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Book Reviews

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BOOK REVIEWS

Constructionism in Practice: Designing, Thinking, and Learning in a Digital World, by Y. Kafai and M. Resnick (eds.), Mahwah, NJ: Lawrence Erlbaum Associates, 1996. xii+339pp.

Reviewed by: Eugene Matusov, University of Delaware

The fourteen-chapter book *Constructionism in Practice: Designing, Thinking, and Learning in a Digital World* is about developing learning environments for children. It is also a report about the latest conceptual developments and practical achievements in the theory and research of **constructionism** and the LOGO project, a programming language for children aimed to promote discovery learning. One of the book's major themes is to develop the argument of why **constructivism**, which branched out from Piaget's theory, should be amended with **constructionism**, the theory emphasizing the role of designing artifacts and social interaction in the process of discovery learning. The book is divided into four parts: *Perspectives in Constructionism*, *Learning through Design*, *Learning in Communities*, and *Learning about Systems*. Each part has three to four chapters. In this review, I will "walk" the reader through the chapters and then discuss the book as a whole.

Perspectives in Constructionism

The first part emphasizes that successful learning occurs when a web of meaning between new content and a learner's life is built. The authors of the three chapters in this part argue that activities and projects should be personally meaningful for the learner. Although this emphasis is not new in developmental psychology and can be found in the classic work of Vygotsky and Piaget, unfortunately it still remains often neglected in both developmental psychology and educational practice.

In his chapter "A word for learning," Seymour **Papert** notes that a lot of psychological and educational theories are focused on teaching and not on **learning**. His arguments echo Lave's concerns (1996) that learning does not necessarily require teaching. **Papert** illustrates his point with a personal example of how he overcame his difficulty in remembering names of flowers. This example reflects

how his learning was both a conscious and deliberate process as well as an uncontrolled emergent process to build a web of meaning. However, one of the striking aspects of **Papert's** example that, unfortunately, was left out of his analysis, is the social nature of his experience. Yet, **Papert** mentions how he developed a strategy to meaningfully contribute to conversations about flowers, albeit without a clear understanding of which flowers people were talking about, without revealing his own ignorance.

Papert also emphasizes the role of artifacts in learning and the diversity of ways of learning. He illustrates these points with an example of a boy whose teacher forbade him to use his fingers for counting and who, consequently, developed a "counting disability" in school (solved when **Papert** suggested to the boy that he use his teeth for counting). This use of tools (i.e., teeth) was undetected by the teacher who insisted on only one legitimate way of counting—counting in one's mind without using tools. These examples, along with **Papert's** analysis, contribute to the ongoing discussion of how newcomers join a community of practice and about legitimizing learner's strategies in the eyes of oldtimers (Lave & Wenger, 1991).

Edith Ackermann's chapter, "Perspective-taking and object construction" revisits Piaget's notion of perspective taking and egocentrism. She makes several interesting conceptual points. First, Ackermann reveals a connection between Piaget's notion of egocentrism and recent ideas about situated cognition (see Lave, 1988). She argues that a child thinking from his/her own position of "here and now" is not always inept. Rather, such thinking reflects an important aspect of human experience that integrates the actor with the situation. Similarly, switching perspectives to the universal "God's perspective" and separating from one's experience is not always more advanced. Ackermann argues that children, in principle, are capable of "diving in" or "stepping out" at any age, but sometimes have difficulties doing it in specific situations, such as those used in classic Piagetian experiments. She suggests that there is a complementary relationship between relating and separating from the situation. From a situated cognition point of view, it would be interesting to investigate how children make sense of a situation in which an adult asks "strange" questions, as well as the sociocultural meaning attached to the "correct" answers expected in mainstream middle-class Western culture.

The last chapter of this part is "Elementary children's images of science" by Aaron Brandes. He describes three studies that investigate the image of science held by elementary school children and their attitude toward science. Like some researchers before him, Brandes discovered that children's excitement and interest in science fade out with time spent in school, although their ideas about science become more sophisticated and accurate. Brandes' analysis reveals that the ways science is taught in school defuse connections between children's lives and scientific practice. As the author shows, many children do not see themselves as participants in science making, even if they have many questions about a

variety of scientific phenomena. Rather, they have **difficulty** identifying themselves with the dominant image of a scientist as a white male working alone. Moreover, teachers often do little to encourage children to think of their inquiries as legitimate scientific practice. Instead, science is perceived by children as a collection of “correct” facts and theories about scientific phenomena that have nothing to do with people’s interests. Brandes argues that images of science are both a reflection of and tools for children’s understanding and engagement in the scientific practice. This theme of an active connection between personal inquiries and the learning subject becomes central in the book’s next section.

Learning through Design

Kafai and Resnick claim in the book’s introduction that “Constructionist theory goes beyond Piaget’s constructivism in its emphasis on artifacts, asserting that meaning-construction happens particularly well when learners **are** engaged in building external and sharable artifacts” (p. 4) or, in other terms, learning through design. This approach is very different from the traditional emphasis on problem solving because, unlike problem solving set up by the teacher, designing involves development of goals and problems themselves. The problem comes not from the teacher or powerful expert but from the learner him- or herself. Problem defining and goal development become a part of the learning curriculum together with problem solving in learning through design.

In chapter four, “Learning by making games,” Yasmin Kafai describes sixteen fourth graders (8 boys and 8 girls) working on the development of educational video games using LOGO language for six months in school. Kafai analyzes the different ways in which children organized their planning—planning ahead versus planning in action, “bottom up” versus “top down” approaches, and extrinsic versus intrinsic learning curriculum—in creating the microworlds of the games. **The** author found that there were no clear boundaries between different ways of planning and individual designers. Instead of treating ways of planning as personality traits, the author suggests treating them as phases and aspects of the activity **processes**.

In the fifth chapter, “Electronic play worlds: Gender differences in children’s construction of video games,” Kafai investigates why video games are less popular among girls than among boys. The findings show that the games designed by boys were much more violent in nature than the games designed by girls. For example, five out of eight games designed by boys involved the theme of evil, while none of the games designed by girls had this theme. In general, boys preferred adventure genres while girls used more “everyday** activities for their genres (e.g., skiing, classroom activities). Moreover, girls typically provided players with opportunities to creatively manipulate the game actors while boys designed games with pre-defined player-game interactions. These findings are important for educators and game designers if they want to develop video games

that appeal to girls. Also, investigating gender differences by using a “learning through design” methodology seems to be a promising research approach.

In the chapter “The art of design,” Greg Gargarian considers such issues as the role of tools, design complexity, user utility, and differences in environment and artifact design in designing computer-based microworlds. This chapter develops conceptual tools for analyzing the design process, an open and emergent process, and illustrates the use of these tools by reporting research on the use of the LOGO programming language to design textile patterns. The author argues that during the design process there is not only a transformation of the object of activity (e.g., developing and using tools), but also a transformation of the actor him or herself, in Gargarian’s terms, in the “design persona.” The design persona changes through the design process and so, consequently, do the products of the designer’s activity because his/her perceptions, motivations, and goals are changing. The author also argues that the design process is always social because it involves explicit or implicit (e.g., via anticipation) negotiation between the designer and the user, who participates in both in shaping the design and the design persona. Gargarian illustrates this interaction by describing how his textile design came to life as a result of his negotiation with a textile practitioner (i.e., a person who is interested in developing new textile patterns). This social **contortionism** is central to the “microworld design by learning communities,” which is the focus of the third part of the book (see next heading “Learning in Communities”).

The second part ends with chapter seven, “Building and learning with programmable bricks.” Here, Randy Sargent, **Mitchel** Resnick, Fred Martin, and Brian Silverman describe the **LEGO/LOGO** construction kit that involves programmable **LEGO** pieces, and their educational use. The authors argue that the Programmable Bricks involve designers at multiple levels, for example, in considering different input-output modalities (such as motors, lights, beepers, different sensors, and infrared transmitters), parallel processes, and interactions between designed objects (e.g., “colonies” of interacting creatures). They argue that the **LEGO/LOGO** construction kit allows children to expand their learning of real-world physical objects, which makes designing more relevant and meaningful for them.

Learning in Communities

In the third part of *the* book, *Learning in Communities*, the authors argue that learning occurs in a community rather than just in an individual. This part starts with chapter eight, “Social **constructionism** and the inner city: Designing environments for social development and urban renewal” by Alan Shaw. Shaw presents the case of a “proximal community,” a geographic neighborhood (in inner-city Boston), in which he used computer networking to try to get the community engaged in discussing issues and organizing community activities. He describes

both achievements and difficulties that he had when he tried to engage at-risk youth in providing paid services to the neighborhood community. Shaw demonstrates that the tools (e.g., the computer network) and activities' contributes not only to the development of individuals but to the development of the entire community.

One of the questions that emerges from Shaw's chapter is whether the community development process can be described in terms of "design." It seems to me that the difficulties that Shaw faced in organizing economic activities for the community's youth cannot be explained solely by the lack of supervising adults, as Shaw suggests, but also by the overall lack of attention to the ecology and history of the open system that any community represents. It is a very interesting conceptual, empirical, and practical question of how "designers" or "missionaries" who come to fix community problems can achieve positive long-term effects without abandoning their "designer/missionary" role. I think that Shaw's notion of "social constructionism" is a very important and promising development, both practically and theoretically, in the constructionism tradition.

In chapter nine, "The **MediaMOO** project: **Constructionism** and professional community," Amy Bruckman and **Mitchel** Resnick describe a networked **virtual**-reality text-based environment that has been used to promote discussions of real life and real research interests among (mainly) scientists around the world. The participants of the project have opportunities not only to communicate with each other but also to design a virtual world that facilitates this communication. Observing the participants' construction in the **MediaMOO** project, the authors conclude that the community created by the project promotes motivation for learning, provides emotional support to overcome technophobia, and an appreciative audience for the completed work. In the world of telecommunications where the structure of communication is often fully controlled by the designers of the media (who often **are** not participants in the communication), the interesting question arises as to how important it is for the participants to share this control and creativity. Bruckman and Resnick's chapter initiates a discussion and investigation of this question.

Chapter ten, "A community of designers: Learning through exchanging questions and answers," by **Michele** Evard, is focused on how a computer-based network allowed elementary school children to share ideas between a class where children were working on designing video games and another class where children, who had already designed games, were acting as consultants on the network. Evard reports evidence of the emergence of a recursive discourse of questions and answers in the community. She also describes the development of rules and norms in the new community of game designers and consultants (e.g., it became inappropriate to reply to a designer's question with "I don't know" because it was not helpful and overloaded the network). However, it was unclear in this chapter what the processes were through which this development became

possible. The ecology and history of the community as well as the role of adults were not described.

A brief chapter by Paula Hooper, "They have their own thoughts: A story of constructionist learning in an alternative African-centered community school," describes a school that attempts to create an educational setting that promotes and values African-American traditions of knowing, interacting, and acting. Hooper describes an eight-year-old girl working on designing a rainbow with the use of the LOGO language and assisted by the teacher. The chapter highlights the diversity of learning experiences that is molded by computer technology, traditional culture, sensitive guidance, and children's creativity.

Learning about Systems

The last section of the book, *Learning about Systems*, argues that the tools that people use for their thinking (e.g., computer programming language) often shape people's own thinking. For example, in chapter twelve, "New paradigms for computing, new paradigms for thinking," **Mitchel** Resnick argues that traditional programming languages based on sequential text-based programming not only limit possibilities for programming design, but also encourage designers to hold "centralized" worldviews (i.e., an assumption that any phenomena is shaped by one locus of control). He illustrates many difficulties that these designers faced with moving to new programming tools involving object-oriented programming and parallelism. This analysis reminds me of Gargarian's notion of the "designer persona" that is both a precondition and a by-product of the design process. Resnick's research using a parallel-programming language, **StarLOGO**, that he designed to help students to explore self-organizing systems like bird flocks, traffic jams, and market economies, contributes to our understanding of the relationship between tools which mediate cognition and people's world views.

In Chapter 13, "Making sense of probability through paradox and programming: A case study in a connected mathematics framework,*" Uri Wilensky demonstrates how a parallel-programming, such as **StarLOGO**, can help students understand probability as a concept that is constructed through negotiation. For example, he provided students with a probability problem for which there are several legitimate solutions, depending on how one chooses to define the concept "evenly distributed." The students used **StarLOGO** to develop several models of this probability concept. In turn, these models served to foster a conversation regarding the possibility of having different definitions of probability. Wilensky argues that in this way parallel-programming simulations can promote understanding complex ideas, such as probability, as the product of construction and negotiation with respect to specific tasks, rather than non-problematic "givens."

Finally, the last chapter, "Ideal and real systems: A study of notions of control in undergraduates who design robots," by Fred Martin, describes students' thinking about systems in the real physical environment during a robot-design

competition that he organized for MIT undergraduates. He analyzes some difficulties that the students faced in developing strategies for controlling the robots. Martin demonstrates that often such problems originated in the students' tendencies to create robots that worked properly under some ideal conditions and not in the "messy" world of the **real** physical environment. Martin suggests revising engineer education in such a way that it will guide students and future engineers to design strategies that suit real-world technological systems.

Conclusions

After reading the book, I have the feeling that constructionism is another important and useful spring in the river of a **sociocultural** (and historical) approach, which includes (among others) activity theory, situated and distributed cognition, theory of community of practices, theory of mediated action, and discourse analysis. Emphases on activity, design, goal, artifact, tool, designer persona, social interaction, social construction, and learning community are important hallmarks of a **sociocultural** approach. Without a doubt, the conceptual, empirical, and practical traditions of constructionism contribute to defining and deepening these notions. Throughout the book a reader can **find** references to different branches of a **sociocultural** approach that the authors see as their conceptual and methodological allies. I believe this alliance can enrich the work of any researcher working within a broadly defined sociocultural approach.

However, it seems to me that what is lacking in this book is the recognition of a **sociocultural** approach that enriches constructionist research by allowing researchers to focus on the ecology and history of their projects, as well as on themselves as participants and stakeholders (i.e., their own pragmatic interests, such as, academic publications, getting more grants, recognition by other scholars, satisfying their own inquiries and ambitions, and so on). Students involved in the numerous projects presented in this book are often described almost as objects and artifacts of the researchers' designs, rather than as co-participants in the projects. With the exception of Gargarian's chapter, there were no descriptions of how the purpose of each project was negotiated with the student participants. For example, how students' designs and projects fit their lives, and the lives of the communities they participated in, were often not described. I think that this neglect of the ecology and history of the designs may be caused by legacy of the constructivist conceptual tradition that focuses researchers only on what occurs "here and now" and not on the bigger contextual frames that transcend an immediate activity or interaction. I expect that the focus on global contexts will be the next exciting turn in development of constructionism.

Notwithstanding the above concern, the very broad spectrum of the discussed issues guarantees that this book will be useful and informative for a broad audience of social scientists, educators, and programming designers, as well as all

who are interested in designing learning environments **that** promote creativity, motivation, sense of community, and agency in the participants. Although it may be overloaded in some places with technical descriptions, in my personal taste, it is easy and fun to read.

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DR. SHARON CARVER

Children's School
Carnegie Mellon University
MMC 17
Pittsburgh, PA 15213
(412) 268-1499
FAX: 4 1 z-268-5060
e-mail: sc0e+@andrew.cmu.edu

DR. DAVID PENNER

Department of Educational Psychology
University of Wisconsin-Madison
1025 West Johnson Street
Madison, WI 53706
(608) 265-4602
FAX: 608-262-0843
e-mail: dpenner@macc.wisc.edu