Activity theory as a systems approach to design creativity and research

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Activity theory is an analytical framework for the analysis and design of learning and work environments. It is based on the original work of Lev Vygotsky (1896-1934) and the idea of tool mediated action and development. The tool mediated and socio-historical aspect of learning was extended by Vygotsky's colleague Leont'ev (1904-1979) and defined as activity theory. Leont'ev incorporated the idea of community and its shaping via rules and divisions of labor with Vygotsky's tool mediated development. Engeström (2014) contributed the graphic representation of activity systems, as shown in the figure below. Furthermore, Engeström's theoretical contributions broadened activity theory into expansive learning, and his practical application of expansive learning used activity to design formative interventions. Activity theory offers a framework for understanding human activity and is used in various research and design contexts.

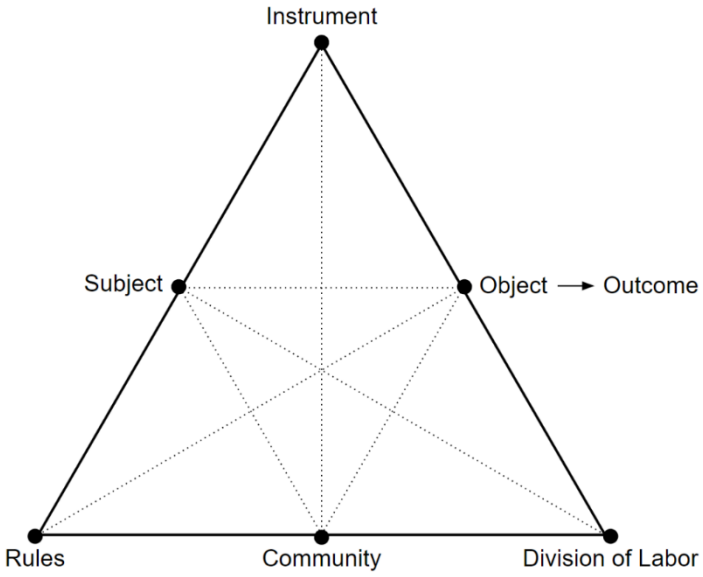

Figure 1. Main components of an activity system (Engeström, 2014)

This triangle represents the primary components of all activity systems. The uppermost triangle (subject-instrument-object) is derived from the Vygotskian idea of tool mediated development. Instruments are richly diverse and can include an array of both conceptual and practical tools. The people in the system (subjects) use tools to realize the object of the system. In this way, all activity systems are defined by their objects. Ideally, people's motivation to carry out work is focused on realizing the object of the system. Activity systems are object-oriented.

The lower three components extend the tool mediated triangular mechanic of development to include socio-cultural context. The activity system's community is elaborated by the rules people follow in the activity and how the work is divided among them. The three categories of rules, community, and division of labor expand the tool mediated action triad (subject-instrument-object) to delineate an activity system that accounts for social and cultural factors. These additional socio-cultural dimensions help account for the multi-voicedness of activity systems.

Building tensions

In any activity systems analysis, the activity system (or systems) is the unit of measurement. An analytical key to understanding developmental change within and between systems is the concept of contradiction. As research is carried out to understand, delineate, and describe activity systems, issues and historical tensions may become apparent in the form of conflicts, dilemmas, controversies, and so on. These manifestations of contradiction can serve as markers for possible change. Some researchers identify manifestations of these contradictions and present them to participants in the system to initiate interventions. People then work to resolve those issues and reshape how work is accomplished in the

system. The concept of contradiction has its roots in the Hegelian notion of the dialectic. The clash of a thesis and antithesis leads to synthesis—new knowledge. In this way, contradiction acts as a force for a potential change in activity systems. Contradictions are often felt before they are fully understood and operationalized. Researchers might focus their analysis on identifying various manifestations of inherent contradictions and design interventions that might help participants address the underlying contradictions and transform the activity system.

Another analytical key to activity systems analysis is time. Developmental tensions and change within and between activity systems occur across time, and so any activity system analysis needs to account for the history of the activity. This characteristic attunes activity theory particularly well for investigating process—in my research, creative process. Research and design informed by activity theory are developmental, and therefore it is necessary to grok the historicity of activity systems.

These six components of activity systems and the focus on their historicity, contradictions within and between them, and their status as the prime unit of analysis are the main characteristics of the studies conducted when using activity theory as an analytical framework.

Another model of activity commonly used with activity theory is the hierarchy of activity, which was theorized by Leont'ev. The top of this three-level hierarchy is the main activity, where the object of the system focuses on the overall motive. Actions occupy the middle and are oriented toward smaller goals within the larger activity. Operations occupy the bottom of the hierarchy. Operations are specific and conditional for each action. Actions are consciously performed, whereas operations are often unconsciously performed. It may be helpful to think of operations in terms of "standard operational procedures."

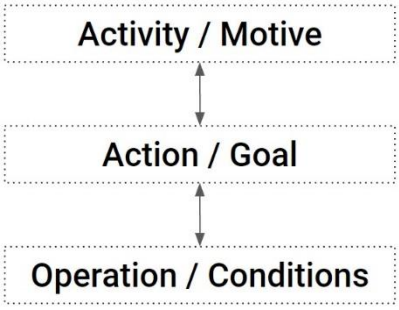

Figure 2. Hierarchy of activity

Just as with the six components of activity systems, the hierarchical levels are dynamic and interrelated. For example, consider an activity system motivated toward the object of learning (e.g., schools, news organizations, advertising agencies.) Some related actions might be related to assessment (testing, polling, data mining.) The operations around each of the actions would be established routines performed as a matter of fact, almost unconsciously (e.g., pop quizzes, online surveys, email address collecting.) During a real analysis, the actions and operations performed within the activity emerge through data collection and analysis. As you might imagine, these details are contextually dependent and give each system its unique character.

How does it feel?

You may have noticed that activity theory specifies the analysis of components and chains of behaviors but seems lacking in its treatment of subjectivity. When considering the design journal, interview, and observational data I collected, it was clear that much of the data concerned how students felt about the actions they carried out.

Consider the hierarchical model of activity as discussed above and how operations are conditional to actions. In this way, operations "surround" each action. Similarly, the data showed feelings surrounded actions. While reading the data, codes emerged that seemed to be at once feelings *and* established constructs referenced in the creativity and design literature. For example, optimism was a design thinking factor, as described by Brown (2008) and Blizzard (2015). Surprise was a feeling that was referenced in the creativity literature (Goslin-Jones & Richards, 2018), the design literature (Dorst & Cross, 2001), and by Vygotsky as well (Smagorinsky, 2011). This comingling of action and affect led me to relate specific actions to the feelings and context surrounding them—much in the same way that operations are conditional to actions.

For example, Julie described her experience of the "elevator pitch." These informal pitches were the first time in the course when students were asked to present their project ideas formally. During our interview, she described a transformative moment for her in the course:

> When I presented my idea in class, I was pretty like I was overwhelmed with the feedback…I could see … different people using [her app] and that made me feel good because then I felt like this is something that could be real. Like it's not just a class project…having that, um, support makes it feel like what you're doing isn't just for a grade.

Up until this point, Julie said she had very low confidence in her idea. So, as a result of presenting her vision to the class, she became optimistic. Here we can see actions and affect intertwining and driving development. Low confidence evolved into optimism due to presenting an initial and very-low to no fidelity prototype of her idea in class. My attempt to represent this as a three-level hierarchy of activity is shown in the figure below.

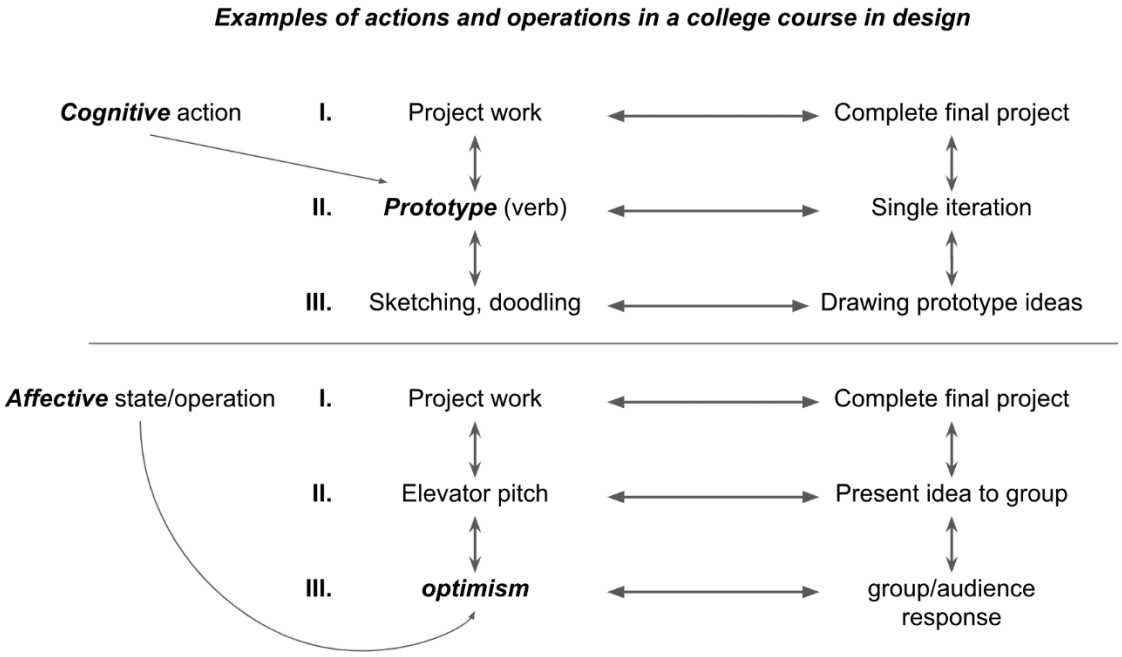

Figure 3. Hierarchy of activity, actions, operations, and affect

To further map this out, the idea of a quotient was used to represent the mix of actions and affect found in the system. This methodological tactic was not rigorous and just a way to sketch out the system. For example, the figure below shows my efforts to conceptualize a ratio of action/affect and the attempt to use the predominant actions and affect to map out movement in relation to the activity system's components across time.

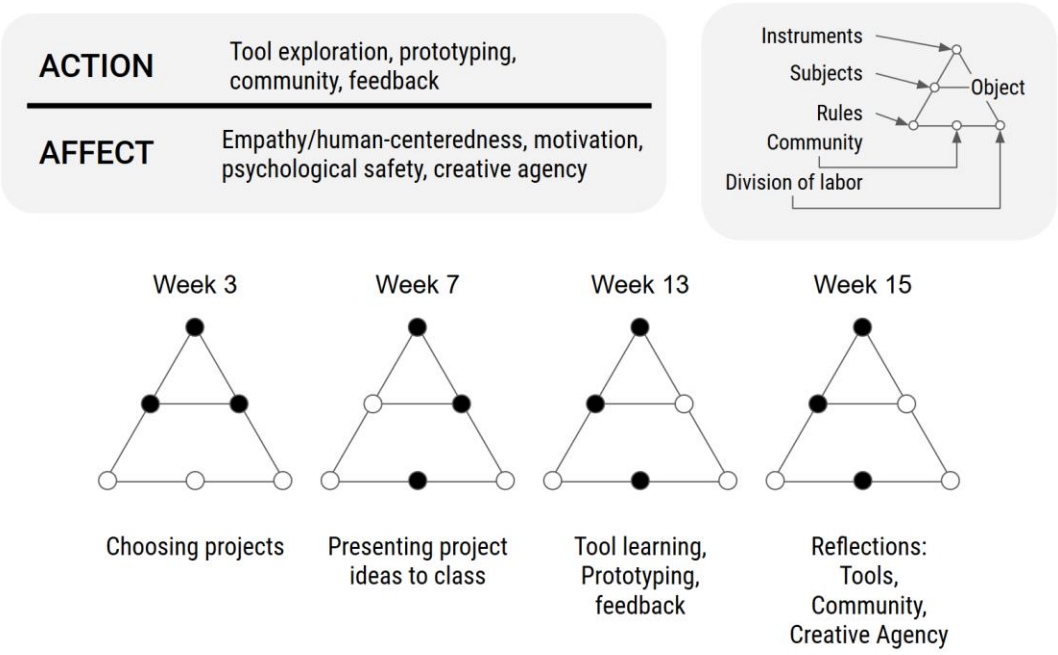

Figure 4. The ratio of action/affect and movement within the activity system

The five main contextual factors that appeared to shape learners' creative design ability were an interrelated cluster of action, affect, and social factors. This triadic cluster seemed to mirror Bandura's (1978) concept of reciprocal determinism.

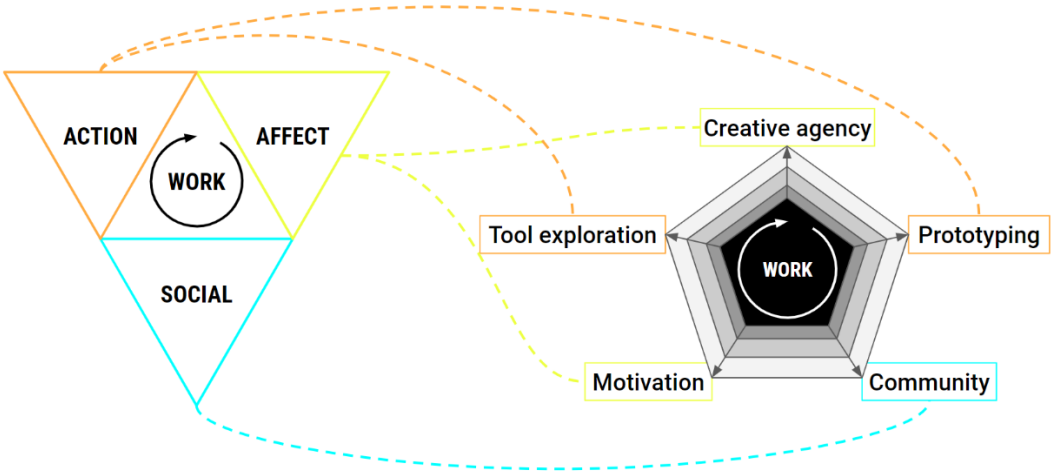

Figure 5. Five contextual factors shaping design creativity and their relation to a triadic reciprocity

Exploring the feelings of participants helps identify what works well in the system and what doesn't. Since identifying contradiction is fundamental to activity system analysis, it makes sense that collecting data around tensions and controversy would help identify contradictions. Exploring participant subjectivities can illuminate various manifestations of contradictions within the activity system and show tensions within the group around specific actions. Focus groups, interviews, and observations are all viable methods for this. A recent development in our field that could be used to reveal the subjectivity within a group is Q methodology (Rieber, 2020.) An advantage of using activity theory as an analytical framework is its openness to various theoretical perspectives and innovative methods.

Finally, here is my representation of the course I studied as an activity system:

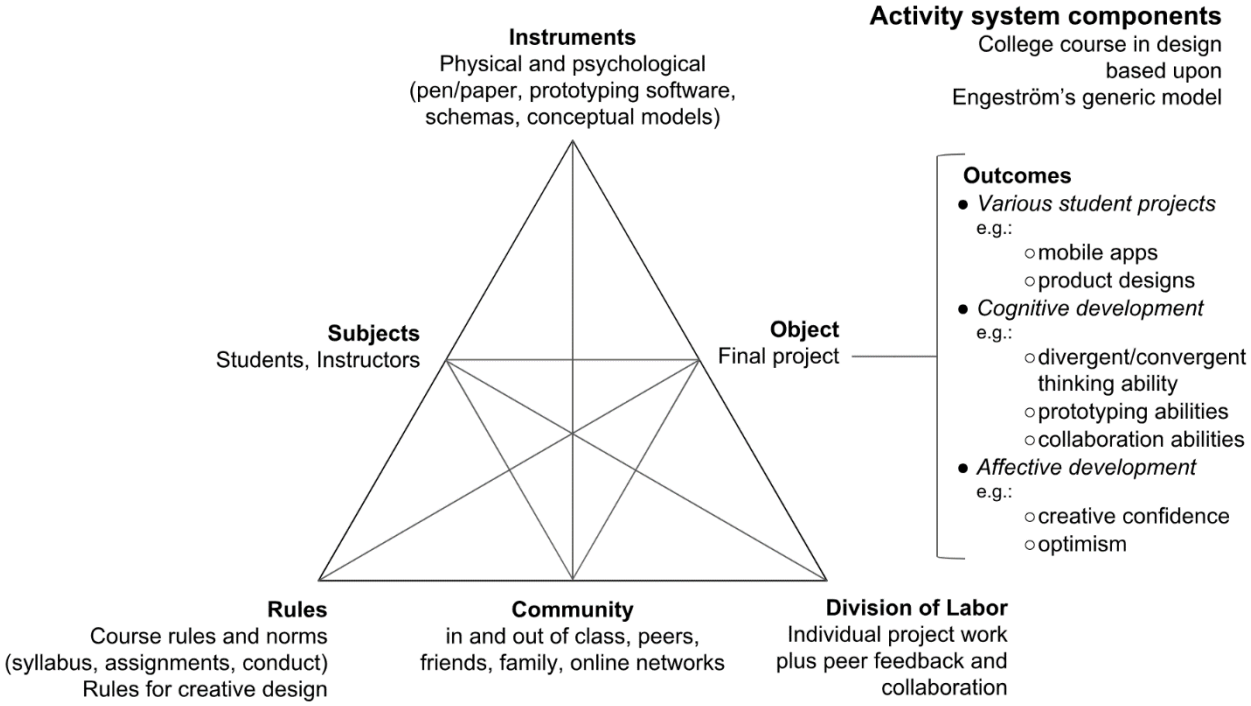

Figure 6. A project-based learning course as an activity system

Try it out

The following exercise is intended to give you a feel for using activity theory as a tool for your research.

Think of an activity that interests you. The only stipulation is that it needs to be substantial enough to occur over a long period—at least several weeks at a minimum.

1. Describe the activity system. Use the worksheet and make short descriptive labels for each of the six main components of activity systems. Resist the urge to elaborate for now. Recall that activity systems are defined by the object/goal of the overall activity.
    a. Subjects: Who are they?
    b. Instruments: What conceptual and practical tools do they use?
    c. Object: What is the goal of the activity?
    d. Rules: What are the cultural norms and explicit rules they follow?
    e. Division of labor: Is the work to accomplish the object shared among participants? If so, how?
    f. Community: Where is the community? How does it interact as it works toward the goal of the activity?
2. Identify potential sources for data for each of the six main components of the activity system.
3. Select the data collection methods for each data source.

Now you have an initial sketch of your research plan.

As you learn about the activity systems and each of its six main components, be on the lookout for the different ways contradictions manifest within and between them. In this way, you may uncover important issues and controversies within the activity system. After significant issues within the system have been identified, they can be used to inform research questions and design initiatives. Additionally, the issues might be packaged for presentation to participants as the start of a formative intervention. These are two

ways that activity theory can be used—as an analytical framework for research or as a design tool for instruction.

Formative interventions – the students' perspectives

This video (Activity theory and formative interventions: https://youtu.be/8U_K4-tF5vI) discusses the course in terms of formative intervention. This section is supplemental to the video and aims to bring the student voices into the expansive cycle. What follows is a (a) summary of the expansive cycle as a formative intervention and (b) participant voices (empirical data) to illustrate the experience within each part of the cycle.

1. The primary contradiction occurs as students are presented with the requirement to conceptualize, design, and deliver a project that is personally meaningful to them.
2. The secondary contradiction occurs as students identify project topics but do not yet know how to transform their ideas into finished projects.
3. The object-motive construction occurs as students learn about, experiment with, and begin to use various concepts and tools to make their abstract ideas concrete (e.g., software, design methods, creativity techniques.)
4. The tertiary contradiction occurs as students begin incorporating the "actions" they have been learning (sketching, presenting, prototyping, creative concepts, design methods, etc.) into new design methodologies within the community's context, or in this case, the newly emerging design collective.
5. The quaternary contradiction occurs when (and if) students continue to use their newly found design methodologies and other outcomes of their experience in new contexts.

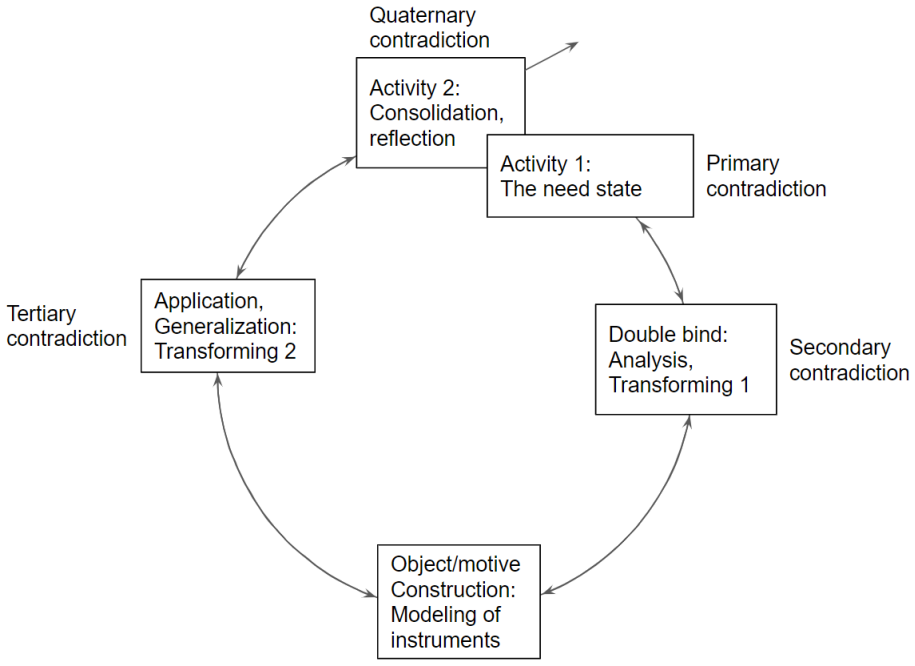

Figure 7. A cycle of expansive trasnformation (Engeström, 2014)

Primary contradiction:

The main challenge I would say that was difficult and important was thinking of a problem we wanted to solve. When you ask a broad generic question like "What kind of problem do you see around you?" it is very confusing on what to think about. Many of the students were afraid to talk because they were not confident in their own thoughts and

> ideas. The idea conception is where the first and hardest challenge came. I believe it is the most important one because it is at this phase, that we decide what to work on for the rest of the semester.

On identifying a personally meaningful project:

> My cousin went through a hard time. I was overwhelmed by like all that. So then that kinda was like fuel for me...that okay...I went through that, like my family went through that, but maybe I can help like...it easier, make it easy on someone else's family.

Secondary contradiction:

> Early in the semester when we were shown a prototype of an application from a student's final project, I was intimidated. I thought that it looked impossible to make and difficult to learn how to use different tools to even begin designing. I was stressed that I could not perform adequately because I am not the best at technology.

Object/motive construction:

"The way I like to do is just kind of play around with it, like pick something that's not so serious, like, and then play around….I'm pretty lucky I have a classmate that's like really fluid and like what he does…having a peer to be like, okay, like this would make it easier if you did this…"

"There's never a wrong idea with [the instructor]." He described how the instructor was open to any idea and if it wasn't "exactly right" he would just try to "shift" it a little. When the instructor heard new ideas from students he would pause, think, and say something like, "Wow, I honestly just never thought of it like that." Michael said his cousin, the Adobe XD online forum, and "those YouTube channels" influenced his project work but reserved his highest praise for the course instructor, "He never makes you feel like you're wrong, which I really like."

Tertiary contradiction – activity 2 – consolidation/reflection

> Just getting like a different perspective and realizing, uh, that everybody's got like great ideas, and you shouldn't let anyone like shut you down or whatever. It's like it was very important, and something [that] is much more applicable than just this class. Like, that goes for like, it's like a life lesson...you got to believe in yourself, you know.
>
> Additionally, talking to my classmates about their methods of prototyping has helped me get a better grasp on the project at hand. For instance, I have had success with the Marvel App after getting help from classmates. With the Marvel app, I now know what I want my app to look like aesthetically, so that is definitely a success!
>
> This class and project have taught me a lot about myself. I do better work when I am pressured, but I have more creative ideas during class when I am relaxed and listening to others talk about their projects.
>
> The biggest thing I'll take away from this project though, is the experience of not being told what to do every step of the way. That was a first for me. The open-ended idea of the project can be very challenging because every single decision about it falls to me. I've definitely grown to like that though. It introduces you to a whole new way of thinking.

I appreciate the time you have taken to review this paper and perhaps the videos I made for this convention. If you have any thoughts, comments, or questions, please do not hesitate to be in touch. I'm very interested in design creativity and project-based learning. I love sharing ideas, collaborating, and discovering new avenues for research.

References

Bandura, A. (1978). The self system in reciprocal determinism. *American Psychologist*, 33(4).

Blizzard, J., Klotz, L., Potvin, G., Hazari, Z., Cribbs, J., & Godwin, A. (2015). Using survey questions to identify and learn more about those who exhibit design thinking traits. *Design Studies*, 38, 92–110. https://doi.org/10.1016/j.destud.2015.02.002

Brown, T. (2008). Design thinking. *Harvard Business Review*, 86(6), 84.

Dorst, K., & Cross, N. (2001). Creativity in the design process: Co-evolution of problem–solution. *Design Studies*, 22(5), 425–437. https://doi.org/10.1016/S0142-694X(01)00009-6

Engeström, Y. (2014). *Learning by expanding* (2nd ed.). Cambridge University Press.

Goslin-Jones, T., & Richards, R. (2018). Mysteries of creative process: Explorations at work and in daily life. In L. Martin & N. Wilson (Eds.), *The Palgrave Handbook of Creativity at Work* (pp. 71–106). Springer International Publishing. https://doi.org/10.1007/978-3-319-77350-6_4

McCalla, L. E. (2019). *Activity, creativity, and design: Modeling and assessing student development in a project-based course* [Ph.D., University of Georgia]. http://search.proquest.com/pqdtglobal/docview/2356062287/abstract/156478DD1C7E41E7PQ/8

Rieber, L. P. (2020). Q methodology in learning, design, and technology: An introduction. *Educational Technology Research and Development*, 68(5), 2529–2549. https://doi.org/10.1007/s11423-020-09777-2

Smagorinsky, P. (2011). Vygotsky's stage theory: The psychology of art and the actor under the direction of perezhivanie. *Mind, Culture, and Activity*, 18(4), 319–341. https://doi.org/10.1080/10749039.2010.518300