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# “It’s Just that Visceral”: Eliciting Design Insight Using Beaded Representations of Online Course Structure

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**Abstract**

We explore an unconventional format for representing the structure of online courses—beaded representations. We used this format as a mediational tool to engage a design team in reflective discussion about the design of its courses. We discuss challenges associated with the design of “massive open online courses” (MOOCs) and position beaded representations within the context of human-computer interaction (HCI) literature on materiality, novel representational forms, and the use of boundary objects to support design teams. We describe the outcomes of a focus group session with design team members mediated by the beaded representations, which include: (1) discovery of curricular connections, (2) understanding of learner experience, (3) insights about the design process, and (4) reflection on the method.

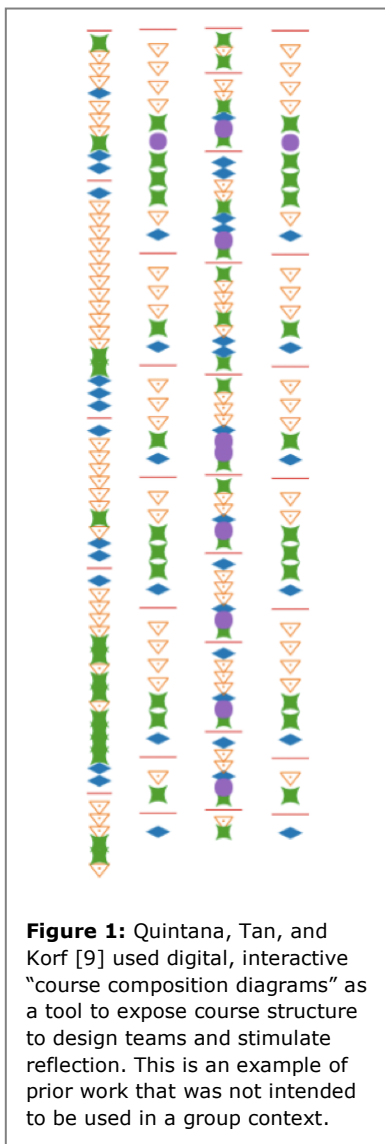
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Design representations; materiality; design teams; boundary objects; learning at scale

**ACM Classification Keywords**

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## Introduction and Motivation

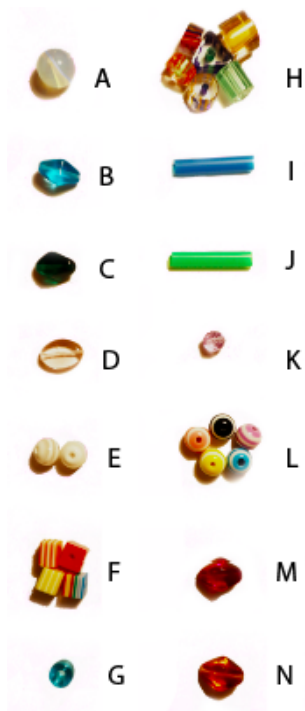
With MOOCs becoming increasingly recognized as a legitimate setting for learning, more attention is being paid to the quality of their design [7]. Margaryan, Bianco, and Littlejohn [7] argue that a course’s instructional design quality is a “critical indicator and prerequisite for effective learning” (p. 78). Design researchers also acknowledge that MOOCs can be structurally complex, because they contain a wide range of activities and resources that can be arranged in various sequences [9,10]. Developing such courses draws on the field of “learning design”, which considers how learning activities (i.e., tasks that learners engage in to achieve a set of outcomes) can be codified and made available to design teams for review and critique in the form of *design representations* [3].

One issue for learning design teams is the difficulty in grasping the overall course structure without a mediational tool or aid [1]. Previous work has examined a variety of formats that bring into focus particular pedagogical dimensions (e.g., “swim-lanes,” which are useful for representing curriculum at the activity level during the course design phase) [4]. However, prior work has mostly relied on two-dimensional or digital representations that may be less effective for supporting design team interaction and shared reflection in a group setting. Here we investigate the use of an unconventional form of design representation—*beaded representations*—that draws on HCI notions of *materiality* [5]. The aim of our study is to understand the potential value of beaded representations for design teams, with the goal of illuminating the qualities of material representations that make them advantageous for supporting group interaction, communication, and active reflection.

## Literature review

Diagrammatic or iconic representations of curricula are valuable because they provide a holistic design view to highlight the relationships among learning activities and give viewers a sense of flow and movement [3, 9]. MOOC researchers have made some initial forays into creating design representations of MOOC curricula, such as Powers’ [11] use of tree diagrams to represent MOOC structure to enable students’ self-regulation. Other MOOC researchers have used iconic representations of course elements (e.g., videos, textual readings) to promote understanding of relationships among course elements for designers [9, 10]. See Figure 1 for an example.

We position beaded representations in the tradition of “HCI and/as craft” [5] because we want to foreground the notion that traditional materials can be used as a medium for communication and expression. HCI researchers have investigated *materiality* as a factor for meaning-making in a variety of contexts. In their study of tabletop board games culture, Rogerson, Gibbs, and Smith [9] surface two main aspects of materiality that players cherish; that it: (1) enables social interaction, and (2) allows players to understand core game mechanics and strategies [9]. Some HCI researchers have explored materiality using design probes in their research of social phenomena [e.g., 4]. Gaver, Boucher, Pennington, and Walker [7] explain that these *novel representational forms* provoke uncertainty, play, and exploration. They suggest that their approach could be expanded to include new methodologies that would “encourage subjective engagement, empathetic interpretation, and a pervasive sense of uncertainty” [4] (p. 56). Other HCI writers have investigated materiality through *boundary objects to support design*



**Figure 2:** Each bead or craft element represents a particular type of course element. A: section heading; B: 10-minute lecture video; C: 10-minute interview video; D: textual guide; E: reflection activity; F: reading provided by instructor; G: external resources; H: sub-heading; I: lecture video longer than 10 minutes; J: interview video longer than 10 minutes; K: visual guide; L: discussion forum; M: team work activity; N: quiz

*teams*. Arias, Eden, and Fischer [1] explicate the mediational potential of material objects in conversations amongst urban planners, framing them as “boundary objects” [1], which can serve to externalize ideas, facilitate shared understandings, and bridge conceptual gaps [1]. Arias et al. [1] elaborate on the strengths of physical media as a means of “focusing the conversation and [being] a conduit for emphasis, feeling, and conviction” (p.4).

### Method of Study

We created visualizations, using beaded representations, of the course structure of the five MOOCs that were part of a MicroMasters™ program being produced by a leading public university’s school of education. Hosted on the edX platform, this MicroMasters™ program is designed to provide learners with a credential that can be used as course credit, provided the learner is accepted into the university’s residential Master’s program.

### Materials and artifact creation

Following the MOOC design phase, we used traditional craft materials (e.g., transparent, translucent, and opaque beads, and colorful drinking straws) to represent individual elements of each course, stringing them together in chronological order. Each course element (e.g., video, reading, activity) corresponded to a “type” of material, (e.g., “readings” were depicted using striped opaque beads—the stripes were intended to suggest lines of text on a page—and assessments were depicted using transparent red beads). Some elements were differentiated using size and shape. Figure 2 shows an abbreviated key. Because the edX user interface uses a nested structure, with course elements organized in sections and subsections, we

depicted each subsection as an individual beaded string. Participants could comprehend the hierarchical structure of the course by viewing the first string of beads, followed by the next string beneath it, etc. The courses we depicted were not entirely linear, and where learners could make choices about where to proceed next, we created a branching structure in the representation by crimping shorter lengths of string and attaching them to the stem (see Figure 3).

### Design questions

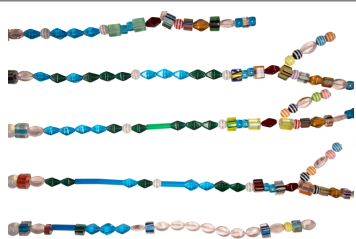
1. How can beaded representations of online course structure lead to insights that could impact learner experience?
2. What might be the value of eliciting insight among design team members?

### Participants

Study participants were core members of the design team that developed the MicroMasters™ series: the lead designer and course instructor (also a full-time professor at the University), a graduate student (co-designer), a MicroMasters™ program manager, a project manager, a learning experience designer, an iteration manager, a media specialist, and a lab director. The focus group session was facilitated by two design researchers from the university unit that supported the course development.

### Focus group session design

Participants were led through an informal discussion that was loosely structured along the following dimensions: (1) What do beaded representations reveal or obscure about the course structure? (2) What is your reaction to viewing the structure of online courses that you are familiar with, in an unconventional medium?



**Figure 3:** The hierarchical structure of a section of a course is evident through the beaded representation. Each string depicts a subunit (an activity sequence that could include elements such as short and long videos, discussion forums, teamwork, and assessments). The opportunity for learner choice is evident in the branching structure of the beaded representation.

The conversation was situated in the context of the beaded representations. See Figure 4 for a description of the focus group session setup.

#### *Data collection and approach to analysis*

We transcribed an audio recording of the one hour focus group session and used a qualitative approach to analyze the transcript [2]. We (1) read the transcript multiple times, (2) extracted meaningful units of text (excerpts), (3) grouped excerpts to form themes, (4) and worked through an iterative process to ensure consistency and eliminate redundancy. We invited participants to provide feedback on the transcript.

### **Results**

Eight themes emerged from our qualitative analysis, which we combined into four overarching ideas.

#### *Idea 1: Discovery of curricular connections*

Participants made discoveries related to course architecture. They observed a pattern where more passive modes of content delivery appeared at the start of a subunit (e.g., videos and readings) and more active modes of interaction appeared at the end of the subunit (e.g., team projects). Participants realized that they had replicated this particular pattern structure multiple times, making the importance of “getting it right” even more salient. Comments related to how the beads showed relationships among course elements, describing concepts such as pattern and variety: *“Like this gives you the sequence. Strung together they would be very colorful and varied. I mean one thing that gets me is that the variety comes at the end.”*

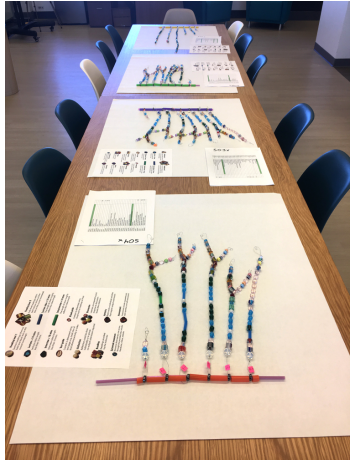
Another set of curricular connections related to pedagogical approaches. Participants reflected how

they had mirrored instructional approaches found in elementary school classrooms where learners are supported to be good learners by standardizing their roles across classes, e.g., by portraying expectations of how learners should behave, interact, and work. The graduate student co-designer looked for the pedagogical structure that she expected to see reflected in the beaded representation—the “Self-directed/Community-supported” approach, which the design team had developed during the creation of this course series. *“It’s directed up front and then you get to the end and it’s ‘community’.”* The lead designer reflected on this pedagogical design, remembering that they had sought to mirror “co-operative learning” approaches that included direct instruction, team practice, and individual accountability.

#### *Idea 2: Understanding of learner experience*

Excerpts we labelled “learner point of view” showed that beads helped participants reflect on how learners might experience courses. Participants speculated on whether learning activity sequence structure and predictability might help make learners feel more at ease by (1) presenting passive modes of instruction before interactive modes, and (2) setting expectations of “what comes next.” The learning experience designer further acknowledged that learners might be kept engaged by introducing variety into the sequences.

The beads helped participants recognize that the course structure could allow for different modes of engagement, or learner strategies, with “audit” learners only paying attention to the more passive modes of content delivery: *“All the heavier stuff is at the back; I mean, you see it more clearly.”* The branching structure of the beaded representations reminded participants



**Figure 4:** The setup for the focus group session with our participants. The beaded representations for each of the five MicroMasters™ courses was displayed against a piece of white butcher block paper. Participants had access to the visual key that explained the relationship between each type of material (e.g., bead or straw) and a particular course element (e.g., reading). For additional support, participants were also provided with a textual outline that listed all course elements in chronological order.

that the learners have choices about which way they want to go, allowing for flexibility. Finally, participants considered the value of showing learners a visual representation at the start of each course: *"I was wondering if, as a learner, there was any advantage to seeing this up front to say, 'Hey! This is how the course is going to unfold.'"*

#### *Idea 3: Insights about the design process*

The beads stimulated discussion on aspects of the design and production phases, including challenges of dealing with a non-linear process where production decisions had to be made before the curriculum design was fully known. Participants explained how they created their pedagogical pattern from scratch, and how it would be interesting to see visual representations of learning activity sequences at the start of the design process (i.e., a menu of options).

Participants also reflected on the unique aspects of online education. In particular, they reflected on how during the design phase, they needed to take learner autonomy and agency into account when creating the curriculum. The teacher's ability to orchestrate the flow of instruction is diminished in an online environment with less control over "when" and "what": *"You also create a lot more opportunities for there to be mismatches between where people are in the process."*

#### *Idea 4: Reflection on the method*

During the focus group session (Figure 4), participants reflected on when there were mismatches between what they recalled and what they saw in front of them, with the beaded representations causing them to examine their recollections and what they were seeing more closely: *"What the beads are doing is driving me*

*to think and rethink."* We labelled this theme reconceptualization of courses.

Finally, participants spent time discussing the impact of the beaded representations themselves. They identified the different kinds of reflections that the beaded representations evoked: (1) conversations about "flow," (2) awareness of elements they expected to see (e.g., assessments), and ones they did not expect to see because they are supplementary to the course (e.g., a companion study guide), and (3) discussion of the production dimension (i.e., process for creating the beaded representations). The group noted that the white paper could be annotated with information such as rationale for design decisions. The lead designer also reflected on the material dimension of the beaded representations and how he found their visual qualities to be compelling and thought provoking: *"These things, I mean it may sound silly, but a little more color up here would be nice. I mean, I don't know why that would be better. But, it's just that visceral."*

## **Discussion**

As with prior work in learning design [3, 9], the beaded representations provided a "bird's eye view" of course structure, allowing participants to make connections among elements, and to notice aspects such as pattern and variety. What is new is that this work sought to use traditional craft materials to create unconventional design representations of online course structure. Our analysis revealed that participants could articulate a nuanced understanding of course structure, similar to the board game players in [6], who described a deep understanding of core game mechanics and strategies after interacting with the physical components of the game. Our aim was to introduce beaded

representations as a mediational artifact to support reflection and provoke design insight [1]. These beaded representations acted as boundary objects [1], facilitating shared understanding among design team members and potentially bridging conceptual gaps between their thinking and the course design. We were also inspired by HCI work on design probes [4], and desired to use materials that would introduce an element of playfulness and intrigue into our participants' experience—the lead designers' remarks about the "visceral" nature of these representations underscores how they had the desired effect. This work demonstrates that learning design could benefit from alternative formats and materials by drawing on HCI notions of materiality to support communication, expression, and social interaction. We plan to address validity concerns by conducting a follow-up study that compares the efficacy of using material and non-physical representations.

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