

Young Makers

2015 INITIAL REPORT

BACKGROUND

Started in 2010, the Young Makers program brings together a community of young people, ages 8-18, of varying backgrounds, interests, and skill levels, with mentors and a space to make. In small clubs, participants work together throughout the season to design and make a youth-chosen, open-ended project, culminating in an opportunity to share and exhibit at a showcase event. Groups meet once or twice a week for 12-16 weeks. The parent organization of this program, Maker Ed, provides professional development, logistical support, and resources that clubs can draw from to best serve the needs of their group. Young Makers clubs exist nationwide, but highest concentration exist in the San Francisco Bay Area, the region that Maker Ed has the most direct contact with clubs, makerspaces and Maker Faires. This report includes data only from Young Makers clubs in this region.

The goal of this study is to document what is going on in these clubs, from the learning of technical and soft skills to the formation and support of personal identity, and to understand in what ways Maker Ed can best support the Young Makers program.

To accomplish these goals, Evaluators from the Science Museum of Minnesota developed a set of pre-post surveys to get feedback from youth and mentors during the 2015 spring season. Surveys were sent from regional Young Makers coordinators to 65 individual clubs in the San Francisco Bay Area. A link to the surveys was also posted on the Young Makers website. Additionally, two short surveys were used to get reflection from youth at the 2015 San Francisco Bay Area Maker Faire, as well as after the completion of the season for a more targeted reflection.

While we made multiple attempts to connect with both youth and mentors, we only heard from a handful from each group. For these reasons, instead of comparing the pre and post results we combined all the data to describe the variety of clubs and participants overall. When the data is a combination of multiple instruments, it will be indicated before the sample size by the phrase “(combined n=36).” Some of the mentors and youth may have taken both the pre and the post; the combined data may include data the same person twice. Other data that came from only one instrument is designated by when it was collected. Either as before the season started (pre-season), at the Maker Faire Bay Area 2015 (Maker Faire), or at the end of the season (post). For clarity, the data is color-coded; all of the **youth data is yellow** and the **mentor data is blue**.

PROFILES: CLUBS, MENTORS AND YOUTH

Combining the pre-season and post-season data we heard from a total of 36 mentors from 21 clubs and 56 youth from 14 clubs. Additionally, we heard from 66 youth at the Bay Area Maker Faire. In this sample, we heard from clubs big and small that are organized in a variety of ways. Some were small family units, with one adult mentor and one or two youth. Others were classes in school, with one to two mentors and 20 to 30 youth. Some of the larger clubs have parent organizations that serve hundreds of kids. When it comes down to it, there is so much variety in the size and make-up of these groups that it is difficult to connect any of these individual trends to a certain type of club. Instead of

slicing the data by organization size and type, we will look at it as a collective. We start with an exploration into what mentors and youth said about the program separately, which will help frame a discussion about what’s going on in these clubs and ways that Maker Ed can support this program.

Mentors

Many of the mentors (86%) in this sample have previous experience working with kids. When asked how, their experiences ranged from being a parent to leading a youth serving group. Most had experience with a mix of age groups, the most common being the elementary and middle school aged youth.

Chart 1. Mentors: In what ways do you have previous experience working with kids? (Select all that apply) Combined n=36

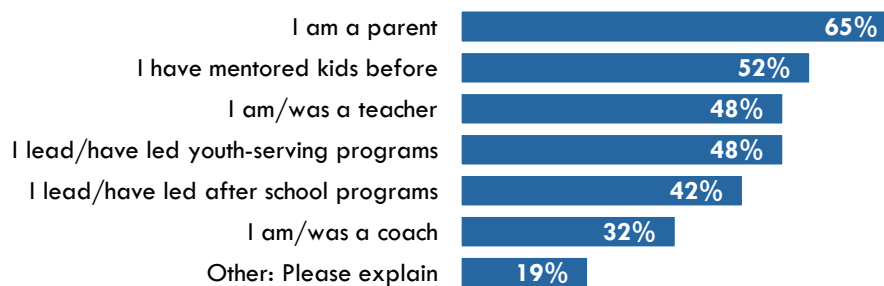
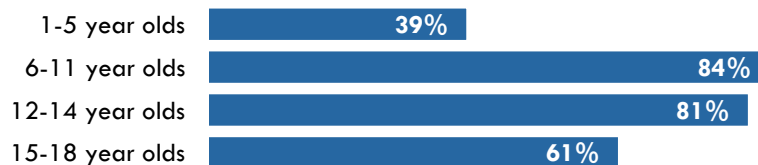
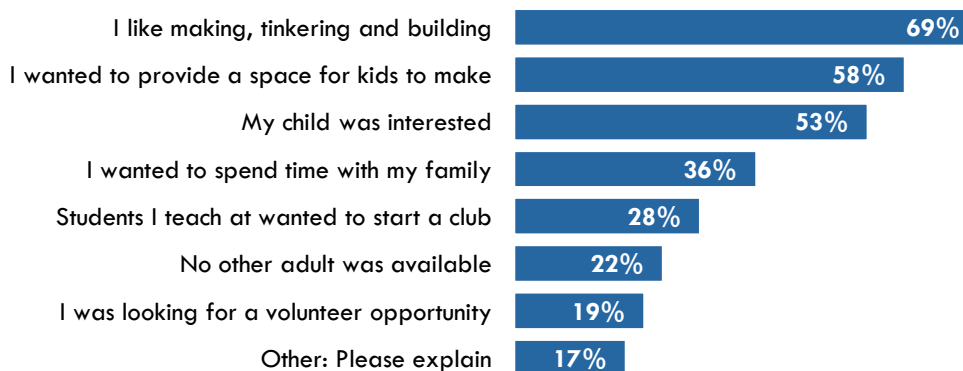


Chart 2. Mentors: What ages? (Select all that apply) Combined n=36



The most common reason why mentors wanted to be a part of their Young Makers club is because they enjoy making. Wanting to provide youth in their community, or their child, with opportunities to make, follows closely behind.

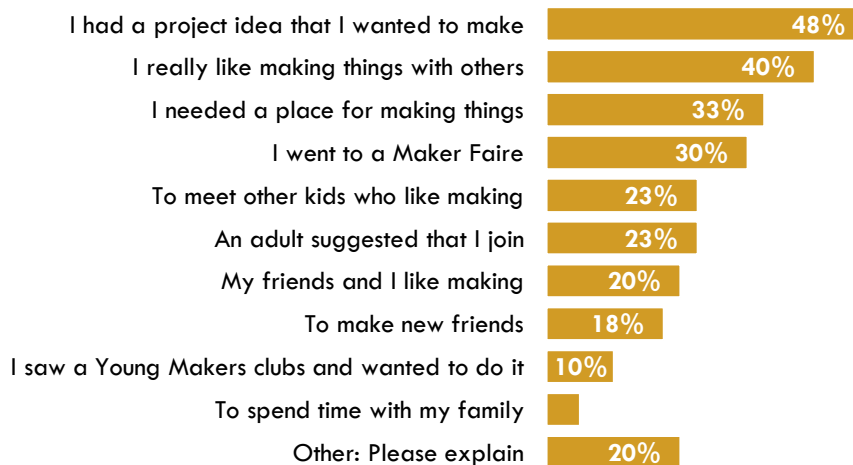
Chart 3. Mentors: Why did you want to participate in a Young Makers club? (Select all that apply) Combined n=36



Youth

Youth had similar motivations for joining, with making coming up at the top of the list.

Chart 4. Youth: Why did you want to join a Young Makers club? (Select all that apply)
Sample from Pre n=40



Looking at how these trends connect, most, if not all, mentors are invested in their club through their personal interest in making, the youth that they are working with, or a combination of both. Youth have similar connections, from friends at school, family, or a general interest and passion for making.

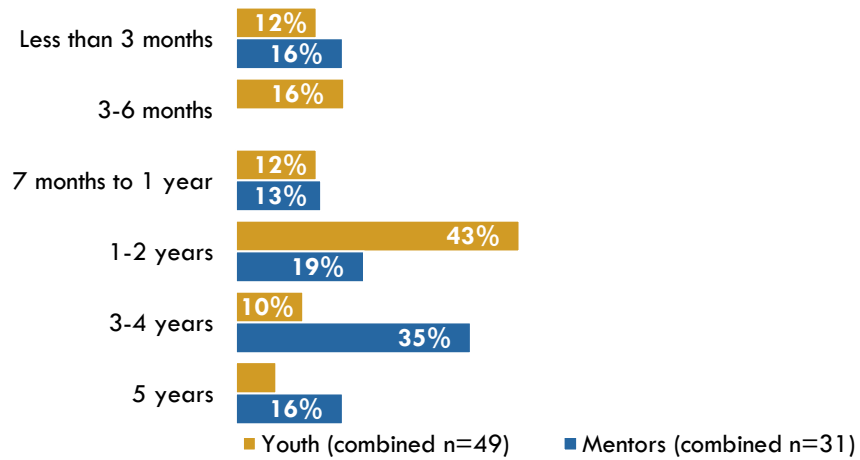
Clubs

Mentors first heard about the Young Makers program mainly from sources that are directly linked to the maker community. Many heard about it at a Maker Faire, or from a Maker affiliate (such as MAKE Magazine, the Maker Ed website, or other Maker Ed programs).

Youth heard about the program in slightly different ways. Many heard about it from their clubs' parent organization (like a YMCA), ranging from a class at school, an after school program, or a youth club, that their Young Maker club is organized through. Other common sources were personal connections, friends or family member, or from a making-affiliated event.

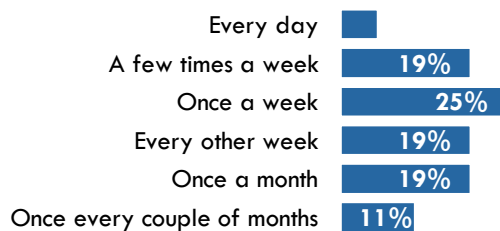
We heard from mentors and youth with varying degrees of experience with the Young Makers program. From beginners, who had been working with their club for less than three months (the season that the clubs meet is roughly 12-16 weeks long), to experts who have been working with their club for a couple of years.

Chart 5. How long have you been working with your Young Makers club?



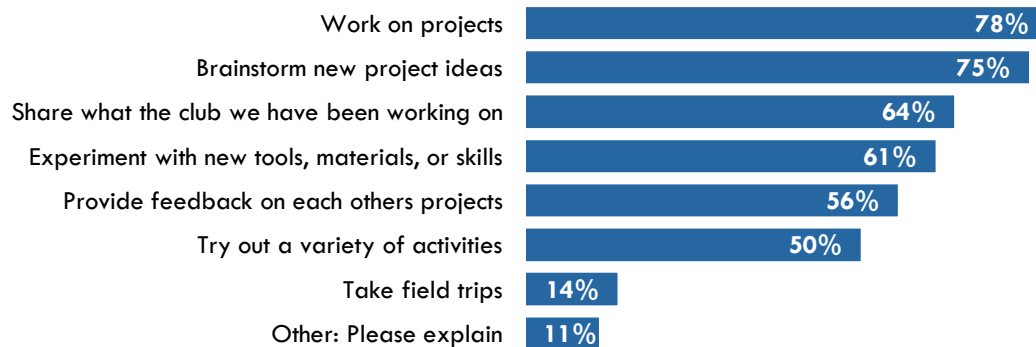
There is a lot of variety to how these clubs are structured, which carries over to what they are doing in the clubs. There is a fairly normal distribution to how often these clubs meet, meaning that the middle of the range has the most common response and the ends are the least making a bell shape to the graph.

Chart 6. Mentors: How often does your Young makers club meet? Combined n=36



When they do meet they are activity and project focused. Most clubs spend the time working on projects or activities, and use the time together to share ideas, try new things, and provide feedback.

Chart 7. Mentors: What do you typically do when your Young Makers club meets? (Select all that apply) Combined n=36



Looking again at this information collectively, the Young Makers program provides a space where youth and adults can come together and share their passion for making, by making.

IDENTITY AS A MAKER

With a strong connection to making, many of the mentors are active in the maker community in some way. Almost every mentor (97%) who responded to the survey has been to a Maker Faire or showcase event. Half (50%) have been to a regional gathering, and just under half (47%) have been to a mentor workshop.¹ Participating in this program has fostered and supported their personal identities as makers, with just under three quarters (73%) thinking of themselves as a maker before joining their Young Makers club which grew to most (95%) thinking of themselves as makers after the season.

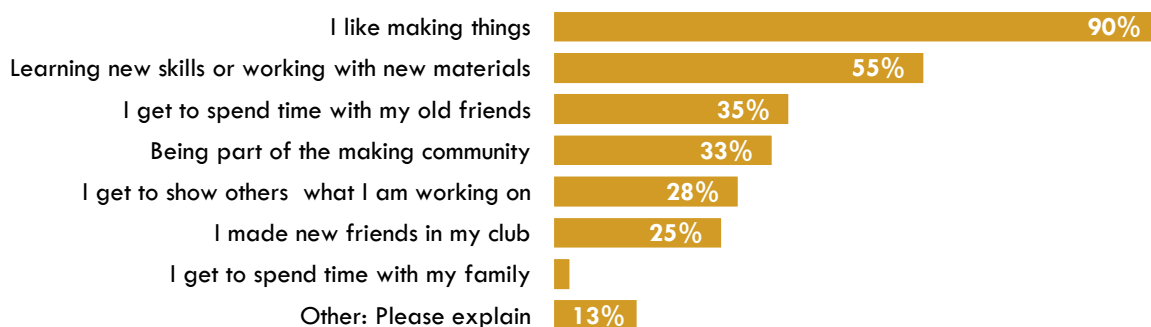
A similar trend can be seen within the youth. Just short of two thirds (64%) of youth thought of themselves as makers before joining their Young Makers club. By the end of the season everyone (100%) thought of themselves as makers. Additionally, many (86%) think they will continue to be a part of their Young Makers club in the next year. Part of this may have to do with their experience at Maker Faire. Of the 16 youth we heard from, all but one went to Maker Faire this year. Of those that went, all but one presented a project at the faire. Going through the full process of working on a project and presenting it during the faire may contribute to their identity as makers and their connections to the larger community.

BENEFITS OF THE YOUNG MAKER PROGRAM

We dug deeper into what youth enjoy about being in their Young Makers club. Before the seasons started and during the Maker Faire Bay Area 2015, we asked youth to reflect on what they liked about being in a Young Makers club. The most common reason, in both cases, was that they like making. Also topping the list were learning new skills or how to use new materials, and community-oriented responses, such as being a part of the larger community to being able to share their ideas with like minded people.

Youth

Chart 8. Youth: What do you like about being in a Young Makers club? Sample from Pre n=40



This question was asked open-ended at the Maker Faire and was coded in a way similar to how it was asked in the surveys. A full list of their responses, by code, can be found in the appendix. To

¹ This question was worded broadly to encompass a variety of different workshops and gathering the mentors might have attended. In its current wording we are not able to differentiate between the different types. In the future this would be a good place to get finer grain details on what people are attending.

illustrate these codes, a couple of examples of each are provided below. (*Sample at Maker Faire n=66*)

Making (59%)

“I like that I can be creative and make very unique projects. I also love working with people my age to solve problems.”

“I like being in Young Makers club because I get to build all sorts of cool things.”

A connection to soft skills (38%)

“I get to share my projects with other people, let them see what I built. It gives them ideas, and they give me suggestions.”

“I really enjoy presenting my project to others, to share what I learned.”

An emotional connection to the experience (30%)

“You get to be funny, creative and most of all. Amazing, Yah!”

“Amazing, I like being a part of something powerful.”

Learning new things (23%)

“I like the support of the group of girls, and that we are all trying to learn from and with each other.”

“I like being a young maker because I learn new and useful skills at an early age to get a head start on my future.”

A connection to identity, community, or friendship (23%)

“It's fun, my friends are in it and I love to build and use my hands to build and make.”

“I like being able to learn how to make stuff and learn from people who know a lot. I also like seeing other people's projects.”

The technical skills they developed (12%)

“I like being a young maker because I learn new and useful skills at an early age to get a head start on my future.”

“Making, designing and prototyping. The end, when things work out, is amazing.”

Other: ranging from subjects to access to resources (17%)

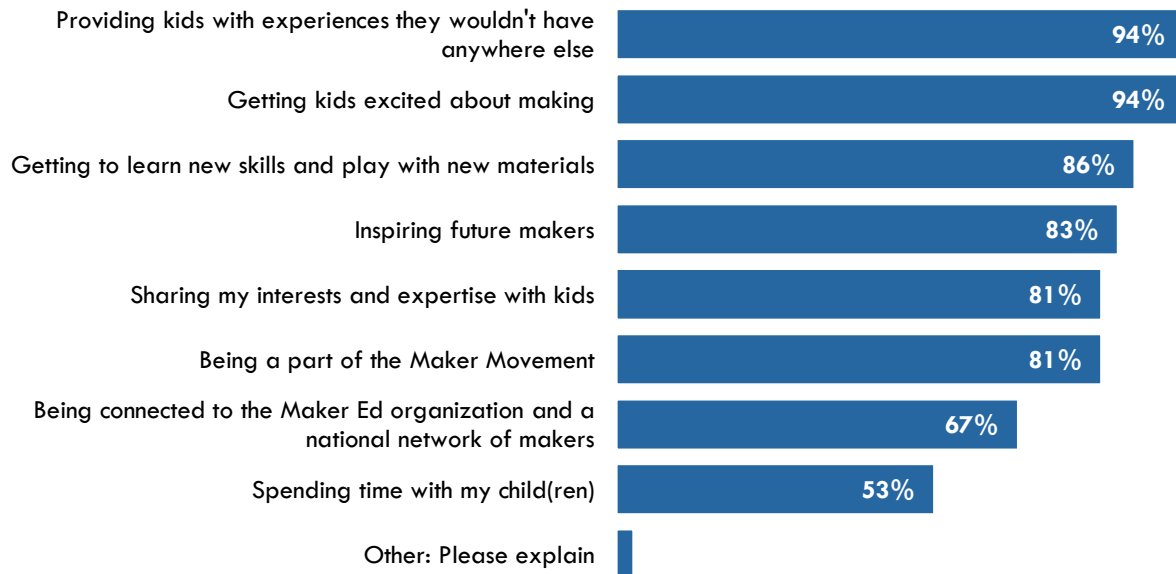
“I like how science and art come together.”

“I have resources to make things that I want to make.”

Mentors

Mentors like being a part of their Young Makers club for reasons similar to why they wanted to be a part of the club. Many of the reasons have to do with providing youth with opportunities to make. Other reasons include their own growth as a maker, from learning new skills and how to use new tools and materials, to being connected to a larger community of makers.

Chart 9. Mentors: What do you like about being a Young Makers mentor? (Select all that apply) Combined n=36



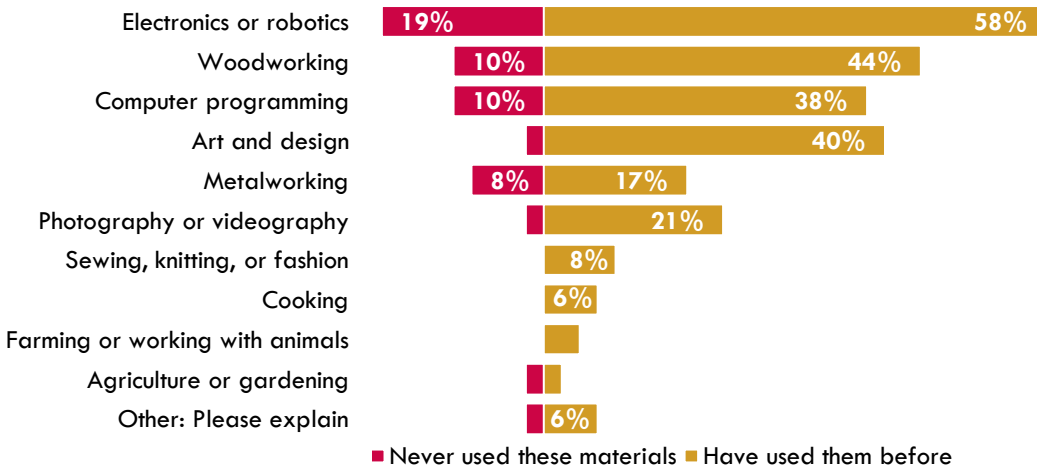
YOUTH INTERESTS AND SUPPORT

Before the season started we asked mentors what they thought the youth in their club would be interested doing in their club. Mentors provided details about specific content, skills, and materials they thought youth were leaning towards. Some said that they were still figuring it out and exploring a variety of different topics. Others said that the youth were interested in a lot of different things. The most common being projects that included: metalworking, woodworking, computer programming, electronics (Arduino was named a couple of times), arts, and crafts and design.

We asked the youth two questions that getting at the same thing. One asked about what materials they were interested in using, and if they had used them before. The other asked what subjects they were interested in exploring.

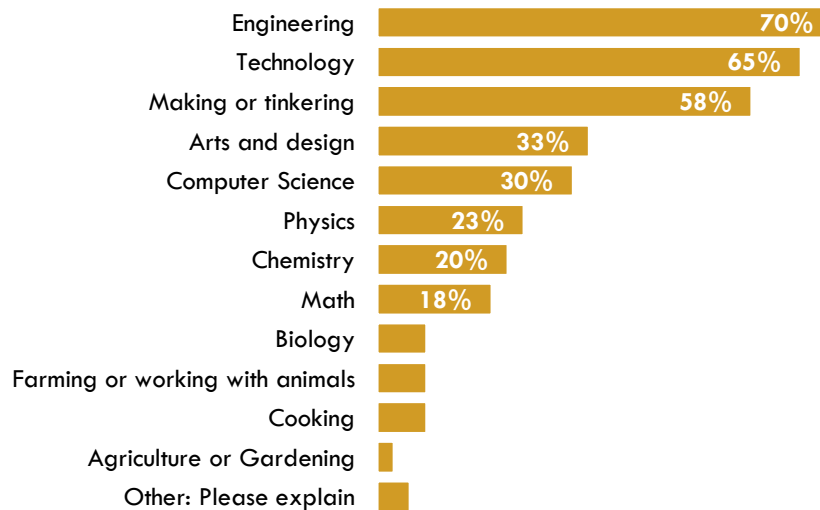
The order, from most to least popular, may not come as a surprise. Youth are most interested in using electronics or robotics, and for many (19%) they were using tools and materials they had never used before. Woodworking, computer programming, and art and design also found a place high on the list.

Chart 10. Youth: What kinds of activities do you want to do in your Young Makers club? (Select all that apply) Combined n=48



The subjects that youth are most interested in working with mirror what the tools and materials they were interested in exploring.

Chart 11. Youth: Which of the following subjects do you think you are interested in making a part of your project? (Select all that apply) Pre n=40

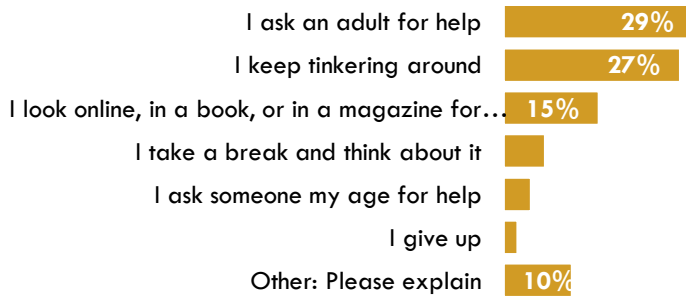


Problem solving

The typical approach that youth take for solving problems when working on a project was to ask an adult for help. This really isn't that surprising considering the range of ages of the youth and the structure of the clubs. Knowing that youth are turning to adults for help is an important piece of the relationship between mentor and youth. Youth are simultaneously developing a variety of soft and technical skills. Having a mentor who can foster and support this development is a real strength of this program.

Looking at the second and third most common choices, we can see that youth are doing some more sophisticated problem solving techniques of task resiliency and research skills. Also, very few say they are giving up.

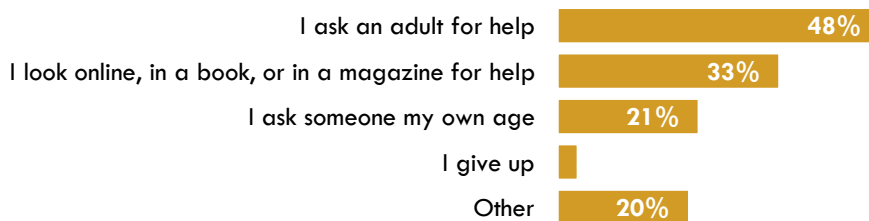
Chart 12. Youth: What do you typically do when you get stuck on a problem when working on a project? Combined n=48



One possible hypothesis for this is that younger makers are more reliant on mentors for help than older makers. As they spend more time working on projects, gaining experience and developing skills, the more self-reliant they become, relying on a variety of problem solving techniques. Having in a place a mentor who can both guide and model these problem-solving techniques very likely contributes to youth developing these skills. This would be an interesting area to further explore in future studies.

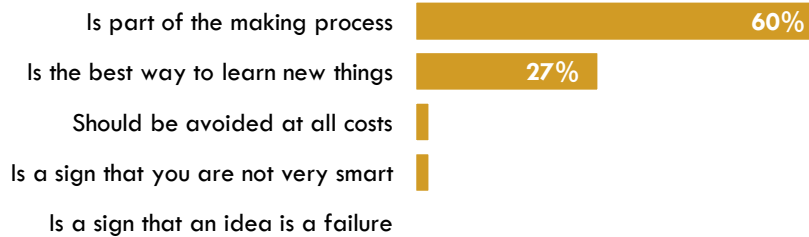
For the Maker Faire survey, not all the same response options were offered. The options with the lower response rate were removed from the list. Responses in the other category were coded using the response options listed in chart 12. Of the 12 responses for “other”, three quarters (75%) mentioned they continue to keep tinkering around, one quarter (25%) mentioned taking a break to think about it, and another quarter (25%) mentioned asking an adult for help. These add up to more than 100% because youth mentioned using multiple strategies in one response.

Chart 13. Youth: What do you typically do when you get stuck on a problem when working on a project? Maker Faire n=66



Youth also have positive attitudes towards making mistakes as many consider them a part of the making process or the best way to learn new things. This resiliency is a promising nod in the right direction for the youth in this program.

Chart 14. Youth: In your opinion, making mistakes when you are working on something...
Combined n=48

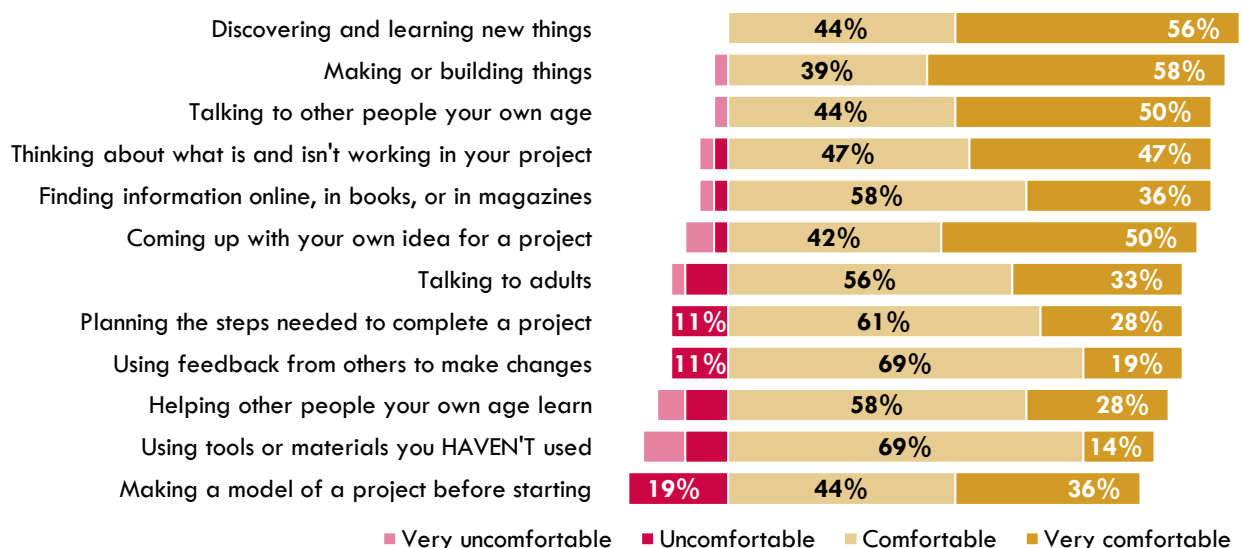


Skills

We also asked youth how comfortable they are with technical and soft skills that are central to working with others and completing projects. The feedback on these 21st century skills was overwhelmingly positive. With most, if not all youth saying they have a high level of comfort collaborating and communicating with others, researching and planning the steps of a project, and taking risks of varying degrees. Due to low response rate to the post-survey, we do not have comparison data to indicate any shift in confidence levels from the beginning of the season to the end.

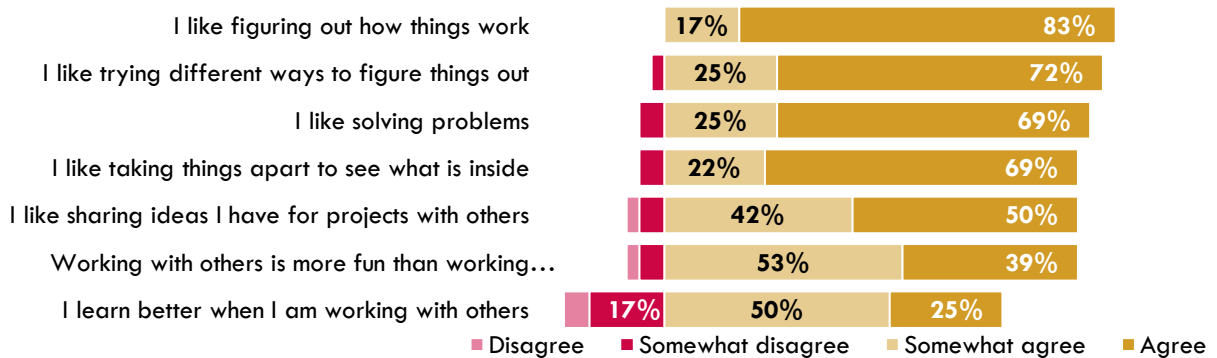
While outside the scope of this study, it would be very interesting to compare youth’s level of comfort doing these things in other settings. For example, by exploring and comparing youth’s comfortable levels with these activities in academic settings, working on classroom projects, we might get a better understanding of the learning environment that is fostered in these clubs.

Chart 15. Youth: How uncomfortable or comfortable are you doing the following things.
Pre n=36



Supporting these ideas of resiliency, teamwork, and communication, youth are very open to working with team-based models, using their imagination to creatively approach projects, and tackling tough problems.

Chart 16. Youth: How much do you disagree or agree with the following statements. Pre n=36



MENTORS: SUPPORT AND RESOURCES

Mentors used a variety of resources with their clubs. Topping the list are web-based resources that provide some level of instruction for activities, from how to steps to general inspiration. In the middle range of use are people, hobbyists to professionals, who have technical expertise that they might be able to connect with and learn from.

Chart 17. Mentors: What resources have you used, or plan on using, with your Young Makers club? (Select all that apply) Combined n=36



Mentors also reflected on which of these resource they found most useful and were asked to articulate what it was they liked about these resources. People liked different resources for different reasons. Many preferred Instructables.com because it provided a lot of guidance for doing a project with how-to steps and detailed resource lists.

Those who liked the Maker Club Playbook thought that it gave a great outline on how to set up a maker space, from logistics on setting up the space, programming ideas, to ideas and inspiration for activities.

“[The Makerspace Playbook] gave me one place to look to do the vast amount of structural program building necessary to support a wide variety of activities with a large number of children simultaneously. Previously, info had been scraped together from multiple sources and was quite incomplete, leaving problematic holes that had me constantly running around trying to support student’s ideas without a good foundation.”

Fewer mentors preferred the other sources. Those who did liked them for the same reasons we already discussed. They provided detailed instructions, they were good sources of inspiration, and they are a place to find expert tips.

Supporting Youth

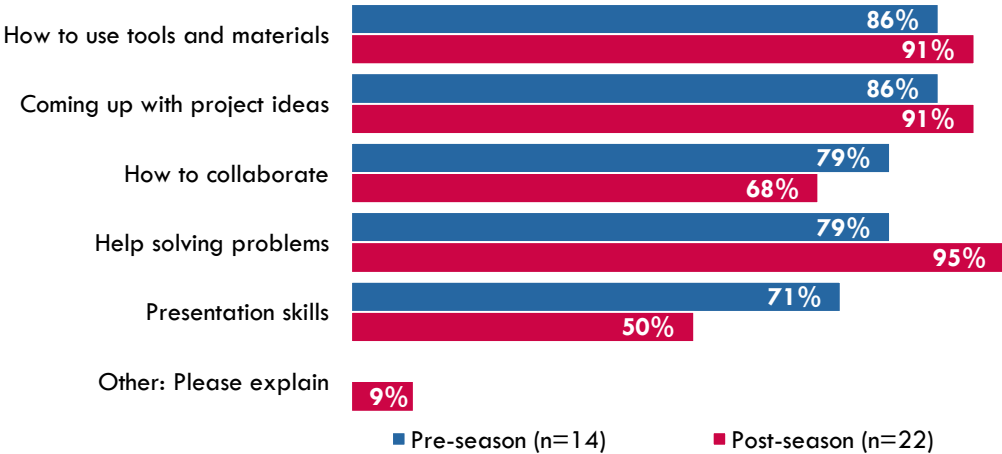
At the beginning of the season we asked mentors what types of support they thought the youth in their Young Makers club would need. After the season we asked them to reflect on what types of support they actually needed. Looking at the differences, problem-solving skills is an area that youth needed more support than mentors first expected. Some of the more social skills, collaboration and presentation skills were areas where youth needed less support than expected. In the other category, mentors listed organization skills, time management and organization of physical materials as additional skills that youth needed help with.

One area we didn’t explore in depth was the details of how mentors provided support to youth. Things like the types of problems youth needed help solving, how mentors provided project management support, to how they helped youth develop skills could provide insights into how mentors supported youth develop in these areas. Ultimately, these insights would help clarify the different roles that mentors play within their clubs and highlight what resources were most valuable facilitating that support. Getting a better understanding of the interplay between resources and types of support youth need will help Maker Ed better understand how they can support the mentors and clubs.

At the end of the season we also asked about two other types of support: motivation to get started or continue working, and emotional support. Both were fairly important, with 86% of mentors saying the youth needed motivation to get started or continue working, and 68% saying youth needed emotional support.

Another area that wasn’t explored in this study was having youth explain what type of support they needed from mentors. Being able to connect what youth say about the types of support they need to the ways that mentors provided support would help illuminate what’s going on in the clubs. Adding another layer to this would be having youth explain how they solve problems, especially when the most common approach is to ask an adult for help. Understanding whether this is help with a task, moving past a project milestone, or getting motivated to work on their project can help Maker Ed shape how they approach supporting mentors. By linking this information to what mentors are saying about how they support youth would bring more clarity to how clubs work through these processes and would shed some light on specific areas where clubs need support.

Chart 18. Mentors: Comparison of what types of support mentors thought the youth in their club would need before the season started, to the support they actually needed.



We also asked mentors what types of support they needed from Maker Ed. The areas that came out as a top priority for mentors are related to doing activities with their club. Things like training on technical skills, ways to connect technical skills to activities, and ideas for activities came out as a top priority. A little lower on the list, but still a priority, are elements of community building, which include meeting other mentors and clubs.

Chart 19. Mentors: What types of support mentors want from Maker Ed. (Select all that apply) Combined n=36



CONCLUSION

As a final piece of reflection, we asked mentors how they think the youth in their clubs have changed since they first joined the club. What we heard reflected and supported a lot of the positive changes we noticed in the data above. One of the most common things that mentors noted is the youth are developing pride or confidence in their abilities.

“They all have hugely grown in their confidence in their own ideas and ability to accomplish big things, they have built resilience, and have made friends outside their normal circles. Plus, they are jazzed about design and engineering, and consider themselves able to do that professionally if they chose.”

From becoming more comfortable using different tools and materials, feeling comfortable taking risks, and developing project management skills, personal growth in these areas was a common theme that a lot of mentors noticed.

“They are much more willing to try new things. At the beginning of the year we introduced glue guns and some of the kids (and mentors) were worried. By the end of the year everyone was excited to learn how to solder - they had built a lot of confidence in their own abilities. I want the kids to not feel intimidated when confronted with learning something new, so this year was a success.”

Mentioned less often, but connected to what we discussed earlier, is a development of an identity as a maker and connections to the larger maker community.

“Participating in Makers Faire made them proud to be a part of maker’s movement and more inspired to take the next challenge. Because our family is our club, they may not have the experience of working with other kids than just a sibling, and even that was limited because they usually do their own individual projects, but they have observed each other’s work and work of other clubs at regional meetings, so I think they will probably be more comfortable to join the similar activities/clubs in the future or even initiating it.”

From this data, it seems that Young Makers clubs are fostering an environment where the youth feel comfortable and supported. From having a collaborative environment where there are peers to bounce ideas off of and mentors who support and guide their efforts, the youth are growing and developing in some pretty fantastic ways. The mentor has a pretty significant role in these clubs. From being a major resource for problem solving to general organization of the space and club, their position in the club is crucial. Finding ways to support them and ensure they are able to provide an environment for youth is a great way to support these clubs.

APPENDIX

Youth

Clubs we heard from:

- American Canyon Young Makers Club
- Codemaker club
- Davidson Makers
- Flying purple tree octonanas
- FRA builders
- Gelfer
- Intel Computer Clubhouse of San Rafael
- Jessi
- Laughing Finch Farm
- Maker Club
- June Jordan School for Equity Makers
- Makin' It
- SAUD
- Willow Glen Makers

Pre

If you know, please describe what specific content, skills, and materials you are interested in working with and using in your Young Makers club project.

- 3D printing, Tools
- I am not sure but maybe wood and electricity?
- I can't wait to 3D print!!! ;-)
- Welding and connecting stuff together
- 3D design, lights, and mechanical dissection.
- I use 3D modeling, woodworking, basic electronics, robotics, and some physics.
- Arduino programming, 3D printing, and sensor programming.
- Hard wood of different types. Making a glue-up, planning down a piece of wood, rounding edges with a disc sander, creating grooves on easel, and making a piece of wood safe for food contact.
- I'm making a box
- I am interested in working with 3-D design, woodworking and coding
- I am making a music box
- I am interested in making woodworking projects and metal, technology and computer game programming
- Arduino Uno 2) old radio controlled car 3) chassis kit 4) small motors 5) e.l. Wire 6) L.E.Ds
- Art and making
- I am making a radio with a Arduino
- I would like to incorporate robotics into my project.
- Coding

- Wi-Fi, HTTP Protocols, Smartphones, and Drones
- Electronics
- Arduino and temperature sensors

Post

What do you like about being in a Young Makers club?

- I think it was a very good learning experience for all ages.
- Learn new things
- The vast pool of human support that can be turned to when the Internet cannot offer you any help, along with the resources located there that I could not normally obtain or use otherwise.
- Without a club, I wouldn't be able to participate in Makers Faire and the deadline of presenting gets us to create cool projects and develop skills that I am proud to show off to others.
- It is a place where any idea is supported, where you are encouraged to try new things, and gets you to do things outside of your comfort zone.

What does being a maker mean to you?

- Making cool projects, building things, taking things apart, figuring things out
- Someone who makes things
- Being a maker means that you make things.
- Creating things with other things
- Being a maker means to be someone who brings ideas to life
- Being creative while creating
- Being a maker means to me is having space were you have freedom of using tools
- Make things that are cool

What, if anything, would you change about the Young Makers Program?

- Our club is really just my Dad and my brother - we don't really have the space to host other kids, but it would be fun if there were a larger space in our town where kids could get together to work on projects.
- More meeting to get advice, tips, and opinions about your project, - Guest speakers
- I might make it so that it didn't feel so much like what we had made was done before.
- I wouldn't change anything
- Nothing
- Nothing
- I don't know

Maker Faire Bay Area 2015

Other: Please explain. What do you usually do when you get stuck on a problem? (Coded categories)

I take a break to think about it.

- I stare at my non-existent cat and wonder why I like to eat noodles.

- I think about it
- Stop and think, then test it.

I keep tinkering around.

- I find out somehow, on my own
- Try to work on it until I do need a teacher.
- Keep trying to figure out what is wrong
- Take it apart and see what I did wrong.
- I try again or re-do it.
- Try different options/techniques then search the Internet for help and ask my parents.
- I try to figure it out.
- I try to first plan others ways around it and experiment with what I have.
- I both ask an adult and look for an answer.

I ask an adult for help.

- Try to work on it until I do need a teacher.
- Try different options/techniques then search the Internet for help and ask my parents.
- I both ask an adult and look for an answer.

I look online, in a book, or in a magazine for help.

- Try different options/techniques then search the Internet for help and ask my parents.

What do you like about being in a Young Makers club? (Coded Categories)

Making

- I like that I can be creative and make very unique projects. I also love working with people my age to solve problems
- I like it; I can finally share what I can do with others.
- Talking to people about what we did making things.
- It's fun to make things
- Gives me the opportunity to do what I want when it comes to making.
- Being given the freedom to do what we want.
- I like the fact that there are people who can help me if I'm ever stuck, or in a position, which I need help.
- I really enjoy presenting my project to others, to share what I learned.
- I get to share my projects with other people, let them see what I built. It gives them ideas, and they give me suggestions.
- I learn how to make stuff. I get to make awesome stuff.
- Going to Maker Faire to show my project.
- You can share your creations.
- Motivates me to complete my project. It gives me deadlines.
- I like learning new things and making robots with my friends.
- I get to make fun stuff with my best friends.

- I love to be able to work on cool projects in which I can develop many skills important for a career in computer science such as coding.
- I get to make and finish a really cool project.
- I love making video games and tape-agami.
- It's fun, my friends are in it and I love to build and use my hands to build and make.
- I can work on projects with like-minded peers.
- I have resources to make things that I want to make.
- Making, designing and prototyping. The end, when things work out, is amazing.
- I like it because you get to make fun stuff.
- I like to make things that show what I can do to others around me that did not make something. I want to inspire others.
- I like making things with my friends.
- Getting to make things with friends. It's fun and cool.
- I like to make things.
- I like being in Young Makers club because I get to build all sorts of cool things.
- I like being in the Young Makers club because I get to build things and see things I have never seen before.
- I get to make what I want.
- Because we get to make whatever we want. I made a
- It is fun to make things and learn new things.
- That I can build a lot of projects that are fun.
- I like to make cool things that I can share with other people.
- I like making and presenting stuff.
- I love to tell others what I have made. I also love trying others projects.
- I like showing my work to others seeing others work and learning new things.
- I like being able to learn how to make stuff and learn from people who know a lot. I also like seeing other people's projects.
- I like being in a Young Makers club because it is encouraging to see and make things that are fun and exciting rather than just buying them.

A connection to soft skills

- I like to show the community different things, so we all learn together.
- I like that I can be creative and make very unique projects. I also love working with people my age to solve problems
- I like the imagination and creativity fostered from the entire experience.
- I like it; I can finally share what I can do with others.
- Talking to people about what we did making things.
- Gives me the opportunity to do what I want when it comes to making.
- Being given the freedom to do what we want.
- It's a super creative and innovative club to be in! Great learning environment.
- I really enjoy presenting my project to others, to share what I learned.
- I get to share my projects with other people, let them see what I built. It gives them ideas, and they give me suggestions.
- You can show your talent while being challenged.
- Going to Maker Faire to show my project.

- You can share your creations.
- I like how you can see other people's projects.
- You get to be funny, creative and most of all. Amazing, Yah!
- I can work on projects with like-minded peers.
- I like to make things that show what I can do to others around me that did not make something. I want to inspire others.
- I get to make what I want.
- Because we get to make whatever we want. I made a
- I like to make cool things that I can share with other people.
- I like making and presenting stuff.
- I love to tell others what I have made. I also love trying others projects.
- I like showing my work to others seeing others work and learning new things.
- I like being able to learn how to make stuff and learn from people who know a lot. I also like seeing other people's projects.
- Helping others.

An emotional connection to the experience

- It's fun to make things
- Amazing, I like being a part of something powerful.
- It's really fun and you learn a lot
- I have fun.
- I get to make fun stuff with my best friends.
- It is so fun!!
- I love to be able to work on cool projects in which I can develop many skills important for a career in computer science such as coding.
- I get to make and finish a really cool project.
- You get to be funny, creative and most of all. Amazing, Yah!
- It's fun, my friends are in it and I love to build and use my hands to build and make.
- Making, designing and prototyping. The end, when things work out, is amazing.
- I like it because you get to make fun stuff.
- I like to make things that show what I can do to others around me that did not make something. I want to inspire others.
- Getting to make things with friends. It's fun and cool.
- I like being in Young Makers club because I get to build all sorts of cool things.
- That I can build a lot of projects that are fun.
- It's very fun and you can learn a lot of neat things.
- I like to make cool things that I can share with other people.
- I feel safe and comfortable because I'm around people with similar interests and everyone is nice.
- I like being in a Young Makers club because it is encouraging to see and make things that are fun and exciting rather than just buying them.

Learning new things

- I like to show the community different things, so we all learn together.
- It's a super creative and innovative club to be in! Great learning environment.

- I like the support of the group of girls, and that we are all trying to learn from and with each other.
- I really enjoy presenting my project to others, to share what I learned.
- I learn how to make stuff. I get to make awesome stuff.
- What I like is that you learn some more things that you didn't know and you can express yourself.
- It's really fun and you learn a lot
- I like learning new things and making robots with my friends.
- I like being a young maker because I learn new and useful skills at an early age to get a head start on my future.
- You can learn and excel in all kinds.
- Learning new things.
- It is fun to make things and learn new things.
- It's very fun and you can learn a lot of neat things.
- I like showing my work to others seeing others work and learning new things.
- I like being able to learn how to make stuff and learn from people who know a lot. I also like seeing other people's projects.

A connection to identity, community, or friendship

- I like to show the community different things, so we all learn together.
- I like that I can be creative and make very unique projects. I also love working with people my age to solve problems
- Amazing, I like being a part of something powerful.
- Yes, we are awesome and we are young.
- I like the fact that there are people who can help me if I'm ever stuck, or in a position, which I need help.
- I like the support of the group of girls, and that we are all trying to learn from and with each other.
- You do it with your friends.
- I like learning new things and making robots with my friends.
- I get to make fun stuff with my best friends.
- It's fun, my friends are in it and I love to build and use my hands to build and make.
- I can work on projects with like-minded peers.
- I like making things with my friends.
- Getting to make things with friends. It's fun and cool.
- I feel safe and comfortable because I'm around people with similar interests and everyone is nice.
- I like being able to learn how to make stuff and learn from people who know a lot. I also like seeing other people's projects.

Other: ranging from subjects to access to resources

- I like to show the community different things, so we all learn together.

- Today is my first day being in it and so far I really enjoy the Maker Faire!
- I like how science and art come together
- I get to share my projects with other people, let them see what I built. It gives them ideas, and they give me suggestions.
- I can explore new things.
- What I like is that you learn some more things that you didn't know and you can express yourself.
- I love to be able to work on cool projects in which I can develop many skills important for a career in computer science such as coding.
- It's fun, my friends are in it and I love to build and use my hands to build and make.
- I have resources to make things that I want to make.
- I like being in the Young Makers club because I get to build things and see things I have never seen before.
- The SCIENCE part.

The technical skills they developed

- Motivates me to complete my project. It gives me deadlines.
- I like learning new things and making robots with my friends.
- I like being a young maker because I learn new and useful skills at an early age to get a head start on my future.
- I love to be able to work on cool projects in which I can develop many skills important for a career in computer science such as coding.
- I get to make and finish a really cool project.
- I love making video games and tape-agami.
- Making, designing and prototyping. The end, when things work out, is amazing.
- 3D modeling/printing

Mentors

Clubs we heard from:

- American Canyon Young Makers Club
- Burlingame San Mateo 4H
- CMP Maker Club
- Davidson Makers
- IoT4Kids
- June Jordan School for Equity Makers
- Laughing Finch Farm
- Makin' It
- Met makers
- Mindx Education
- North Berkeley Young Makers Club
- Piedmont Makers
- Project Make

- Richmond District YMCA STEM
- SRClubhouse MAKERSPACE
- Terra Linda Young Makers Club
- The Flaming Flyback Transformers
- The Mix at SFPL
- Willie's Woodshop
- Willow Glen Young Makers
- Young Makers Yolo

Combined Pre/Post responses

Of the resources you used, which did you find most helpful? Why was this an important resource for you? (Coded categories)

Instructables.com

- It has the widest variety of examples that match my student's creative ideas.
- So many ideas about how to build random stuff for our projects! INVALUABLE!
- A great variety of project with any easy to navigate format.
- [It's full of] great ideas.
- So many ideas! It's so easy for students to see how to build things!
- High variety and detail of information.
- Listed step-by-step [instructions] and included resources.
- Step based and adaptable to youth lessons.

Maker club playbook

- It gave a good outline on starting a maker space.
- I am a teacher and I teach making as a class and needed some inspiration for projects.
- It gave a good idea of how to setup a club.
- I just started the club this year and it had a lot of good info.
- Gave me one place to look to do the vast amount of structural program building necessary to support a wide variety of activities with a large number of children simultaneously. Previously, info had been scraped together from multiple sources and was quite incomplete, leaving problematic holes that had me constantly running around trying to support student's ideas without a good foundation.

MAKE Magazine

- It's the best resource
- Inspiration with how-to instructions.
- It's the best resource

Other web sources

- Gave us ideas and assistance with technical issues
- Ideas; how-to videos

- It was the most specific to the task and the easiest to use

Maker Ed's resource library

- Lots of curriculum I can use for the classroom
- Wide variety of sources

Professional metal workers, carpenters, or other trades people

- Their detailed instructions.
- Their personalized expertise.

Hobbyists

- I have used them for years.

Other community resources

- Can ask questions; learn from other maker groups; get ideas; get a jumpstart that is quicker than learning on your own, etc.

Pre

If you know, please describe what specific content, skills, and materials the kids in your Young Makers club are interested in working with and using in their projects.

- Most kids show up drawn to making something either out of wood or out of electronics / Arduino.
- Woodworking Programming Crafting
- Still exploring
- It varies by project.
- Metals/Motors-Electric and Gas/Electronics/Design/Sewing and crafts
- Arts and crafts, electronics (Arduino), woodworking, sewing, soldiering, kinetic art... Would like to learn welding.

Post

Other: Please explain. In what ways would you like more support from Maker Ed?

- Tools and materials organization for our maker studio and storage closet; how to make making/fabricating accessible to those teens who don't have a STEM education background; how to accommodate beginners and teens with more experience simultaneously (i.e. differentiated learning support)
- A list of local experts that we can access for tours, guest visits to our group to teach a specific project; discount for our Young Makers to take a Tech/Shop class as a group; people in area who are willing to be a "guest teacher" for one of our meetings; volunteer network by skills who are willing to be called upon for one or two classes. Etc...
- Providing helpful links to different sites and tutorials that can be found online or organizing inspirational presentations as it was done at the beginning of Young Makers movement in Exploratorium

How do you think the kids in your Young Makers club have changed since they joined?

- They are much more willing to try new things. At the beginning of the year we introduced glue guns and some of the kids (and mentors) were worried. By the end of the year everyone was excited to learn how to solder - they had built a lot of confidence in their own abilities. I want the kids to not feel intimidated when confronted with learning something new, so this year was a success.
- Proud of themselves for making and also presenting and explaining their creations to people at Maker Faire.
- The club was not as fun, nor motivating this year so I will be starting my own club in the Naglee Park area of San Jose. It will be a weekly group meeting at lunchtime at the school I teach at.
- They've become excited, and see what is possible (that they can achieve and do as well as be a part of something exceptional).
- Hopefully they have gained confidence in their ability to make things and showcase them at Maker Faire.
- More self-reliant and learn new skills
- They are more open to working with their hands, and building.
- Hard to say, as we're just forming, but our Board of Advising Youth members loved having the chance to see all the amazing projects at Maker Faire
- More confidence with tools and projects, more willing to take risks, a better understanding of entrepreneurship
- They have developed special skills and increased self confidence
- Become really proud of what they've created. Willing to work hard and not give up. Really call themselves makers now.
- They've become more confident in themselves and their skills. More geek pride.
- They have grown up and gone to college.
- Too early to determine
- I took this job on because I had a wood working class in middle school; I made a pig cutting board. After that I felt like I could make anything. This is not true and I know it but I still feel that way. That hope, for our youth, fuels our STEM program. I know to some extent your youth come out with this same feeling.
- They all have hugely grown in their confidence in their own ideas and ability to accomplish big things, they have built resilience, and have made friends outside their normal circles. Plus, they are jazzed about design and engineering, and consider themselves able to do that professionally if they chose.
- They now have an outlet to do "show and tell" of their incredible creations, and an audience who loves to see them. Parents feel more positive about their kids' open-ended experimentation with Making instead of always having to have a "kit" with defined directions. Parents are more positive about allowing their young makers collect "junk" (recyclables, freebies, discards, etc.) for their potential maker projects now that they have seen their creativity with all sorts of odds and ends. More confidence in using new tools, collaborating. More eager to jump in and "make" in an unstructured environment with or without a kit. Enthusiasm in being around like-minded makers!
- Participating in Makers Faire made them proud to be a part of maker's movement and more inspired to take the next challenge. Because our family is our club, they may not have the experience of working with other kids than just a sibling, and even that was limited because they usually do their own individual projects, but they have observed each other's work and

work of other clubs at regional meetings, so I think they will probably be more comfortable to join the similar activities/clubs in the future or even initiating it.