The eLearning Coach Podcast: ELC 054
Do learners understand your instructional graphics?
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Connie: Welcome to the eLearning Coach podcast online at the elearningcoach.com. I'm Connie Malamed bringing you ideas, tips, and best practices for success in creating effective learning experiences. Hello learning people, and welcome to Episode 54 of the eLearning Coach podcast. Are we all a little over-confident about the graphics we use to promote learning? Today's guest, Elizabeth Boling, has done research the demonstrates we are. We assume that people can understand our intent in the instructional graphics that we or others produce. Elizabeth Boling has done a lot of thinking and research in this area. She is a professor of instructional systems technology in the School of Education at Indiana University.

Connie: Her resume includes 10 years of design practice, five of which were at Apple. She was editor-in chief at Tech Trends and is the founding editor and current editor-in-chief of International Journal of Designs for Learning. You can find the show notes and a transcript at the elearningcoach.com/podcasts/54. Here's our conversation. Hi Elizabeth, welcome to the eLearning Podcast.

Elizabeth: Hi there.

Connie: I would love to start with some conversation about your research. That was the first way I got introduced to you. The point of your research is that there can be a great discrepancy, and correct me if I'm wrong, between the intended meaning of an illustration, and the meaning interpreted by the learner. Can you talk about that research and what you found?

Elizabeth: Sure. At that time, I was especially interested in the little extra bits that we put into pictures. You might think of them as some of the same kinds of things that show up in comic strips. They're an augmentation of the meaning. So it's not just a picture of a guy, but he's got a little like curly sign above his head, showing that he's frustrated, something like that. Down to the arrows that we put into diagrams that are supposed to convey something that is not just a picture of something. We call those. We had a name for them.

Connie: Well, I always think of them as graphical devices.

Elizabeth: No, I think that's fine. We might have called that visual elements, but that's even more vague. At any rate, I was working with at least one of my co-authors, who was doing her dissertation work at the time with deaf and hard-of-hearing students in an environment where educators make the assumption very often; that if you show a picture, people

will understand what you mean. I was really looking at the same question in a kind of broader context. We put together, from her experiential knowledge, a subset of the kinds of images that represented frequent moves in instructional illustration, something with an arrow, something explaining the picture in half, these kinds of things, and took our little set around to a number of populations and ask them a very simple question, which is basically, what does this picture mean?

Elizabeth: We had kids who were young enough that someone else had to write it down for them. We had adults. We had a whole variety of people. Essentially, what we were able to show was that the one image that had what I usually call the not sign, the circle with the slash cross-it, this had one of the highest rates of agreement between what we had intended and what somebody put down as the meaning of that picture. It was only at around 60%, if I recall correctly. Maybe a little higher than that. But essentially, I'm not good enough especially for a visual element like that, many of us just assume as ubiquitous and clearly understood by everyone. This was not just that our population in Taiwan didn't get it, and the ones in the US did get it. It was just, what I would characterize as, a disappointing showing for a mode of communication that a lot of people presume is going to be effortless.

Elizabeth: Now, just today, I was talking to a colleague and looking back up at some of the work on multimodal communication, modern visual literacy. This is very consistent with what other scholars are saying as well. People have to decode or at least they have to have reached a point of widespread social understanding about what something means. But then, they also have to consider the environment that they see it in.

Connie: Mm-hmm (affirmative), context.

Elizabeth: Exactly, what's on their minds at the time, what role do they think they're playing right now. We noticed some of that even in this study, which was fairly simply constructed. A number of people played with the pictures and gave them because it wasn't in the context of a lesson. They saw themselves as just a guy or a gal looking at a picture rather than, "I'm a student in a class."

Connie: Well, a couple things surprise me. First, that the adults wouldn't know what the graphical devices meant, because ... I mean I guess it could depend on the person's age, but people who have read comics or graphic novels would often know what those graphical devices are. The other thing is that adults failing to understand arrows. In terms of visual literacy, the arrow was the symbol that everyone understood.

Elizabeth: I don't think it's a matter of not understanding that it's an arrow or even that the purpose of the arrow is to point out a direction. In any particular context, there's a

reason that you are showing me the arrow. That's why one of the later studies that I shared with you was instructional designers' intention and the learners' perception. I put it there because I wanted you to look that direction, where the interpretation of not that it is an arrow, or even that is pointing to the right but why did you show it to me? It's a very different question than, do I recognize what it is?

Connie: You're right. Can you talk a little bit about the later studies?

Elizabeth: I'll talk about the one. There's a study I did with two of my students at the time, Colin Gray and Micah Modell. We showed images in the context of language learning activities to two groups; Arabic speakers who were learning English, and English speakers who were learning Arabic. They had some of the similar kinds of elements in them. Although, in this case, that was also a question of cultural appropriateness. We started out looking for that, but we ended up recognizing that when people were talking to each other, making decisions about which picture was the right picture to answer certain questions, they were using not only so much more than the content of the image, but in some cases, not particularly using the content of the image at all. A number of the things that we've done as visual designers with a particular intention, it wasn't even that the intention was not apprehended, but that it just didn't register.

Connie: Interesting. Essentially, what you're saying is that oftentimes the learner doesn't understand the symbol or may not understand why it was even put there. They may know the symbol, but they don't understand the meaning. Is that what you're saying within that context?

Elizabeth: Yeah, they're not sure which meaning they should bring out of any repertoire they may have to match whatever meaning they think that I might have had. I'm going to just say, in general, in information design, there is some work showing that people who are looking at visual materials for the purpose of educating them or informing them, it is actually pretty close to the surface of their cognition that someone else made this and they make assumptions about who made it. That helps them try to think about what they were intended to get out of it.

Connie: That's interesting. For example, let's say there's an arrow and an illustration. Whereas, the designer might be thinking, "This is the most important aspect of this information graphic for this diagram." Someone else might be thinking, "Oh, I'm supposed to turn the page," or, "I'm supposed to be looking at the other graphic on the next slide or over here." Is that the thing that happens?

Elizabeth: Yeah. Or this thing in this picture is connected to that other thing.

Connie: That really makes you think you should be using text more often with your graphics.

Elizabeth: Way back when probably in the 90s, I did some work on literally the arrows, the forward and backward arrows that people were using in digital tutorials at the time. Then they would go on screen forward, go one screen back, and then they'd be the double arrows. We found in that study was people could interpret go forward one, go backward one, but they get really mushy on what does double arrow mean.

Connie: That's true. If you're not really into diagrams, you don't grow up seeing double arrows.

Elizabeth: Mm-hmm (affirmative). There is a mismatch. In that older study, what we discovered was that if we use text to augment the visual, to augment the arrow, then we could disambiguate for people. Because text job often is to disambiguate and the job of an image is to be open to interpretation.

Connie: But not instructional graphics, art is. But would you not say that with instructional graphics, we're trying to be as specific as words even if we don't achieve it?

Elizabeth: We are, and yet, if we're trying to make certain kinds of images as specific as words, we're probably using their own mode. We're trying to force an image to do something that is not going to be good at. You can argue this the other way too. That is, if I want to show you just a generic picture of a human being, one of the troubles with using photography for that is that every photograph is a specific image of a human being. There's a way in which you could argue the holistic images are much more specific context. Back on the question of arrows, in instructional graphics, I don't think we can assume that they are more specific just because we want them to be.

Connie: That's really your point.

Elizabeth: I'm thinking about that with arrows as well. I make these little narrated chalk talks from my online students, very fast and loose with the arrows because I am talking while I make the arrow. I'm conveying what it's supposed to mean at the time that I'm creating it. There's no gap between me and the person who is supposed to be interpreting what I mean by this thing.

Connie: To synchronize the arrow and the audio would be an interesting way to make sure that people understand it.

Elizabeth: Right. Well, and to be efficient, I draw them all in advance. Then I use the highlighter and highlight the one I'm talking about. If you go back and you watch without the voice,

or you go back and just look at the last slide in a series where it's all gummed up with arrows and marks, I would venture to say you have no hope of decoding that.

Connie: Right, right. Now, back to our discrepancy topic, the discrepancy between intended and interpreted meaning. What can an instructional designer or graphic designer do to reduce that discrepancy?

Elizabeth: I'm tempted to recommend teaching a lot more of these things a lot sooner in school. That is, when you teach people to generate graphics, and you talk about graphic designers, they are often more attentive and better able to make guesses as to what a designer meant. Then, I would say a general population individual, because they've got a lot of understanding about how that that mode of thought works. I read a study a long time ago about the icons that appear on the buttons of photocopiers. One study, they asked a bunch of people what the buttons meant. In the second study, they asked them what they meant in the context of a photocopier. In the next iteration, they gave them some information about the way the designers had put the set together, and then ask them what they meant. Amazingly enough, it was that last group that actually interpreted most of them the most correctly.

Connie: Isn't that interesting?

Elizabeth: That's a way of me saying that it can't just be the graphic designer. I think it has to be all the learning designers who understand that, if you will help me recognize some of the visual language you're using by telling me about it, before I start using the materials, then I have a better shot of appreciating the visual moves that you made in order to support my learning. This is what happens when you put a text label on an icon, in a very abbreviated form, is you're saying, "Here's what I intend by this." Even if standing alone, either one of them might not have been as informative. But I'm starting to think that as often the author of a book, especially an instructional book will start out by saying, "Here's how to use this book." That we may need to pay more attention to. Here's how these images were put together. Here's some of the assumptions we made. Now we've armed you a little better to go ahead and try to interpret. Why did I show you this? What did I think it was supposed to mean to you?

Connie: That is pretty interesting. I did see research about user interface design that putting text on an icon is the way to go. Hold on. You know what that's like. A magnifying glass can mean search, or it can mean enlarge. I mean there's so many icons that have duplicate meanings.

Elizabeth: Right, right, which is what I mean by images are inherently open to multiple interpretations. Whereas, you've got to work hard with text to open it up to the

multiple interpretation. It's the reason that poetry is an art because a great deal of what is happening there is trying to open text in a way that a painter gets for free.

Connie: Right, right. People who are creating instructional graphics were not trying to have these open interpretations, usually.

Elizabeth: Yes, I would agree.

Connie: I was at an escape room with about six 13-year-old girls a few weekends ago. They had these old devices. I held up a floppy disk. I said to them, "This is where the save icon came from." They'll go, "Oh."

Elizabeth: Right now, I'm looking at the Skype screen, and there's an icon for hanging up, and it looks the handset off of an old fixed-location phone.

Connie: Right. I did read from an icon designer who said, and this was not research-based but it was experienced-based, that icons of older objects seemed to be more appealing and effective. Maybe they had a little bit more shape to them or something. I don't know why.

Elizabeth: I think about if you make an icon out of a smartphone, for example, you can't just use the outline of it. It doesn't have a canonical type outline. You've got to put a screen and a home button on it in order to indicate what it is.

Connie: All your icons would end up being boxes.

Elizabeth: Yeah. Understanding an icon is much more reading a word than it is like interpreting and picture.

Connie: Well, let's talk about that because you said that's also true for interpreting diagrams and many information graphics or abstract graphics.

Elizabeth: Diagrams are the visual productions made up of elements that have fixed meanings. They may not always be 100% precise. They may have synonyms just like verbal languages do, but the meanings are comparatively fixed. In order to understand what the diagram means, you understand the vocabulary that the diagram is using. You are reading a diagram in a way that you don't necessarily read a pictorial image. I don't know. I guess if you look back in some of the highly symbolic paintings, say of previous centuries, there're ways in which those paintings are being read, as well as they're being appreciated visually. It means something if there is a blackbird or a sparrow. That means something if a person has a hand on a book, one hand on a book and one hand on a

globe. There's an argument there also that that vocabulary is socially shared. Once that segment or sub-segment of society has disbanded or has disappeared into the mists of time, so has that language.

Connie: Interesting.

Elizabeth: I'm not sure exactly what my point is about this, except that I think if graphic designers work from a premise that these things are immutable, that they are somehow built into people's brains at birth, that there's something you can count on for free, instead of something that takes a great deal of repetition and effort. Even if it's quite distributed throughout my life experience, if that visual is encountered by someone who doesn't share much of that life experience, that is the only share a very tiny bit. I've just made it as if they were looking at an old, old painting and missed half the meaning because they didn't know what those socially-constructed dimension of the communication was.

Connie: Our ability to understand graphs and diagram seems to be based on a person's visual literacy. Would you agree?

Elizabeth: Sure, yeah. Visual literacy has so many dimensions. That would be yes, one dimension of shared visual literacy. In fact, it is a dimension that we do tend to teach in school. You tend to learn, to read some elementary graphs and charts, third grade science, whatever it is that you get started on that. By the time, most of us are doing it as adults. We forgot that we learned it.

Connie: Right. One thing in that same vein that I think is so fascinating about icons is there's no consistency. Some are learned symbols. Some are small versions of the object. Others are what they call exemplars so you will have knife and fork to represent a place to eat on a highway sign. I just find that fascinating. Some we've learned, and some you're trying to figure out. I will look at a device on a stove, then I go, "What does this symbol mean?" If there's no text, you just have to try it out. You might burn your house down, but at least you know what the symbol meant.

Elizabeth: That's right. The device might turn your lights on at one in the morning. I think that we have to remain engaged with how are we going to do these things, how do we get people to understand graphics, graphics to communicate what we want. How do we fit more symbols onto smaller spaces and all that? I'd say the point of selling my scholarship is not to necessarily answer, "For every situation you should use this or that." But to say, "Never approach these situations with the assumption that what it occurs to you to do is actually going to communicate in the way that you mean, testing these things." The International Standards Organization lays out some guidelines for how you have to test visual symbols. It's interesting because you not only have to reach

a certain threshold of people who understood what it meant, but you have to stay below a certain threshold of people who made catastrophic errors in understanding what something meant.

Connie: Interesting. Do you know how many people the symbols need to be tested on?

Elizabeth: A lot.

Connie: It makes sense.

Elizabeth: Yeah, lots and lots. It is not the kind of, say, usability testing where ... I mean early, early testing of symbols, you can get eight to 10 people. If six of them guess wrong or make the wrong interpretation, you have a problem. If you're trying to put buttons on the dashboard of airplanes, we need an awful lot of people to reach the threshold where you feel that your statistical analysis got some force. What this means to me is that we should be, I'd say, more careful, more worried, less optimistic about what is happening when we make these designs. Of course, that is a sliding scale as well. In many, many cases, close enough is pretty good. Most of the time, you're not going to burn your house down.

Elizabeth: You may get a device that plays music at an embarrassing moment. But I don't mean to indicate that nobody should ever use a picture unless they have tested it on 1000 people. I do think we should really recognize first the high failure rate that we're liable to encounter. Therefore, if we've got redundancy in our communication, that's the minimum we can do. To recognize that, just because it's not catastrophic, doesn't mean that it didn't fail.

Connie: That's a good point. Testing is always a good idea even if it's limited. In light of all of this, when you teach, do you give any criteria for using visuals for learning experiences, when it's going to enhance learning? Do you have any criteria for that?

Elizabeth: I do have some, and I've got to say that I'm going to be probably right up there with all the hypocrites in having lots and lots of reservations about some of the assumptions we make on graphics and teaching from pretty strongly craft-oriented position on graphics. We have to make some assumptions. We have to move forward with our best shot. I find myself asking a lot of times, is that image showing the thing, the part that the person needs in order to stand? Why are you using that image? Actually, you need a picture if people need to be able to recognize a thing.

Connie: Sure.

Elizabeth: You need an image if there's something people can't actually see in their real life, but they will understand better if they can envision how it's put together or get some mental picture of it. In a process, you need to use a picture if the gesture somebody's going to need to make in order to carry out a physical process is not intuitive to them or not dictated by the object they're working on. My example for that is people get out on the flight line and inspect planes and replace parts, for example. They may be almost bent backwards, double, and looking over their own head at the part they're going to have to replace. If they're inside the wing of an airplane, for example, I understand that's the position your body's going to have to be in order to do this job. There's nothing like an image to let you know because it's so difficult to describe in text.

Elizabeth: You use an image when people need to appreciate more than one part of something not only at the same time, but in relation to the other part. I think that an actually fairly robust way to think about what are the situations in which people most need visual support.

Connie: I agree. I think those are some really good guidelines. In that same vein, let's flip it around. When can visual elements detract or hinder learning?

Elizabeth: I think what I said about that before is that when they are not well-matched to the people who are learning or the situation of the learning, I certainly think they can get in the way. I've seen another study. This was from the UK. It was also done a number of years ago, probably in the 90s. They took science illustrations from textbooks. They gave younger kids, second and third grade kids. These were their textbook images. They gave them a crayon and said, "Read the text here and then circle the part of the picture that it's talking about." A number of times they got it wrong was just dispiriting. They were all over the place. They didn't really know what to look at in the picture. They didn't know, which part the text was talking about. Some of them had those parts highlighted and that actually seem to ... Here again, I'm got to say it was not part of their visual vocabulary.

Elizabeth: That when I make this darker, that means that it's more important part. They were just not comprehending it. I guess what I'm trying to say is that when we show people images on the assumption that they know how to read them, hindering learning might consist in having them look at the wrong part of the picture and get the wrong idea. It may be that it is taking up page space that could have been used for something else for picture that isn't getting looked at or isn't providing any meaning of what it is. The one thing that can be true is that line art, for example, which seems it's simpler. Therefore, you might want to use it because there's not all that surface and texture and stuff in the way. It can be very confusing to people who have a limited experience with perceiving

which part of a line is supposed to indicate a foreground or a background. I'm going to just go ahead and say, crummy pictures.

Connie: Sure. Bad graphics are going to detract from learning too.

Elizabeth: Right.

Connie: As far as that line art goes, I believe there was some research. I think the person's name was Dwyer from Penn State, and it was years ago. His research was probably for people who were quite visually literate. There was no problem perceiving it and knowing that it was a form. What his research found was that because there are fewer extraneous cues for novices, it may be better for instructional purposes to use line art. Or what I think what I've gathered from all this is that when you reduce realism, you're taking out the noise when you're taking out the extraneous cues. If someone's new at a topic, let's say if they want to learn the parts of a car engine, that is simpler illustration for a novice and someone who's visually literate, and I like the way you're forcing me to be so specific, is going to probably be more effective than a complex photograph.

Elizabeth: Yes. I'm going to sign up to that, in general. I'm going to do that with the caveat that; first, it has to be good line art. Second, there has to be some attention paid to how the piece that you're showing me does fit into the whole. I would be inclined to use some device that helped me understand. I'm looking at a piece of something and here's where it came from, so I haven't learned because I think it is a detriment to the learning outcome. If I learned individual bits of things, and I can't put them back together.

Connie: Definitely. Good point.

Elizabeth: Right. Then second, that it's the perspective from which I'm seeing it is carefully chosen, so that if I do look into that engine later, I'm going to recognize it in the perspective that I'm going to see it.

Connie: I agree, and I think that texts can enhance that in captions and titles.

Elizabeth: I'll go back to something that I said very early on. I just really wish that we started earlier. We're very conscious about teaching some of this instructional visual literacy to kids much younger.

Connie: That would make our job much easier, wouldn't it?

Elizabeth: Have some learning around that, together with the rest of your education, I think is probably positive for your future visual literacy. Then a graphic designer would have more to depend on.

Connie: It does seem like it's almost essential now. Because things are more visual, it just seems it has to be taught now.

Elizabeth: Here's the positive upbeat side of the way that I look at all this stuff. It is incredibly amazing that we look at flat stuff on paper, or on the screen. We think it looks a person or a cow or a bucket. I don't know how we do that. By the way, the researchers don't know how we do it either.

Connie: It is really amazing. On that positive note, we'll wrap this up. Thank you so much for being a guest on the podcast, Elizabeth. Thanks for sharing your research and your knowledge about graphics.

Elizabeth: I'm so glad you asked me to do it.

Connie: I'm so glad too.

Connie: I hope you found this episode valuable. I think the most important takeaway from Elizabeth's scholarship is that we need to be more cautious and careful when we produce and deliver instructional graphics. There are many nuances of meaning in images. So understanding the audience, the culture, and the context and testing when possible, is the best path to designing effective graphics. Again, you can find the show notes and a transcript at the elearningcoach.com/podcasts/54. If you've benefited from this podcast, please take a moment to rate, review, and share it. Thank you. Talk to you next time. Take care.