The Mission Covenant Church Holm Glad No. 2 Primary School: Learning by Doing Program

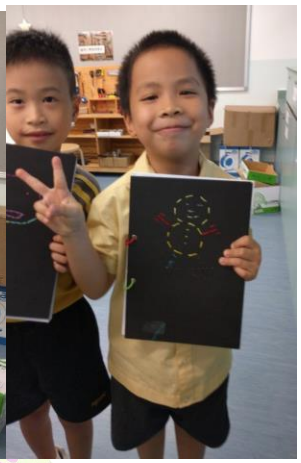
1st Term Making Class Curriculum (2016 - 2017)

Overall theme: Water and Energy

	1	2-3	4-5	6-12	
P6	小創客筆記 Young Maker Journal	小小木工 Young Maker Bench	小小木工 Free woodwork making	自給自足烏托邦: 魚菜共生 Self-sustainable city: Aquaponics Garden	
	1	2	3	4	5-7
p4,5	小創客筆記 Young Maker Journal	螺絲起子遊戲 Screwdriver game	環保木頭車 Recycling car design	認識電路 Circuit boards	發想未來綠色交通 How to power our future transportation?
	1-2	2	3-4	5-7	
P2	小創客筆記 Young Maker Journal	螺絲起子遊戲 Screwdriver game	縫紉初探：筆袋 Sewing pencil case	縫紉: 水樽套 Sewing water bottle case	
	1	2	3	4	
P1	磁石日曆 Magnetic Calendar	磁石日曆 Magnetic Calendar	磁石日曆 Magnetic Calendar	磁石日曆 Magnetic Calendar	

What do We want the kids to develop through the program?

Module 1: Young Maker Journal



Module 1	Young Maker Journal ● Each student make their own unique Maker Journal to document all the projects they work on at Maker Classes
Class Level	P.2 - 6
Objectives	● Learn how to record their ideas, process and result of the maker classes in writing and drawing ● Develop student's basic skills in design and stitching ● Train up student's skills and habit in writing and reflective thinking
Skills and competencies	● Basic stitching skill: make knot, running stitch, backstitch, end a stitch ● Basic design skill ● Basic documentation
Activities	Lesson 1 ● Demonstration of finished journal cover ● Demonstrate hand stitching skills ● Design their own cover Lesson 2 ● Make their own stitch cover
Materials/ Equipments	● Cardboard cover (2 per student) ● Push pin (one per student) ● Needle (one per student) ● Colored threads (4 rolls per 7 students) ● Ring (2 per student) ● Reinforcement ring (4 per student) ● Reinforcement ring puncher (1 per 7 student) ● Pencils (students bring their own) ● Ruler (students bring their own) ● Scissors (students bring their own)
Grouping	Individual project: each student make and design their own journal

Instructors	Maria, Kit (MakerBay)
Facilitator to student ratio	1:10
Role of facilitator	Provide support when student ask for help and demonstrate how to make a knot, backstitch and end a stitch in their own group
Resources	Notebook with stitched covers: http://howdidyoumakethis.com/notebooks-stitched-covers/

Review and Recommendation:

Observation	**Recommendations for improvement**
• Lacking debriefing with students to talk about how to make good use of the journal	• Prepare some worksheets with questions to prompt student reflect. • The reflection worksheet can be implemented in each module • Spend 15-20 minutes on debriefing and sharing at the end of each module
• Class schedule was too compacted, younger students (especially P2 and P4) takes more time to master new skills such as making knots, backstitch etc.	• Demonstrate each step separately and give mini exercises to students to practice before moving to next step.
• The design of some students were quite complex. Many of them do not know how to estimate the time required to do the stitching of their design	• Let students practice on stitching simple shapes (i.e. square, triangle) before doing their own designs • Prepare a few samples of finished work to stimulate students' imagination and increase their level of interest

• Revise lesson plan for the Module	• Lesson 1
	  ○ Introduce objectives and demonstrate of finished journal cover
	  ○ Demo hand stitching skills
	  ○ Practice stitching simple shape
	• Lesson 2
	  ○ Design cover
	  ○ Making/stitching
	• Lesson 3
	  ○ Finalise the journal
	  ○ Fill out reflection worksheet
	  ○ Sharing/ presentation

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Module 2: Young MakerBench


Module 2	Young MakerBench ● Students learn how to use various hand tools to assembly and varnish two maker benches for the makerspace
Class Level	P. 6
Objective	The class work together to build a workbench for the Maker Room in the school. In this activity, they can learn how to design for user experience, basic woodwork skills and collaboration.
Skills and competencies	● Basic woodwork skills ● Collaboration
Materials/ Equipments	● Precut wooden boards ● Saw ● Power drills ● Nails ● Hammer ● Tools set for bench
Grouping	Whole class build one workbench
Instructor	Maria, Nicolas
Facilitator to student ratio	1:10-15
Activity	Lesson 1 - Safety induction - Assembly (divide students into 2 groups: small shelves and bottom frame) Lesson 2 - Furnish

Review & Recommendation:

Observations	**Recommendations for improvement**

• Too much students building on 1 bench, so some students can't experience the building process much.	• 8 students building one bench at most, not more than that. Also can ask them to design the maker bench together first. Possible student grouping is Team 1: building bottom frame, Team 2: building mini shelves, Team 3: design banner and how to put the tools. • incorporate the design process, let them experience from 0 to 1

Module 3: Free Woodwork Making

Module 3	Free Woodwork Making ● Each student is free to make anything desktop size from wood by applying the basic woodwork skills learnt in previous lessons.
Class Level	P. 6
Objective	Practice using saws, hammer, screwdriver and hand drills to build simple wooden furnitures Measurement, design and planning
Skills & competencies	● Design and sketching ● Measurement ● Planning ● Basic woodworking skills
Materials/ Equipments	- Scrap wood - Saw - Screwdriver - Screw - Nails - Sandpaper - White glue - Hot glue gun - Rulers
Grouping	Each student works on their own piece
Instructor	Maria, Nicolas
Facilitator to student ratio + Duty	1:10 Safety and technical assistant, supervise student using hand tools and give advice in their design, encourage students to make clear design drawing with dimensions
Activity	Lesson 1 Lesson 2

Review and Recommendation:

Observations	**Recommendations & improvements**

As each student has their own piece to work on, it was very hard for us to take care and keep pace with everyone of them.	• Set a theme to let student brainstorm some ideas
As our facilitator to student ratio is too high, we may not able to keep eyes on every students.	• For safety reason, we recommend to lower the ratio to 1:6
Some students have no idea of what to make	• Get students to design on a theme • Encourage them to do online research • Show them some finished products
Not enough tools, students need to wait for a long time.	• Buy more hand tools such as hammers, saws and hand drills. We recommend to have at most 3 students sharing 1 hammer/ saw. And 5 students share 1 hand drill.

Module 4: Self-sustainable City - Aquaponics Garden

Module 4	Self-sustainable City - Aquaponics Garden ● A class investigate the challenges we faced in our food production. Then design and build an aquaponics system for the school.
Class Level	P. 6
Objective	1. Practice scientific inquiry through performing simple experiment 2. Critically evaluate information from diverse sources in order to enhance integrated practice 3. Enhance their ability to express findings and societal deliberation in written and oral formats 4. Design and planning 5. Group collaboration 6. Understand the roles of fish, plants and bacteria in the nitrogen cycle
Skills & competencies	● Basic scientific inquiry ● Research skills and critical thinking ● Design and planning ● Group collaboration ● Basic documentation skills
Materials/ Equipments	Pesticide detection Experiment: - Test tubes - Vegetables from market - Pesticide detection paper Introduction of Aquaponics: - A mini aquaponics system from online store Building aquaponics system: - Materials depended on students' design - But Seeds, fishes, fish food is a must
Grouping	Whole class build one aquaponics garden. The class is divided into 5 groups, each group with 3 - 4 students. Group 1: Pipe system Group 2: Bioreactor Group 3: Frame

	Group 4: Biology Group 5: Automated fish feeder
Instructor	Maria, Kit
Facilitator to student ratio + Duty	1:10
Activity	Lesson 1 - Brainstorm what is the problem with our food production - Video introduce problems - Do experiment on pesticide detection of vegetables Lesson 2 - Conduct online research on existing ways to solve these problems - Short presentation on their findings - Disassembly and study an established aquaponics system Lesson 3 - Present their proposed principles of aquaponics system - Co-design their own aquaponics system at school Lesson 4 - Planning and buying materials - Grouping (5 groups) Lesson 5 - Build Lesson 6 - Build Lesson 7 - Build and test
Resources	Project wiki: https://sites.google.com/site/learningbydoingmakerbay/home/p6-yu-cai-gong-sheng

Review and Recommendation:

Observations	**Recommendations & improvements**
Not enough time for consolidation and final presentation.	Better to develop a progress check system for students and for instructors. Also highly recommend to put a 5-10 min consolidation session at the end of each class.
Lack incentive to do documentation. Two students are assigned to be the reporters in each lesson, but most of the time they are taking photos and videos yet not much in written format.	Can move the consolidation and presentation to WDLBD, so that students can share what they have made to other students and teachers in school. This also helps provide incentive for students to do better documentation
Loose in completing tasks in each group. (weak at setting goal and monitor progress)	Put up a project progress chart in the classroom, ask each group to set their goal before class and mark their progress and reflection on the chart at the end

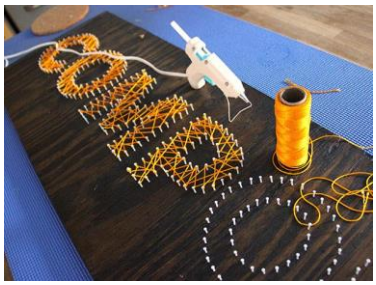
	of that class
Go further	This learning activities can get both involvement of other grades students. For example P2 can help in sprouting and take care of the fishes (teach them lessons about life on earth and responsibility). We can practice flipped classroom (can conduct a survey to check how many students have internet access at home) so that there will be more time to spend on practice making and consolidation in class.

Module 5: Screwdriver game

Module 5	Screwdriver game ● Each student learn how to use screwdrivers through playing games
Class Level	Primary 2, 4-5
Objective	Training hands' fine motor skill and practice using screwdriver safely. The game also incorporate spatial concept, problem solving and spelling practice.
Skills & competencies	● Problem solving ● Collaboration ● Basic making skill: screwdrivers
Materials/ Equipments	Screwdriver (1/student) Wooden game board (1/student) Screws Worksheet
Grouping	1 students
Instructor	Maria, Kit
Facilitator	1:15
Activity	Lesson 1 - Use screws and screwdrivers to make patterns following the worksheet - Screwdriver spelling challenge (3 Students work in a team)
Resources	Screw game Worksheet

Review and Recommendation:

Observations	**Recommendations & improvements**
Difference in learning.	Improvement: Set different levels. For example:

	● Level 1: finish patterns on worksheet ■ Level 2: Spelling challenge (fast and accurate) ■ Level 3: Draw with screwdrivers  
When working in teams, students' concept of collaboration are still very weak.	Improvement: Give clear instruction on different roles in a team and give them time to do the labour division before kick start the group game.
Students need more help with new skill building and provide support when they encountered problems	Recommendation: lower the facilitator to students ratio to 1:6

Module 6: Recycling Car Design

Module 6	Recycling Car Design ● Each student design and build their wooden car using recycling materials
Class Level	Primary 2, 4-5
Objective	1. Students can learn to design a car with recycling materials such as scrap woods, plastic bottles, cardboards. 2. Learn and practice to use hand drills and screwdrivers 3. They can also test on different designs to work out the best design that allows the car run fast and smooth in the competition.
Skills & competencies	● Basic design skills ● Basic woodwork skills: hand drills, screwdrivers, hot glue gun ● Problem solving
Materials/ Equipments	Wooden base (1 per student) Small scrap wood (around 2-3 per student) Wheels (4 per student, small and big) Screws (4 per student) Hand drills x 2 Plastic bottles Cardboards Markers/ crayons
Grouping	1 students
Instructor	Maria, Kit
Facilitator	1: 10

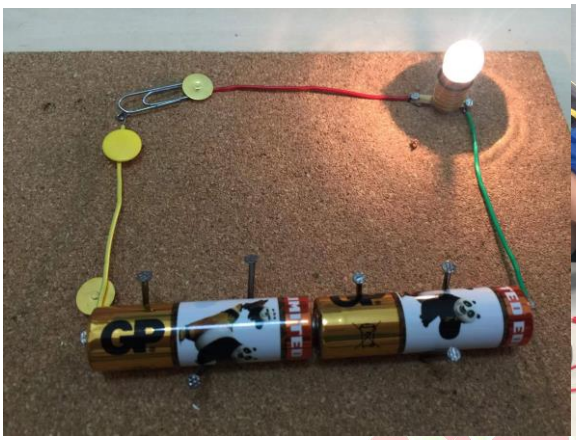
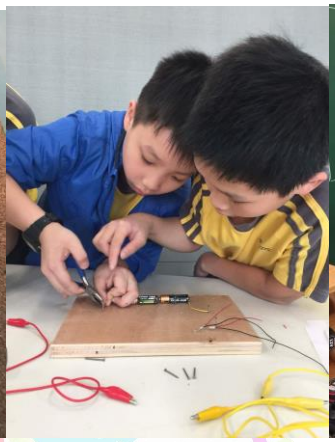
Activity	Lesson 1
	- Safety induction on using hand drills and hot glue gun
	- Students design their own car (Theme: Future dream car)
	- Set up 4 stations with different set of tools(each monitored by one facilitator):
	  - (1) Hand drill
	  - (2) Screwdriver, screw & wheels
	  - (2) Recycling materials & color pens/crayons

	- (3) Hot glue gun
Resources	Note to Facilitator: https://docs.google.com/presentation/d/1h4RmjuBCemFJLHPe57cpsRk5Fz2dzJphC1yVQylJajY/edit

Review and Recommendation:

Observations	**Recommendations & improvements**
When students were asked to design their own dream car, they usually don't know what to put on paper.	Could give students a handout to facilitate brainstorm and guide them through the design process
The class was finishing quite rush and lack time for consolidation	• Set goal together with students in the beginning of the class. For example, a showcase, presentation or car racing at the end of class • Give a brief rundown of the class to let students know how much time do they have to work on the project
Go further	Revised lesson plan: Lesson 1 - Design - Build the car Lesson 2 - Add additional features with littlebits - Competition and sharing

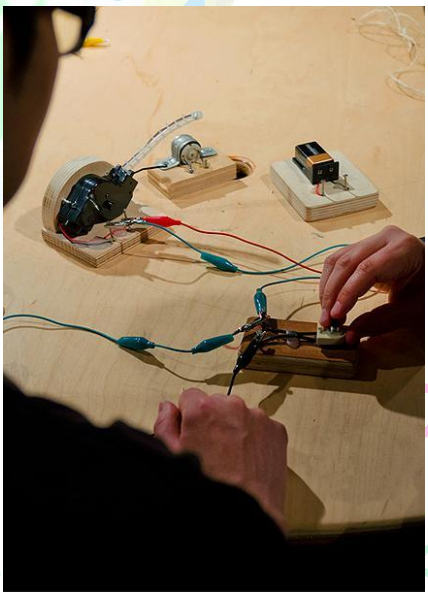
Module 7: Circuit Boards


Module 7	Circuit Boards ● Students work in groups to tinker with batteries, light bulbs and wires to build different circuits. They go through different challenge stations to learn about basic electricity concepts
Class Level	Primary 4-5
Objective	1. Foster the mindset of inquiry. 2. Learn about electricity concept such as voltage, current, parallel and in series circuit through tinkering (without providing answers in advance).
Skills & competencies	● Scientific inquiry ● Problem solving
Materials/ Equipments	- Alligator clips (6 per group) - 1.5 V Batteries (2 per group) - Light bulbs (3 per group) - Paper Clips - Nails (or push pins) - Hammers - Wooden board (or cork board) - Worksheet - Mini motor (optional) - Buzzer (optional)
Grouping	3-4 students
Instructor	Maria, Yvonne
Facilitator to student ratio + Duty	1:10 Do not tell the answers to students. Encourage students to experiment. But can give some tips to student by asking questions if they are stucked.
Activity	Lesson 1 - Demonstrate how to connect a simple circuit to light up a light bulb (5 min) - Teach them how to draw circuit diagram (5 min) - Grouping 3-4 students in a group to work on the challenge station

	shown on the worksheet (60 min: ~ 15 min per station) - Students share how they figure out the answer (10 min) - Debriefing & consolidation (5 min) - Tidy up (5 min)
Resources	Worksheet: https://docs.google.com/document/d/12SWI4nfnqX4pUCnZj3JIRuHo7wiklBXxsmt4h_mBoKY/edit?usp=sharing Exploratorium circuit workbench: https://www.exploratorium.edu/snacks/circuit-workbench http://tinkering.exploratorium.edu/circuit-boards

Review & Recommendation:

Observations	**Recommendations & improvements**
Lacking time to let students share their foundings	Improvement: better extend
Some students spent more time on play with hammers and nails instead of doing the electric circuit which is our main objective.	Improvement: (1) Premade blocks with light bulbs/ buzzer/ motor/ switches (2) Extend the class into 2 lessons. First lesson allows students to tinker with premade blocks. Second lesson let students make their own block and test it with other classmates. 
Difference in learning.	Improvement: Set different levels. ● Level 1: Tinkering with premade circuit boards ● Level 2: Complete the challenge stations ● Level 3: Make their own circuit boards

Module 8: How to power our future transportation

Module 8	How to power our future transportation ● Students work in groups to investigate how solar power generate energy for vehicle. Then they design and build a mini solar car.
Class Level	Primary 4-5
Objective	1. Apply the circuit concept into practice 2. Basic mechanics: how to use gears to move things 3. Design skill 4. Learn about green energy (especially solar power)
Skills & competencies	● Basic research skills ● Engineering process: Ask, Imagine, Plan, Create, improve ● Collaboration
Materials/ Equipments	- Solar toy car - Hammer - Scrap wood - Mini motor - Solar panels - Gears - Bamboo sticks - Wheels (laser cut or purchased from online) - Recycling materials E.g. plastics bottles, cans, cardboard - Sun ! / Halogen light source
Grouping	Lesson 1: 1 student Lesson 2-3: 2 students in a group
Instructor	Maria, Kit
Facilitator	Help asking questions to help student explore further
Activity	Lesson 1 - Assemble solar toy car - Learn about how 2 gears and solar panel move the car - Tinker with the circuit

	Lesson 2 (lesson plan) - Design - Build Lesson 3 (lesson plan) - Finish building and test - Presentation
Resources	IVE 太陽能電動車揚威世界挑戰賽

Review & Recommendation:

Observations	**Recommendations & improvements**
Some students assemble the solar car fast, while some need more help.	Improvement: Can give different levels challenges to those fast-pace students. For example ask them how to reverse the moving direction of the car, question them how to make the solar power supply more reliable.
Go Further	• Level 1: Teach them soldering skills. Try solder 2 or more solar panels in series and in parallel • Level 2: Add a on/off button • Level 3: Solar power storage • Level 4: Remote control

Module 9: Sewing Pencil Case

Module 9	Sewing Pencil Case ● Each student make and customize a pencil case using stitching skills
Class Level	P. 4-5
Objective	Continue and extend skills learned in previous lessons in design and stitching
Skills and competencies	● Stitching skill: make knot, running stitch, backstitch, end a stitch ● Basic design skill
Materials/ Equipments	● Heavy fabric ~20cm x 30cm (1 per student) ● Needle (one per student) ● Colored threads (4 rolls per class) ● Sewn on snap fasteners or Magnets (1 per student) ● Color markers (1 set/group of 6-7) ● Scissors (students bring their own) ● Glue gun (3 per class)
Grouping	Individual project
Instructor	Kit, Maria
Facilitator to student ratio	1:10
Activity	Lesson 1 - Review Safety on handling of needles - Review stitching and knot tying skills - Instruction on pencil case design - Individual work Lesson 2 - Continue individual work - Complete pencil case - Briefing
Resources	Hand stitching for beginners http://www.apartmenttherapy.com/how-to-sew-basic-stitches-221433

Review & Recommendation:

Observations	Recommendations & improvements
Difficulty in managing varying skills of students	• Need to reduce facilitator to student ratio
Some students are not engaged or show low interest	• More knowledge of student's interest would help in planning project • More options in end product for different students

Module 10: Sewing Water Bottle Case


Module 10	Sewing Water Bottle Case ● Each student stitch and customize a 3D container for water bottles
Class Level	Primary 2
Objective	Continue and extend skills learned in previous lessons in design and stitching, incorporate understanding of 3D shapes
Skills & competencies	● Intermediate Stitching skills: stitching 3D objects ● Concept of dimensions: from 2D to 3D
Materials/ Equipments	- Plastic bottles (student bring their own) - Cloth - Needle - Scissors - Movable eyes
Grouping	Individual project
Instructor	Kit, Maria
Facilitator to student ratio	1:10
Activity	Lesson 1 - Introduce 3D shapes - Work on paper 3D shape handout - Instruction on water bottle case design - Individual work Lesson 2 - Continue individual work - Complete water bottle case - Briefing

Review & Recommendation:

Observations	Recommendations & improvements
Some students show advancement in skills	/
Some students begin to lose interest in project	More options in end product for different students Give alternative activities but related to stitching for them to choose, such as gather kids who like to play football and challenge them to make a football by stitching.

Module 11: Magnetic Calendar

Module 11	Magnetic Calendar ● Each student creates a 6 weeks revolving calendar and to practice self-management and planning
Class Level	Primary 1
Objective	Using magnetic whiteboard as base to create a 6 weeks revolving calendar
Skills & competencies	● Fine motor skills ● Self-management and planning
Materials/ Equipments	-Whiteboard (1per student) -Whiteboard tape (3 rolls per group of 7-8) -Printed magnetic paper with 12 month's name, weekday names, dates, holidays -scissors (1per student)
Grouping	Individual project
Instructor	Kit, Maria
Facilitator to student ratio	1: 10-15
Activity	Lesson 1 -review the need to keep time

Review & Recommendation:

- Some cannot manage keeping the magnetic stickers in place, but lose them.
- Not enough time to practice using the calendar to do planning