makerspace concept melds with the IB Design Cycle and the inquiry-based focus of the IB MYP. Based on a growing body of evidence, makerspace is more than just DIY building. With proper guidance, support and vision, Makerspaces are hubs of learning where students can explore and elaborate on concepts learned in classes.

Appendix C


Academy for Discovery Makerspace:
How to integrate the Maker Space and the MYP Design Cycle into your course.
1
The Maker Centered Learning Movement and the IB Design Cycle
2
What is a Maker Centered Learning?
3
The Teachers Role in Maker Centered Learning
4
MYP Design Cycle
5
Criterion A
6
Criterion B
7
Criterion C
8
Criterion D
9
Sample Project:
Paper Airplane Design
This is a perfect project to introduce students to the MYP Design Cycle we will be using for every project we complete.
10
Student Design:
11
Lift, Slide, Drop & Fly?
Goal: Build and launch a paper plane to fly far and straight.
PAPER PLANES
12
13
Criterion A - Inquiring and Analyzing
14
Criterion B - Developing Ideas
15
Criterion C - Creating the Solution
16
Criterion D - Evaluating
17
Data Sheet
18
Remember the MYP Design Cycle can be used in just about any hands-on makerspace lesson!

Appendix D



Questions Responses 49 Settings

MakerSpace Student Survey

Form description

Email *

Valid email

This form is collecting emails. Change settings

The Makerspace Lab environment made it easy to collaborate on a group project.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

I liked the overall layout of the tables in the Makerspace Lab.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

I was able to understand the teachers expectations in the Makerspace Lab.

- Strongly disagree
- Disagree
- Neutral
- Agree

I would prefer working in the Makerspace over a traditional classroom.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

I would consider joining an afterschool Makerspace club that utilizes the Lab.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

What projects would you like to use the Makerspace for:

- 3-D Printing projects
- Coding Drones
- Hands on building things.
- Sewing projects.