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Defining Measurement Constructs for Assessing Learning in Makerspaces

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Defining measurement constructs for assessing learning in makerspaces

Abstract: This research paper presents the initial construct definitions for an assessment instrument to measure student learning in makerspaces. Makerspaces enable learning through social interaction and hands-on activities when creating physical solutions to a problem. Due to the positive perception of the impact of makerspaces on student learning, these spaces have drawn the attention of different types of institutions, including libraries, communities, and those in higher education. As such, new makerspaces are constantly being created, and research about those spaces is also proliferating. However, there are currently no instruments with evidence of validity and reliability that can be used for assessing learning in makerspaces. Therefore, as the first step in the process of generating an instrument, this study seeks to answer the research question: "What are the definitions of constructs for learning in a makerspace?" To create our construct definitions, we first assembled a team of instrument development experts and makerspace experts. The makerspace experts had previously conducted several qualitative studies on makerspaces, culminating in a Learning Typology for Makerspaces. Following the principles of instrument development outlined by Netemeyer et al. (2003), our team created concise essence statements for each of the constructs in the typology, which summarize the main idea behind each of the constructs we want to measure. Next, we created conceptualization statements derived from the essence statements, expanding on each construct's meaning by incorporating key empirical knowledge of the makerspace experts. Finally, we conducted a literature review to ground the final definitions for each construct. This literature review was guided by the ideas present in the essence and conceptualization statements, and thus, the final definitions expand on the empirical knowledge of our experts with other perspectives reported on the literature. We created a set of essence and conceptualization statements along with a formal definition supported by the literature for a total of six constructs related to learning in makerspaces. The six constructs are (1) Learning by Doing, related to the process of learning through active engagement in maker activities; (2) Learning by Others, related to the process of learning through engagement with other people or artifacts created by others; (3) Content Knowledge and Skills, related to the technical disciplinary knowledge learned in makerspaces; (4) Cultural Knowledge and Skills, related to learning and navigating the culture of a makerspace; (5) Ingenuity, related to the inventiveness of learners when creating solutions constrained by their making environment; and (6) Self-awareness, related to learners' development of transferable attitudes, motivation, and character. The definitions were created as a starting point for developing a quantitative instrument for measuring learning in makerspaces. Having experts in makerspaces along with experts in instrument development proved to be beneficial to the process, as it allowed the concepts to be explored in greater depth. These resultant definitions enable the continuation of the development of a makerspace instrument, while also serving as an operationalization of learning in makerspaces for the wider research community.

Keywords: makerspace; instrument development; assessment; literature review

This research paper presents the development of initial construct definitions of different aspects of learning in makerspaces. The creation of such construct definitions is important because it enables the development of a quantitative assessment instrument intended to measure student learning in makerspaces. Every instrument designed to measure constructs that are not directly observable starts with a strong theoretical basis that informs what is being measured. Therefore, defining these latent constructs provides the foundation upon which the instrument will be built [1]. In the case of learning in makerspaces, much of the existing literature focuses on specific cases or outcomes, and thus comprehensive explorations of processes, outcomes, and different settings are few and far between [2], [3]. The Learning Through Making Typology provides one thorough examination of learning experiences in makerspaces, including the processes and outcomes of learning [4]. Because of its comprehensiveness, the typology holds potential for being turned into a quantitative assessment instrument. To support the creation of an instrument that can serve diverse academic makerspaces, we sought to enrich the typology with findings and considerations from the wider makerspace literature.

Measuring latent socio-psychological constructs, such as those related to learning, is a process that requires the development of valid, reliable, and fair assessment instruments [5]. Under the argument-based approach, validity is thought of as how the instruments' results can be interpreted and how they can be used [6]. In that sense, validity is built through multiple evidences that support each proposed interpretation and use. The concept of reliability reflects how consistently the instrument measures what it is designed to measure—in other words, how much the scores are consistent [1], [7]. Finally, fairness is about considering and avoiding the different ways the instrument might be biased against or in favor of certain groups, both in terms of how they are scored and how the scores might impact groups differently [8]. These three concepts are important when considering the development of an instrument because evidences of these concepts can ensure that the information one gets from the instrument are relevant for a wide population and that it actually reflects what it is intending to measure [5].

With the rise of makerspaces in academic contexts, educators need valid and reliable measures for the learning facilitated by such spaces in order to better understand the process and outcomes of students' experiences in those environments. For makerspace instructors and administrators, knowing how and what learning happens in a makerspace remains a challenge. Makerspaces have become increasingly popular both inside and outside academic contexts, with recent estimates pointing at the existence of over 1,000 active makerspaces worldwide [9], [10], [11]. Makerspaces are appealing due to being conceived as welcoming learning communities that allow people to engage in making activities with other people [12]. In other words, makerspaces enable users to create and explore projects or ideas with various degrees of guidance and freedom using the resources available within the community [13]. Studies of qualitative nature indicate that this structure can be associated with positive learning experiences, because it allows people to develop their technical and design knowledge, explore solutions to problems, and develop a working proficiency with tools and equipment used for creating and prototyping [14], [15]. In the current literature, however, there are few quantitative studies that provide large-scale evidence of the impacts of makerspace in learning [2], [3], [16], potentially because there is no framework that enables such an assessment.

To address this gap and create an instrument that effectively measures the learning that happens in makerspaces, instrument developers need to define the learning aspects they want to measure. In this study we, therefore, set out to create a strong foundation of definitions that we will later use to inform the development of the Learning Through Making Instrument (LMI). The purpose of this research paper is reflected in the following research question: "What are the definitions of constructs for learning in a makerspace?"

To answer this research question, our team—which includes some of the original creators of the aforementioned Typology—engaged in a reflective process guided by the Typology about our own understandings of learning in makerspaces along with a review of relevant literature that addresses similar topics. This process led to the creation of essence statements, conceptualization statements, and construct definitions. An essence statement provides a summary of the most important aspects of that construct based on the team's knowledge, while a conceptualization statement complements the essence statement by providing more details on specific aspects of the essence statement, as informed by the team's experiences. These statements helped guide our literature search, which ultimately led to our construct definitions. Construct definitions are our current understanding of what we intend to measure, informed by our starting framework (the Typology) and additional literature that provides insights into different makerspace organizations and cultures. These statements helped guide our literature search, which ultimately led to our construct definitions.

Background

Maker culture

Although making can be defined in a multitude of ways, there are certain traits that are common to most definitions as a result of the culture bolstered by the modern maker movement. The culture of making and makerspaces guides much of the experiences people have when engaging in these activities. Some aspects that are common to most definitions of making include: the act of physically or digitally creating something, using resources that are available, and engaging with a community [3], [13], [17], [18]. As Jordan & Lande [19] emphasized through their grounded theory study of maker communities, sharing is ingrained into the maker culture: people share their creations, processes, and instructions as a means to inspire and help others in their own making efforts. Because of this communal support, those who have been helped or inspired by others feel compelled to give back to the community by sharing their own new creations. The sharing aspect of maker culture applies both to in-person settings—at conventions or at local makerspaces—and online settings—through forums or dedicated websites [20].

Even though sharing is a key trait of the maker movement and the community prides itself on democratizing making, the maker movement is still dominated by white men, which signals some potential concerns when thinking about the reach of makerspaces. Existing studies that examine makerspace demographics highlight that white men with moderately high income represent the majority of users across academic environments, non-academic environments, and maker fairs [12], [18], [21]. Such demographics are reflected in the activities deemed "acceptable" in makerspaces and in the additional effort members of underrepresented communities need to go through when occupying these spaces. Previous studies highlighted how this dominant demographic results in making activities being gendered, with certain forms or approaches to making (e.g., sewing) being unvalued [22], [23]. People from marginalized groups might be patronized or even harassed as they try to participate in makerspaces, which pushes some away from these environments in the long term [22], [24], [25]**.** As a response, some makerspaces specifically aimed at these populations traditionally underrepresented in the maker movement have emerged to provide a safer space, but these are the exception rather than the rule [26].

Finally, another defining aspect of maker culture is that makers tend to work with the resources they have at their disposal, often making adjustments to their ideas and designs to fit their making realities. This need to be resourceful ends up being important when learning in makerspaces because it promotes flexibility and an ability to work through limitations. According to Sheridan & Konopasky [13], the idea of resourcefulness is important because it highlights that the community and the space itself have a critical role in determining how makers approach their making process. Similarly, *bricolage* has been used to describe making efforts with a more experimental and resourceful approach, which relies on one's repertoire to navigate the available resources [17], [27]. These approaches justify how makers can succeed with the resources at their disposal, as every makerspace will have different materials, equipment, and people to work with [17], [28]. Therefore, in makerspaces, the cultural elements of resourcefulness, community sharing, along with rules and expectations, determine a significant portion of one's experience when making and are aspects that should be considered when assessing learning experiences.

Learning in makerspaces

As makerspaces become more prominent in settings such as universities, schools, museums, and libraries, understanding how people learn in those spaces emerged as an important topic of research. Understanding the process through which people learn in makerspaces is important for facilitating learning experiences that lead to desired outcomes. Existing research on the process of learning in makerspaces ties it to the theories of constructivism, constructionism, and critical pedagogy [18], [29]. Because making can be presented as an open-ended activity, users can guide their own learning according to what is interesting and seems achievable to them—which aligns with the authentic engagement posited by constructivism and constructionism. Constructionism, in fact, is considered by some to be the reflection of maker-based education, as it states that learning happens through engagement that results in the making of something [18]. Cohen and colleagues [30] have proposed a framework to describe the learning processes in makerspaces that is based on constructionism, framing the learning experience through four principles: creation, iteration, sharing, and autonomy. Elements of critical pedagogy are also at the heart of making's learning process—learners are empowered when they engage in making with problems that are meaningful personally or for their community [16], [29]. These learning theories thus provide an important framing for aspects of the learning process in makerspaces that should be considered when creating related construct definitions.

How people learn in makerspaces is not the only thing that got the attention of researchers, as other studies investigated the many outcomes of learning in makerspaces. With an understanding of what people learn in makerspaces, the learning experiences can be better tailored to foster those outcomes. In their literature review focused on making with computational tools, Timotheou & Ioannou [3] define three major categories of outcomes that have been explored in the literature: (1) Knowledge outcomes, in terms of disciplinary knowledge [29], [31], [32]; (2) Attitudes, in terms of feelings towards learning [33], [34], [35]; and (3) 21st century skills, related to information literacy and professional skills [31], [34]. In parallel, Vossoughi & Bevan [16], defined eight learning dimensions through their broader review of learning in makerspaces. There is plenty of overlap between the categories described in the two reviews, but the latter includes more details and nuances in some aspects, notably the acceptance of an iterative making mindset and an increased sense of collaboration [16]. These investigations then provide a broad overview of what learners can potentially achieve as "serendipitous" or "deliberate" learning when engaging in makerspaces [30]. Such findings again guide the development process of construct definitions related to learning outcomes in makerspaces.

Theoretical framework

For the purpose of determining how to approach the assessment of learning in makerspaces, we are using the Learning Through Making Typology [4]. The typology (summarized in Table 1) was empirically developed in the context of two U.S. universities and captured the learning people might experience in makerspaces through two broad categories: *Mode of Learning* and *Product of Learning* [4]. The *Mode of Learning* category includes the classifications that explore how students learn within makerspaces, and it includes the subcategories of *Learning by Doing* and *Learning by Others*. *Learning by Doing* captures students' descriptions of learning when physically engaging with the makerspace, whereas *Learning by Others* captures their learning when engaging socially. For the *Product of Learning* category, the authors included classifications that explore what students learned within makerspaces. The subcategories *Content Knowledge and Skills* and *Cultural Knowledge and Skills* make up the cognitive dimension of *Product of Learning*. These subcategories capture descriptions of when students learned content and skills from technical disciplines as well as the rules, expectations, and navigation processes for participating in the makerspace. The intrapersonal dimension of *Product of Learning* comprises the subcategories *Ingenuity* and *Self-awareness*. *Ingenuity* refers to the creative problem-solving abilities that students develop and use when creating their solutions in a makerspace. *Self-awareness*, conversely, refers to the personal attributes makers apply in makerspaces but that are transferable to other settings. The Learning Through Making Typology presents a broad understanding of what learners experience in makerspaces and we contend is a good starting point for the creation of a quantitative instrument—which requires further literature investigation to ensure it captures aspects not made explicit by the specific sample used in the qualitative studies.

Table 1. Categories in the Learning Through Making Typology [4].

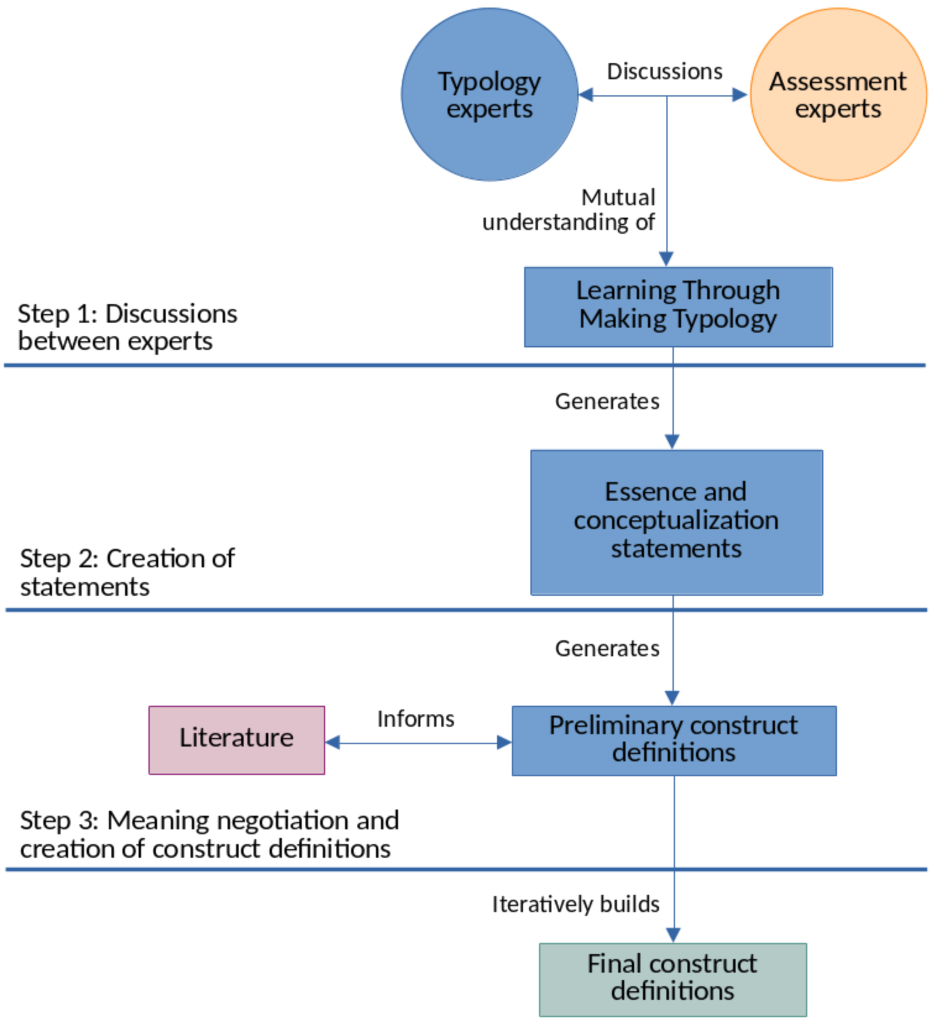
Category	What/How students learn
Mode of learning	Learning by doing
	Learning by others
Product of learning	Content knowledge and skills
	Cultural knowledge and skills
	Ingenuity
	Self-awareness

Methods

Our process started with the Learning Through Making Typology, which informed the general direction we wanted to take our instrument. Our team consisted of people who developed the original typology (typology experts) and people with experience in instrument development (assessment experts). Figure 1 shows a summary of our approach to developing the construct definitions. The first step of our process was to have the assessment experts question and discuss the elements of the Typology with the typology experts in order to create the essence and conceptualization statements. Simultaneously, the assessment experts got acquainted with the details and nuances of the original Typology. The assessment experts created the original versions of the essence and conceptualization statements based on their understanding of the Typology. These original versions were then presented and further discussed with the typology experts, which helped direct the statements to cover missing aspects and further refine the writing. After multiple rounds of revisions, the entire team felt comfortable moving forward, as the statements were accurately representing the typology experts' empirical understanding of learning in makerspaces.

With the creation of the essence and conceptualization statements, our team moved on to the creation of the construct definitions through a lengthy process of discussions and literature review. For each of the constructs we were defining, a member of the team engaged in a targeted literature search with the goal of finding publications that presented findings that directly supported, contradicted, or expanded on our understanding of each topic in the Typology. The literature search started with queries in general-purpose scholar databases (Google Scholar, Web of Science Core Collection, and Scopus), and more publications were found through snowballing. Our goal with the literature search was to find other publications that confirmed, expanded, or denied our understanding of the constructs. Initial findings from the literature were then brought back to the whole team, and we proceeded to have more discussions about other search terms and authors we could include in our search. This process was iterative, and important in order to ensure our definitions could be relevant for makerspace contexts different from the ones our typology experts worked on while developing the typology—which ensures our instrument can have a wide reach. After the team was satisfied with the literature found for each of the constructs, the assessment experts created preliminary definitions that synthesized the main findings from the literature into concise statements. As with the previous statements, these preliminary definitions were further discussed and refined with the help of the typology experts.

Figure 1.Development process for the construct definitions of learning in makerspaces.



Results

Following the procedures detailed above, we created essence and conceptualization statements for each construct along with a final definition. These are all reported in Table 2.

Discussion

As evidenced by Table 2, our statements evolved significantly over the course of our discussions and review of the literature. This result highlights two important outcomes of this research: The contributions of having a team of diverse expertise; and the changes in perspective afforded by our increased exposure to the literature of makerspaces or tangential to makerspaces.

Throughout the course of our study, the assessment experts and the typology experts had to support and push each other further in order to create a shared understanding of our construct definitions. When initially starting work on the project, the assessment experts had a basic understanding of makerspaces and were not fully aware of all the nuances of the makerspace learning experience that was part of the typology experts' knowledge. To work around that, extensive conversations, writing, and revising were necessary to get the assessment experts up to a similar level of proficiency, leading up to the essence and conceptualization statements based on the typology. Next, the assessment experts' inexperience in the field also led them to be more open during the literature search stage of the study, leading to additional conversations that pushed the typology experts to see certain aspects of makerspaces under a different perspective. We believe that the ability to have these two sets of people working on the study allowed our final construct definitions to be both truer to the Typology and to the maker research community.

Table 2. Essence, conceptualization, and definition statements for the constructs derived from the Learning Through Making Typology

Construct	Essence Statement	Conceptualization Statement	Definition
Learn by doing	The process of learning through exploration, failure, struggle, and persistence in their active engagement with equipment/things in the space (e.g., tools, machines, software, computers, ideation tools) in a process/method facilitated by the space.	The process of learning (actions, approaches, mentality, etc., used by students to develop proficiencies in the makerspace) through exploration, failure, struggle, and persistence (being hands-on) in their active engagement (immersed/committed, OR attention, curiosity, interest, optimism, passion) with equipment/things in the space (e.g., tools, machines, software) in a process/method facilitated by the space (providing equipment, people, inspiration, motivation to students).	The process of active learning guided by students' projects within a space that promotes and supports authentic and exploratory making experiences in which students strategize, fail, reflect, and succeed in realizing their ideas [3], [36], [37], [38], [39], [40], [41].
Learn by others	The process of learning through observation, communication, and active engagement with other people, videos, training manuals, and watching making/production facilitated by the space.	The process of learning (actions, approaches, mentality, etc., used by students to develop proficiencies in the makerspace) through observation (monitoring/watching other people's engagement), communication (messages conveyed through non-verbal and verbal means) and active engagement (immersed/committed, OR attention, curiosity, interest, optimism, passion) with other people (other students/users of the makerspace), videos, training manuals, and watching making/production facilitated by the space (providing equipment, people, inspiration, motivation to students).	The process of learning through observation, co-presence, or communicative sharing of inspiration, know-how, ideas, and designs through relationships in the maker community [19], [20], [42], [43].
Content knowledge and skills	Students' gaining/learning of the technical knowledge, techniques, and operational skills acquirable through active engagement in the makerspace.	Students' gaining/learning (developing proficiency) of the technical knowledge (disciplinary and design skills), techniques (making process, tips and tricks), and operational skills (use of the equipment, software, material properties, and common engineering components—e.g., gears and resistors) acquirable through active engagement (immersed/committed, OR attention, curiosity, interest, optimism, passion) in the makerspace.	Students' internalization of making operational skills and techniques through engagement in the makerspace, which informs technical knowledge and experience [36], [44], [45], [46], [47].

Construct	Essence Statement	Conceptualization Statement	Definition
Cultural knowledge and skills	Students' gaining/learning of the perceived cultural norms, attitudes and gendered expectations to negotiate the dynamic space and the community of a makerspace.	Students' gaining/learning (improvements in/exhibiting proficiency) of the perceived cultural norms (the accepted/endorsed ways of being and behaving in the makerspace), attitudes (dispositions towards the materials and space) and gendered expectations (the implicit and explicit rules/roles that guide and naturalize behaviors, space, and equipment along the gender spectrum) to negotiate the dynamic space (the physical space, including the layout of the makerspace, the access to the facilities, and norms around the usage of equipment) and the community (the typical ways in which the community at this specific makerspace engages with their activities) of a makerspace.	Students' learning, translation, and negotiation of the implicit and explicit rules, conventions, and identity-related expectations within a dynamic makerspace community [2], [22], [48], [49], [50].
Ingenuity	The strategies students are learning/developing and using to create a range of solutions and adapting to their situation given available resources in the makerspace.	The strategies (how students develop their projects and how they approach their work—whether structured or unstructured) students are learning/developing (gaining, improving, and exhibiting proficiency) and using to create a range of solutions (mundane to novel, i.e., thinking outside the box) and adapting to their situation given available resources in the makerspace (personalizing solution to work with social structure, equipment, materials, resources).	The practices used to innovate solutions shaped by the constraints of the makerspace and students' social relationships [13], [27], [51], [52].
Self-awareness	Students reflecting on their personal growth of transferrable attitudes, motivation, and character they are learning/developing and using when working in makerspaces.	Students reflecting (thinking critically about their experiences, skills, and identities) on their personal growth of transferrable (can be used in other contexts) attitudes, motivation, and character (how they inspire, present, feel about themselves and what happens in the makerspace) they are learning/developing (gaining, improving, and exhibiting proficiency) and using when working in makerspaces.	Students' reflection on their identity and their personal growth in attitudes, motivation, and character through engagement in the makerspace community [51], [53], [54], [55], [56].

In terms of the changes to our definitions, the concepts of *Learn by Doing*, *Ingenuity*, and *Cultural Knowledge and Skills* were the ones with the most significant changes between the team's original understanding and the final definition. In the case of *Learn by Doing*, the changes to our definition were influenced by the theories of constructivism and constructionism being closely aligned with how makerspace users achieve learning [3], [39], [40]. Although we were already aware of these learning theories within the context of makerspaces, our interactions with the literature solidified the importance of authentic making experiences for the purposes of learning, which we wanted to reflect in our final definition. For *Ingenuity*, the changes came in the form of better acknowledging the role of the community. In certain makerspaces, the availability of resources in the space is not the only thing shaping the users' ability to solve their problems—the community around them shapes what those problems are, and the resources available to the community itself might be another factor when users consider the applications of their solutions because of the impact they want to have [13], [27]. Finally, for *Cultural Knowledge and Skills*, the construct initially emphasized gendered expectations as part of the maker culture that users needed to familiarize themselves with to negotiate their belongingness in the space. As we familiarized ourselves more with the literature, we realized that expectations related to other sorts of identities (e.g., race, ethnicity, field of study) resulted in similar understandings of what is acceptable or not within makerspaces [12], [26]. We, therefore, expanded our definition to more broadly cover minoritized identities, while still being mindful of the expectations set specifically in terms of gender.

When expanding our understandings, some concepts used in makerspace literature stood out and helped us with the construction of our final definitions, namely tinkering, activity theory, and *bricolage*. Tinkering is a term that is more routinely part of discussions around making and is usually understood as being a strategy used while making [3], [36]. In that sense, tinkering is defined as the act of engaging with objects or processes in a more exploratory manner, usually with a purpose of understanding how they work or purely for fun. This is seen as a making strategy because it fits with the type of exploration that is so important to the core of making [36]. Tinkering thus became important for our definitions because this literature examines more of the exploratory side of making in informal learning experiences, which influenced our definitions for *Learn by Doing* and *Content Knowledge and Skills*.

The second impactful concept, activity theory, originated in the education field and was used as a framework to investigate the dynamics of constructivist learning experiences. Activity theory is used to explain learning and interactions within larger systems/working spaces and is rooted in Vyogtsky's perspectives [49], [57]. The theory posits learning as a complex interplay between tools, division of labor, community, rules, and the subject, all mediated by artifacts. Because we previously explored the meaningfulness of constructivism for explaining learning experiences in makerspaces, activity theory becomes appealing for the exploration of the interactions within makerspaces. More specifically, one of the principles of activity theory states that "the activity system itself carries multiple layers and strands of history engraved in its artifacts, rules and conventions" [49, p. 136]. It is established that new members of certain systems (e.g., a makerspace) are required to understand those rules and conventions as they seek to negotiate their presence. Such perspective on rules, conventions, and history was important for the development of our *Cultural Knowledge and Skills* definition, as it helped us emphasize the dynamic nature of the culture of a makerspace.

Finally, *bricolage*, a French term that was coined in the 1960s to refer to human activities using what is available, has been used to describe a more exploratory approach to making [17], [53]. Before being brought into the makerspace literature, more modern interpretations of *bricolage* were discussed within the organization and management literature, where it was extensively associated with improvisation and adapting to the surroundings [27]. Curiously, this literature contrasts the *bricoleur* approach against that of an engineer in terms of how the approaches differ in action, knowledge, and world view—often being polar opposites in these regards. It is argued that it is impossible to be purely on one side of this spectrum, but rather that every approach falls somewhere in the middle. Therefore, bringing the bricolage into the makerspace literature is used to argue for making experiences that are not completely planned, which corroborates the idea of constructionism that the planned and the unplanned are both essential parts of the learning experience [58].

Conclusions

In this paper, we presented the process and outcomes for the creation of operational definitions for aspects of learning within makerspaces, with the goal of aiding the development of assessment instruments. We first established the importance of having a solid theoretical basis to explore the different nuances of learning in makerspaces, which we accomplished through the use of the Learning Through Making Typology. Through the cooperation of a team that included some of the proponents of the Typology and some experts in the development of assessment instruments, we were able to push the boundaries of the team's understanding of the aspects in the Typology. Coupling the team effort with our literature review process, our final definitions incorporated elements of diverse branches of makerspace research, resulting in definitions that should be appropriate for makerspace settings that differ from those used in the development of the typology (i.e., academic makerspaces in U.S. institutions).

These definitions are important for future research made by the makerspace community because they provide a new set of theory-informed perspectives that can be used to understand the role of makerspaces in learning. Researchers might be interested in using our definitions because of the breadth of aspects related to the makerspace learning experience and some of the different takes on making—including tinkering, bricolage, and activity theory—emphasized by our definitions. These definitions can also serve as a basis for future theory-building efforts around learning in makerspaces. Following this study, we intend to continue with the process outlined by Netemeyer [1] for the development of assessment instruments. This process includes the development of the survey itself—including the generation of survey items, conducting an expert review on our items and definitions, performing cognitive interviews with makerspace users—and performing validity, reliability, and fairness studies for the instrument. Finally, it is important to acknowledge the limitations of this study. Even though we searched the wider literature to create our definitions, the typology, which served as our starting point for the study, is reflective of a U.S. experience of makerspaces in academic settings. Therefore, researchers might have to make additional considerations when using our definitions in non-academic or non-U.S. contexts.

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