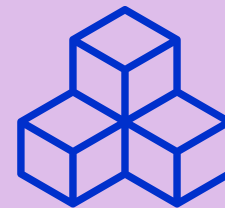


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RESEARCH
B R I E F

Supporting Making-Centered Experiences in Distance-Learning Contexts

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The making movement—also known as tinkering or innovating—encourages learners to design and build creative, unique, and exciting products through hands-on, design-based learning experiences. Making sparks creativity, critical thinking, and collaboration. When kids tinker and make, they develop proficiency in the science, technology, engineering, art, and math (STEAM) disciplines, and build confidence in their ability to tackle math and science content. Making and tinkering are fun and accessible entry points to STEAM experiences for learners of all ages, genders, backgrounds, and lived experiences. By drawing on an individual’s prior knowledge and interests, making connects the learned content to what motivates the learner. The approaches of making embody properties of high-quality learning, where people gain competence most effectively through social interactions, iteration and reflection, and authentic experiences.

Making is offered in schools, museums, afterschool clubs and programs, libraries, and a host of other community-based locations. Now, due to the COVID-19 pandemic of 2020 and its deep social and economic disruptions, many institutions that offer in-person making experiences have had to shutter their doors to participants. These maker organizations face the great unknown question of how long their spaces will have to be inaccessible or modified while the current public health conditions prevail. Even as places begin to reopen, there is a recognition that these hands-on, interactive experiences are likely to be some of the last to return to their physical spaces.

The current COVID-19 pandemic has forced many sectors to quickly adapt to functioning in online venues, including the making field. Arguably, this was simply an acceleration of a trend that has been developing for several years. The in-person closures have prompted makerspaces to focus on their distance-learning offerings—some for the very first time. Organizations were faced with the challenging task of capturing all the nuances and depth of in-person making, and transforming those qualities into a virtual experience. It has been both a challenge and an opportunity as program developers and leaders strive to find new ways to encourage learning, reach new audiences, and address long-standing access issues in the making and technology worlds—all while keeping the learner engaged through the screen.



Distance-Learning

While there are various approaches to creating distance-making experiences, they can generally be characterized as Synchronous, Asynchronous, or a Hybrid of the two.

Synchronous approaches describe activities where learners are interacting in real time with facilitators and/or peers. They include experiences such as Zoom gatherings, live-streamed videos, chatrooms, and shared digital resources like whiteboards, Jamboards, and Padlets. As learning is a social activity, digital, synchronous approaches enable communication, collaboration, discussion, explanation, and sense-making that mimic in-person interactions. However, synchronous approaches are potentially problematic because they require technology and network connectivity. Access to technology, digital literacy, or scheduling conflicts are possible challenges for some families or communities. It is important to acknowledge the digital divide: technology and an appropriate internet infrastructure are not available for all users, and consequently, some participants may not have access to a consistent connection or sufficient bandwidth (Johnson & Burke, 2020). Careful consideration must also be given to the length of synchronous sessions, in order to retain participant engagement and prevent fatigue. Furthermore, video and sensory stimuli may be taxing, particularly for individuals with learning disabilities (Sklar, 2020). Therefore, providing breaks or allowing participants to have their cameras off unless speaking are ways to reduce the downsides of (synchronous) screen time (Fosslien & Duffy, 2020).

Asynchronous approaches describe learning experiences that are done independently, on the learner's own time or schedule (although, like homework, they can be connected to a wider learning experience). These include videos that can be watched independently and written activity guides (with or without accompanying kits). Given the access concerns with connectivity and bandwidth and the negative consequences of excessive screen time, asynchronous time should focus on offline activities as much as possible. Asynchronous approaches are often done in an individual capacity and hold the risk of creating feelings of isolation, which directly contrasts the belief that learning and making are most significant and rewarding when done in community.

Hybrid approaches offer some combination of the above, including potential in-person but physically-distanced components. They provide flexibility with

schedules and timing to watch an introductory video or explore materials before participating in synchronous sessions. Since hybrid sessions are a combination of synchronous and asynchronous, many of the same challenges of each apply here. The main factors to consider are which components are best offered in real time, and which should be made accessible at a time of an individual's own choosing.

Connecting Making and Distance-Learning

Since 2011, Cognizant's *Making the Future* initiative has supported maker-centered learning experiences that catalyze lifelong learning. In that decade, Cognizant and the field have learned and written extensively about what constitutes high-quality making activities. Though these components may be well documented, imagining how they may be implemented in online settings is new, challenging, and replete with both potential opportunities and pitfalls.

FACILITATION

Typical making experiences and makerspaces have educators and facilitators on-site to support the curiosities of participants, assist with the creation of products, and share expertise. The lack of physical support and inability to troubleshoot technical problems were often cited as points of frustrations for the facilitators and participants during virtual experiences. Unfortunately, it is impossible for a facilitator to reach across the screen to hold up a tower of popsicle sticks, while the learner is trying to glue it together. This challenge turned out to be a teachable moment, however, as educators learned to reframe the situation to encourage and practice creative problem solving—foregrounding the importance of design-thinking and developing persistence in program participants.

Another important role of a facilitator is to notice and point out moments of divergence or out-of-the-box thinking and doing. This was difficult to do virtually, especially when some participants would have their cameras off during the making and iterating process. As a work around, some organizations found it helpful to have multiple facilitators in a program (if the program is being run synchronously). Then as one facilitator is leading the activity, the other can be monitoring the chat, observing those who do have their cameras on, and engaging those who choose to be incognito through the chat platform.

Working with groups online may give rise to the issue of homogeneity. In physical makerspaces, visitors are able to work at their own pace and enter at different stages of the design cycle. For virtual programs, it feels like participants all have to march to the beat of the same drum or be left behind. It is then up to the facilitator to support those who are lagging in the group and also to offer extensions to the activity for those who finish the work quickly.

Asynchronous facilitation has shown some potential in terms of widespread access, which can be seen through offerings such as activity guides and design challenge instructions. However, these resources are devoid of the live feedback piece that exists within in-person and synchronous online experiences. As a result, social media has been utilized as a tool for facilitators to provide commentary and feedback on learners' projects. Although it places the focus on the product and does not address the process of making, this channel of communication provides access to making-experts and affords for social interactions with the greater making community.

OPEN-ENDED

For in-person maker experiences, activities are interdisciplinary and **open-ended** to include several entry points of participation. This provides opportunities for learners to execute different design objectives based on interests and experiences, while also encouraging further exploration, such as building upon or completing more complex goals. By integrating different disciplines, entry points are accessible across multiple age groups, interest areas, and levels of expertise. In this way, learners are able to apply knowledge across content areas while acquiring new skills. Open-endedness invites creative solutions, innovation, and experimentation, allowing learners to become invested in an activity or process while bringing prior knowledge, lived experiences, interests, ideas, and expectations to the making process.

In virtual programs, activities can feel more structured or be more likely to follow a prescribed set of instructions. To prevent this from occurring, consider showing learners a project model during the synchronous sessions (to serve as an inspiration) that they can then build upon in asynchronous sessions, rather than providing step-by-step guides. Or, leave the objective of an activity open-ended so that learners have the creative freedom to decide how they want to tackle a problem. On written activity guides, ask expanding questions such as “what



different materials might you use?” and “how would changing X affect Y?”, or have a section featuring additional examples and resources that invite further investigation and deeper engagement. After all, there is no true endpoint to a making activity—you simply run out of time! Making from home means there is no longer a hard cut-off time to the activity.

DESIGN CYCLE

Making activities include a **design cycle** that focuses on achieving a particular goal by creating, prototyping, testing, evaluating, and iterating designs via hands-on exploration, observations, creative problem solving, and reflection. This includes engaging with the processes of trial and error, sensemaking, questioning, collaborating, generating solutions, making changes or improvements to designs, and learning from and persisting through challenges. (Bevan, et al, 2015). The design cycle is also related to Carol Dweck's growth mindset (Dweck, 2006), which is situated within the context of the iterative process. The design cycle and growth mindset emphasize the merits of productive struggle and learning through failures, though it may feel discouraging at times for new learners. However, participants gain a greater sense of accomplishment when they are able to work through problems on their own initiative and reflect on the process of their own learning. Thus, participating in a design cycle fosters a “maker mindset.”

Being able to observe instances of design thinking is difficult to do in person, and even more so virtually. Having prompts that encourage tinkering and sharing decisions aloud would help ensure that participants are

engaged, and that facilitators can gain an understanding of the methods and procedures used. Additionally, there has to be enough time built into the activity to allow for sufficient exploration while also striking a balance between giving support (so that novices don't get stuck for too long) and providing the exact solution to remedy a problem (so that novices don't learn a skill incorrectly). For written guides or video resources, labeling the different steps in the instructions with the corresponding design process places the maker mindset at the forefront of the experience—forming clear connections for the learner to understand how the concepts relate to the actions.

RANGE OF MATERIALS

Activities that invite learners to explore and experiment with a **range of materials** (such as high and/or low-tech materials) are successful in creating experiences that promote creativity, collaboration, curiosity, and inquiry (Wardrip & Brahm, 2015). Rather than being told to use a particular material to perform a specific function, learners are encouraged to try out different materials, to consider and evaluate their properties, and to reimagine and repurpose existing materials. This approach engages their problem-solving skills and enables them to think independently and creatively, while simultaneously gaining knowledge about materials and tools. Low and/or high-tech materials also serve as inspiration and embolden learners to accomplish different objectives and create unique designs, and are also utilized for the ideation, prototype, creation, and iteration of design goals.

Some programs have created material kits that can be distributed to users either for free or at a cost. Programs use a range of distribution methods to get the kits into the hands of the learners: shipped via post to users, included with food bank items, offered via schools who have some in-person classes or meal distribution programs, and available for check-out in libraries. Sometimes activity kits may be missing materials, which can hinder the making experience. In these situations, facilitators can help troubleshoot through creative problem solving and design thinking—encouraging participants to consider the qualities and purpose of that missing component, and identify replacement materials.

When organizations decide to provide a list of materials needed for their activities instead of the materials themselves, they often suggest everyday items found around the residence that are easily accessible, familiar, readily available, and inexpensive. To allow for open-



endedness, programs offer lists of suggested materials without requiring specific items to complete certain functions or tasks. Using simple, everyday items from around the household helps those who are new to making feel less intimidated by the novel experience, and pushes past the misconception that you need fancy tools or materials as a prerequisite for creativity and innovation. Indeed, it is the beauty in simplicity that can help form those real-life connections and have learners begin to identify themselves as a maker.

INTEREST-DRIVEN EXPERIENCES

Making experiences can involve considerable mental effort and persistence, which requires sustaining learners' motivation and cognitive engagement. Learning experiences that are **driven by the learner's interests** are more likely to sustain engagement, motivation, persistence, and active commitment to an experience, task, or activity (Fredricks, et al, 2004; Vossoughi & Bevan, 2014). Interest-driven projects empower the learner to make design decisions (Ryoo, et al, 2015; Sheridan, et al, 2014) while considering the purpose and audience of the designs (Bevan, 2017). This contributes to relevant learning opportunities and a greater understanding of concepts (Vossoughi & Bevan, 2014). Making and tinkering can be thought of as coming up with solutions to problems you find that are important or interesting.

In order to promote interest-driven projects in an online setting, Kim, et al. (2020) suggests capturing the interests of the intended audience through the use of surveys, interviews, and teen advisory boards. Linking the making experience to an aspect of personal

relevance or soliciting input from the community better enables organizations to develop programs that fulfill the needs and interests of their audiences. Tan, et al. (2018) also reported that through ethnography and by developing a greater understanding of the needs of underrepresented communities, youth were engaged in personally and communally relevant making activities, such as generating designs and solutions in response to a particular problem within their community.

Having facilitators take more of a supportive role and inviting learner voices to the table results in participants developing greater investment and ownership over their activity or project. Interest and engagement can be tricky to gauge online. Keep in mind that manifestations of engagement vary widely from person-to-person in both distance and in-person experiences. Educators may be surprised to hear that the child who looked bored on camera spent hours after the session tinkering with their project.

FUN OR PLAY

Making activities integrate a **playful or fun element** by presenting opportunities to experiment on interest-driven and self-directed projects with different materials, tools, variables, and concepts. This component of making can be a motivating factor that draws participation (Peppler, et al, 2020; Bevan, 2017) and sparks interest, therefore promoting persistence, autonomy, and knowledge of concepts through exploration.

In distance-learning environments, the ability to capitalize on the affordances of being online is essential for participants having fun. Instead of the screen being an obstacle to authentic interactions, turn it into an



essential element of the program. Organizations have gotten creative with designing programs around space exploration and other topics in which communicating through screens feels like a natural part of the narrative. For example, one program had their facilitators acting as astronauts while the participants took on the role of mission control. As a part of the “authentic” space exploration experience, the two parties had to communicate issues and propose solutions solely through the screen, in order to solve challenging engineering and programming problems to build a life-sustaining geodesic dome, suitable for human survival.

Feelings of formality and awkwardness about coexisting on screens can also be potential obstacles to fun, social connections. In order to break down those walls, it is crucial to build in social opportunities and construct group norms. Whether through silly ice breaker challenges, smaller breakout rooms, designated sharing time, or utilizing the chat to encourage peer-to-peer conversations, providing different avenues for interactions fosters greater communication and interest. Many programs include moments of movement and action, breaking up the time spent sitting and looking at the screen. When you are able to form a sense of community and excitement within a virtual space, learners will in turn be more comfortable engaging others with their making projects.

SOCIAL, COMMUNITY EXPERIENCES

Making activities are designed to be **social experiences** that are **facilitated**, which create a sense of community and a willingness to collaborate. Though we may be familiar with virtually connecting within our existing social spheres, establishing new communities exclusively online is a whole new ballgame. Community building—by encouraging interaction and collaboration among participants—is an important feature of distance-learning, and sparks the sharing of designs, products, resources, tools, expertise, ideas, and knowledge. Online making activities work best when they include components that promote community, interactions, feedback, and the documentation and sharing of ideas and products that arise from engaging in the iterative design process (Kim, et al., 2020). Individuals can interact with and help each other while working together and sharing feedback. Facilitators of making activities can also assess learners’ prior knowledge while providing guidance through questioning, probing, and sharing expertise in a manner that fosters skills and community building (Brahms & Crowley, 2016).

Research also indicates the importance of creating a safe culture and environment online (which is often seen in virtual schools) through the implementation of norms (Cavanaugh, 2010). By establishing norms for online sessions, participants are aware of expectations such as when and how to communicate with other participants (Fosslien & Duffy, 2020). The debate over whether participants should have cameras on or off has added to the difficulty of forming social ties. On one hand, it's hard to put a face or a name to a blank screen. On the other hand, being on camera could be taken as inviting a group of strangers into your personal living space—an idea that not everyone is comfortable with.

Furthermore, instructors can facilitate and support the online experience and discourse among users by providing feedback and scaffolds for learning during synchronous sessions. Creating social experiences for asynchronous and hybrid models of programming is possible. For example, the sharing of ideas, knowledge, and products can be expanded through the use of social media (Halverson & Peppler, 2018). With online tools such as Flipgrid, Padlet, and Google Docs, and social media platforms such as Instagram and Twitter, learners have spaces where they can congregate and engage with each other by commenting and offering suggestions or admiration for each others' projects.

Looking to the Future

At the beginning of the pandemic, distance and virtual programming felt like a stopgap for the circumstance. Organizations thought of what they already knew about past program offerings, considered which ones might be suitable to be done online, and then started creating with the lowest hanging fruit. But as building closures persist and the need for distance-learning remains, a different set of questions emerge: How can we do those things better? Is there a place for distance experiences in making? What are the avenues of distance-making that are worthwhile to pursue?

For some institutions, it's clear that nothing will beat the in-person experience. The online space doesn't allow for the same magic as getting lost in the fairy-tale-land that is a makerspace. Learners are unable to access the high-tech tools and are restricted in the materials they have available to them. The social experiences are not as genuine and don't leave as big an impact. Virtual programs were created to address an immediate need, yet there are some benefits that institutions have begun to explore.



Despite the many challenges, there are assets to bringing making online. Organizations have witnessed the far-reaching potential of virtual programs. A PDF guide of an activity can be translated into multiple languages, accessed across multiple countries, and shared amongst the global community. New audiences and partnerships have emerged as a result. Future business plans are being written that include online educational offerings—most likely hybrid programs, or asynchronous resources that are low cost, but high enjoyment. The potential to offer teacher and educator professional development courses is extremely appealing as well, as it would cut out the need for commuting to a physical location to engage in maker education. Through this ordeal, makerspaces discovered a new muscle in designing online programming that they have a desire to continue exercising, as they uncover ways in which the virtual world can be incorporated as a part of the making ecosystem.

The virtual world opens the door to a wealth of skills and knowledge literally worldwide. Institutions are able to tap into the deep well of expertise of local makers and provide exposure to different cultures' approaches to making—giving a larger worldview of what making can look like and augmenting possibilities for socialization. Makerspaces and maker organizations have the opportunity to develop or deepen their community ties and school partnerships. The social bonds formed by listening to new perspectives and co-learning with partners can lead to the creation of making experiences that are both wanted and meaningful to the community.

Key Components of Making and Design Considerations for Access and Distance-Learning Approaches

Key Component	Synchronous	Asynchronous	Access considerations
FACILITATION Offers guidance to learners by questioning, probing, and sharing expertise	Provide support so that learners can work at similar paces, giving more attention to those who may be behind	Empower adults as facilitators by explaining the design process and pointing out examples of how they can manifest in their learner’s maker experience	Ensure that all participants have an opportunity to share if they want
OPEN-ENDED Includes various entry points for learners; invites creativity and exploration	Offer challenges or extensions for further exploration past the group’s shared time	Offer general guidance and also encourage divergent ways of doing deeper exploration	Support and encourage divergent solutions
DESIGN CYCLE Prototyping, testing and iterating designs through hands-on exploration; learning from and persisting through challenges	Build in ample time for iteration while taking into consideration the number of times participants may want to iterate and the time spent per iteration	Connect and label sections of instructions with the corresponding step in the design cycle Forefront the value of tinkering, failure, and iteration	“Failure” can have a stigma; make sure it is perceived as a key part of the design process; people from different backgrounds may perceive iteration/failure differently
RANGE OF MATERIALS Materials lists include a range of potential materials, enabling participants to experiment with materials that enable a solution	Make available a list of materials in advance so that materials can be collected beforehand, including optional or range of materials	Allow user to find and experiment with materials at their fingertips (e.g., already in their house)	Provide info about how to use online tools Materials should be low-cost or provided so that it is not a burden to participants (think “junk-drawer”)
INTEREST-DRIVEN Sustaining engagement and active commitment to an experience through genuine engagement and/or relevance	Build upon moments of wonder and fascination Have intentional time for learner-driven curiosities and questions	Collect input on audience wants and needs through market surveys and community conversations	Learners select projects Facilitators are there to help them learn the tools
FUN OR PLAY Exposure to different materials and tools, while allowing projects to be interest-driven and self-directed	Engage with participants physically and allow moments of movement Co-create social norms and agreements in the virtual space	Make clear in instructions that activities will get messy Offer activities that use common items in an unconventional manner	Ensure group agreements so that everyone feels comfortable and welcome
SOCIAL EXPERIENCES Creates a sense of community, collaboration and sharing of designs/products, resources, tools, expertise, ideas and knowledge	Small groups in breakout rooms where youth can share ideas via google doc or virtual whiteboard or chat Reserve time in the program for group sharing	Links to social media or other opportunities to share Suggest sharing and engaging with family members or friends (in the learner’s physical bubble)	Seeing into participants’ personal lives; inequities (big private rooms, shared spaces) more visible Not everyone wants to speak, so allowing for range of modes of expression

Arizona Science Center—Pivoting to Virtual Platforms

What is CREATE?

[CREATE](#) at Arizona Science Center (ASC) is a community space offering in-person making experiences with equipment and heavy machinery for 3D printing and woodworking, for members and passholders to utilize. Hands-on workshops on the use of technology and equipment such as soldering and laser cutting are led by staff and offered to youth and adults. Workshop participants are then welcome to collaborate on or create their own individual projects using the available resources. CREATE also has education programs for students and educators. This consists of field trips centered around project-based learning and the engineering design process, mobile programming for schools throughout Arizona that can range from school workshops to family programs, and afterschool challenge-based programs where youth work in teams alongside local organizations to solve community problems.

How did the COVID-19 pandemic impact the program?

Due to the pandemic, field trips and in person experiences were paused and CREATE transitioned to offering making experiences online. They provided free online resources to the public such as activities on Facebook live, lesson plans for K-8 teachers related to the maker mindset and regular member events. However, with the uncertainty of the upcoming school year, CREATE began to modify future programming to include small professional development group experiences with teachers on how to build project-based learning and a maker mindset with their students.

CREATE also recognized an immediate need to create a sustainable plan, therefore developing and implementing [CONNECT](#), an online platform with different levels of subscription that are fee based and available to the public and educators. Each level includes different resources ranging from pre-recorded to live video sessions via Facebook and Zoom, worksheets, and maker kits. The different online formats such as live webinars include two staff members and foster interaction among participants and facilitators as well as a deeper exploration of concepts. For example, during a synchronous members event, a facilitator and

moderator oversaw a session on stenciling and screen printing with the use of low-cost materials. This allowed participants to engage in conversation with one another by asking questions about materials through the chat feature on Zoom. Collaboration was also encouraged as the session moderator and educator read and answered questions out loud for the group.

How did the CREATE Program at ASC change it up and succeed?

The online programs focus on project-based learning, encourage creativity, are interdisciplinary, and relate to college and career pathways. The key components of the online programs also differ based on the length of program and intended age group. Programs that are geared for younger audiences focus on engineering, whereas programs for older youth emphasize the design process, design thinking and empathy in order to build knowledge and 21st century skills. When designing online experiences, CREATE is also intentional about addressing equity and not making assumptions about what is readily available for participants. Free programming such as TinkerCad and materials that are easily accessible and can be repurposed are incorporated in their activities.

CREATE has encountered challenges from online programming such as ensuring the privacy and security

of participants. As a result, links are embedded and accessible only through the CONNECT platform and an authentication process and waiting rooms are being utilized to admit participants into sessions. Another challenge with online programming has been the digital divide. Therefore, the CONNECT platform is mobile friendly and QR codes are available for participants. Scholarships are also offered for families to access the CONNECT platform. Lastly, printed bilingual instructions are included in maker kits in order to offer non-digital learning materials to Spanish speakers.

Where will Arizona Science Center go next?

In terms of next steps, Arizona Science Center is concentrating on marketing efforts that will reach a broader audience to get more people interested in making. A future endeavor also includes focusing more on community building such as establishing a model that will reach more schools and communities through their afterschool program for middle school and high school students, creating maker clubs for communities, and leading hackathons with schools. Moving forward, other plans for Arizona Science Center are still being considered as it is important to be creative and flexible with online program design.



Maker Ed—Creating Collaborative Learning Communities

What is Maker Ed?

[Maker Ed](#) is an organization which provides professional learning opportunities to a number of individuals and institutions across the country in maker education through workshops, trainings, resources, and supportive networks. By establishing local and national communities of practice, Maker Ed facilitates the exchange of knowledge and capacity building across the field—framing a new approach to education which highlights learner agency, problem-solving dispositions, and collaboration. Making has the potential to transform not only the way in which learning is experienced, but also change the mindset and lived realities of students and educators alike.

How were professional development programs modified?

Due to the cancellation of in-person workshops, trainings, and the Maker Ed Institute, Maker Ed was forced to reimagine how these offerings could look online. *Making Spaces* is one of Maker Ed's featured offerings: a 30-month long program which connects nearby maker leaders and maker hubs to educational partners into geographical "hubs." Luckily, most of these professional learning resources were already being hosted virtually—such as monthly cohort meetings, check-ins with *Making Spaces* team members, and the online library of tools and resources that help integrate making into educational environments. When the shift to physical-distancing occurred, the 2-day workshop that took place in person in the spring needed to be adapted for a digital space. Furthermore, Maker Ed was now faced with the challenge of figuring out how to virtually support educators and other making professionals who were offering making online.

In order to do this, Maker Ed made changes to the content and facilitation of the workshop, the technology used, and the fee-structure. The workshops for maker educators were offered at a lower cost when they transferred to an online platform. Focus was placed on discourse about how making can be utilized to teach curriculum in distance education through collaboration, community building, inquiry, and learner-driven projects.

Equity was a critical component that was incorporated into programming: workshop participants were asked to read about relevant topics in advance, and then discuss during workshop sessions. Reflection was another essential condition, with Google sites serving as a tool for participants to share and apply what they had learned from their experiences and exploration.

Since collaboration and establishing a sense of community among participants are essential components of Maker Ed, breakout rooms were utilized to advance social interaction and discourse. For example, during a virtual *Making Spaces* call, members were assigned to different breakout rooms based on interest where they discussed comparisons between virtual and in person making experiences. There was extensive collaboration, dialogue, and exchanging of ideas among participants during the breakout rooms and with the larger group. Various concerns for offering online experiences—such as how to build and maintain relationships and integrate content alongside materials synchronously, asynchronously, or in a hybrid model—were discussed. Participants shared ideas on building and facilitating social interactions and conversations through community builders in order to learn more about others' interests. Other strategies included encouraging creativity and variability through the open-endedness of materials, doing a scavenger hunt around homes to gather and explore materials that can be repurposed, or using different digital tools such as Flipgrid and Padlet.

Despite the extensive dialogue that occurred in the *Making Spaces* call, Maker Ed reported that facilitating and promoting discourse in multiple simultaneous breakout rooms was a challenging component of online workshops. They addressed this challenge by sharing norms at the beginning of workshops, providing clear instructions, and encouraging participants to appoint a facilitator in each breakout room. Participants also engaged in the chat feature in the breakout rooms, and shared with their group an intention that motivated them. Maker Ed found that some participants felt uncomfortable engaging in

conversations related to race and equity, whereas others recognized its value and importance. This was a lesson learned in considering how to frame and build equity when establishing goals and designing program sessions.

How did Maker Ed support school districts and students?

Prior to the COVID-19 pandemic, Maker Ed was working in collaboration with a local school district to create a coding program and coding curriculum. Because the program was written to be used in person and educators could no longer use the curriculum as intended, Maker Ed pivoted to ask the school district about emerging needs due to the new distance-learning conditions. The school district's response prompted Maker Ed to supply kits with low tech materials and online activity guides for student use.

As another way to cater to the needs of schools and families, Maker Ed began offering a free program called *Learning in the Making: LIVE!* which was posted on YouTube. This program aims to share activities that learners can do independently or teachers can have their classes partake in, with the goal of connecting classroom content and hands-on making with social-emotional learning, mindset development, and the development of critical consciousness.

Where will Maker Ed go next?

Maker Ed has recognized the need for creating safe spaces catered towards those who are technology neophytes and individuals (such as essential workers) who may not be at home with their families. Moving forward, Maker Ed is working towards utilizing platforms or systems that can elicit and document feedback across participants, while allowing more social interaction to occur—especially during asynchronous times. Maker Ed would also like to maintain the *Learning in the Making: LIVE!* program past the pandemic, and is hopeful about the opportunities that will be offered in the Fall.

The Possible Project—Expanded Toolkit for Virtual Experiences

What is The Possible Project?

[The Possible Project](#) teaches students how to start and run their own businesses while acquiring personal and professional skills, such as growth mindset, design thinking, tech agency and identity development—all skills that have been identified as helping to “propel them to long-term success in life.” Through participating in a design-based and designed-focused curriculum and through creating STEAM projects, students develop an entrepreneurial mindset. A makerspace is one component of the entire program—integral to entrepreneurship and the enterprise curriculum—and through this, youth have access to high-tech tools such as 3D printers, laser cutters and computerized textile manipulators that enable them to prototype and produce complex products while learning critical STEAM skills.

How did the COVID-19 pandemic impact the program?

Like many learning programs that include making or tinkering, the COVID-19 pandemic made it challenging to offer their typical in-person summer bootcamp experience including access to the specialized equipment and technology of the makerspace. It also potentially limited the types of products students were able to create during the summer programming, all of which could have had a strong negative impact on youth development and learning. Instead, the program focused on increasing student agency and community engagement.

How did The Possible Project change it up and succeed?

First, early on, through discussion with students and community partners, program leaders at The Possible Project realized that their standard five-hour a day summer bootcamp would not be feasible in an online environment. The question they asked themselves was, “How can we provide a high-quality remote experience where youth can work online without feeling isolated?” They created a program where they could maximize synchronous time together but provide flexibility for youth during asynchronous time. They decided to limit the use of an online video call platform (they used a secure Zoom setting) to 90 minutes per day. In this setting, they offered

three different bootcamps, the first focused on business principles where students redesigned business logos; the second focused on design sprints where students identified a problem and then created a final product for industry partners; and the third focused on creating videos that captured the unique stories of 12 local BIPOC businesses. All of them included breakout sessions for small groups to have fun and work together. The goal was to provide a rich environment for learning with a strong sense of community. Attendance was generally good, although the extent to which youth participated in the discussion varied, as it does with in-person learning environments as well.

Second, because skill-building in technology is a key component of the program, The Possible Project had to find alternative opportunities for youth since the makerspace was inaccessible during the pandemic. Many of the computer-based tools, such as CAD and Adobe Illustrator, could be made available to students, and The Possible Project was able to provide licenses for students so that they could use this software on their home computer (some of which were provided to youth through schools and The Possible Project). While access to the internet was still an issue for some youth, providing hardware and software to students ensured greater equity since all students had access to the same or similar equipment.

Third, for the business bootcamp, the program focused on logo design. Through their license to Adobe Illustrator, youth had the flexibility to work on their own time. Recognizing that some youth might struggle with the software, the project allowed students to draw and scan their logos. Their final products were submitted in a wide range of formats. The program leaders also focused on what tools they felt were critical for youth to know how to use, such as tools in the Google suite. They realized that this presented an opportunity to lean into students’ development of tech agency as many youth are not familiar with spreadsheets or other common business software. This change-up enabled educators to see ways to improve their program offerings overall. As one youth said, “I liked learning how to use the physical tools last summer,

but virtual tools are the future!”

Finally, youth interviewed entrepreneurs of color in their communities. Instead of speaking in person, the interviews were conducted via video conference calling platform. One surprise that emerged from this approach is that both students and interviewees felt more comfortable conversing virtually, since they were in their home environment during the conversation.

By the end of the summer program, youth created virtual products, such as podcasts, a playlist of videos, or virtual presentations. For example, one cohort chose to survey other students in their local school district to learn how they felt about distance schooling and how the pandemic was impacting their education. Youth from The Possible Project created a presentation, with recommendations, based on their findings from the survey, which was then presented to the district superintendent. Throughout the summer programs, students were driving the learning and were able to assume more ownership and agency. The authenticity and student agency of these projects were the keys to their success. For instance, students in the business bootcamp considered the recent modification of brands such as Uncle Ben’s or Aunt Jemima as informed by the larger Black Lives Matter movement. Students in the video project created blogs about the impact of COVID-19 on their lives.

Where will The Possible Project go next?

The Possible Project encouraged program leaders to be mindful of the interests of their students. While these components were included in the program prior to the pandemic, program leaders emphasized responsible decision making, developing social capital, social-emotional learning, problem solving, and the development of an entrepreneurial mindset. The redesigned program was so successful that youth asked for it to be extended an extra week! The Possible Project plans to incorporate some of their learnings from the virtual summer program into their yearlong program and is interviewing and surveying school and community partners to understand more about the benefits of distance-learning with the hope of continuing some form of virtual program in the future.

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