Towards a formal assessment of design literacy: Analyzing K-12 students' stance towards inquiry

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We present a tool for quantitative assessment of K-12 students' stance towards inquiry as an important part of students' development of design literacy. On a basis of design thinking literature, we position designerly stance towards inquiry as a prerequisite for engaging with wicked problems. The Design Literacy (DeL) assessment tool contains design of a qualitative survey question, a coding scheme for assessing aspects of a designerly stance towards inquiry, and a description of how, we have validated the results through a large-scale survey administration in K-12 education. Our DeL tool is meant to provide educators, leaders, and policy makers with strong arguments for introducing design literacy in K-12 schools, which, we posit, function within in an age of measurement.
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Keywords: design education, design research, reflective practices, evaluation

This paper supports the claim made by current design studies literature that design thinking offers major educational opportunities to support the new literacies needed for the 21st century (Balsamo, 2009; Burdick & Willis, 2011; Pacione, 2010). Design thinking provides educators with a substantiated knowledge base for addressing some of the intangible and inter-disciplinary practices, attitudes and knowledge students must pursue, in order to succeed in work and life in the 21st century (as advised by organizations such as OECD's Partnership For 21st Century Learning). Framing design as a form of literacy among many (e.g. mathematical literacy, technological literacy) implies that students should develop basic design abilities, such as inquiry, ideation, and externalization. These designerly ways of thinking are examples of aspects of design from which everyone may benefit when interacting with the world.

In this paper we present a tool for assessing K-12 students' *stances towards inquiry* when asked to solve a *wicked problem*. The tool is meant to assess whether students take a designerly stance towards inquiry in early stages of the design process. However, we do not, claim that our tool assesses all aspects of what it means to take a designerly stance towards inquiry. Rather, our tool focuses on aspects of design that are oriented towards studying *the existing* in

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the early stage of a design process. The early stage of the design process tends to be oriented towards being empathic to learning in order to gain a deep and holistic understanding of the problematic situation (Kelley & Littman, 2005; Kembel, 2009; Löwgren & Stolterman, 2004; Nelson & Stolterman, 2012). In this early stage designers utilize a diversity of ethnographic and/or anthropological techniques, many of which have later been tailored for design (Hanington & Martin, 2012; Kelley & Littman, 2005). One of many ways that designers approach wicked problems, is to discern the problem's preconditions for future design. To do this the designer needs to be able to observe, describe and understand the context and environment in which the problematic situation is present. This presupposes personal reflection on first intentions (Nelson & Stolterman, 2012), and reframing of the problematic situation (Cross, 2011; Schön, 1984, 1990). Contrary to this, our previous field observations, showed that the K-12 students' design processes in maker settings ' … often resulted in simplistic solutions and finalization.' (Smith, Iversen, & Hjorth, 2015). The focus of the tool presented here, is to better understand students' approach to the early stages of design processes. We investigate this from the two perspectives of a designerly stance towards inquiry, or a stance of technical rationality.

To successfully introduce a designerly stance towards inquiry, and by extension design literacy, as part of K-12 education, we need to understand the modus operandi of the current educational institutions. In his seminal work, educational philosopher G.J.J. Biesta (2008, 2010) has argued that today, education operates in an 'age of measurement.' In this age, what is valued in education is to a large part determined by what is measured. Educational outcomes are valued by institutions' capacities to perform on quantitative assessments. In other words, what is valued in education is strongly influenced by the content of assessment tools. We recognize the criticism of this problematic situation of valuing what is measurable, but nonetheless, it is what educators and policy makers expect to base many of their decisions on. Therefore, we take the contemporary focus on large-scale quantitative assessment as a given. Thus, if we value design as educationally desirable for the general public, we need new ways to assess this new design literacy.

The idea of integrating design thinking as a subject in general education has been suggested previously (Baynes, 1974; A. Cross, 1980, 1984). However, the idiosyncratic nature of design poses great difficulties for large-scale assessments: you cannot force the many dimensions of design into a formula. Design researchers such as Cross (2011), Nelson and Stolterman (2012), and Dalsgaard (2014) describe design as a particular form of engagement with the world. The designer approaches problematic situations by engaging with these situations through reflective conversations with stakeholders, the design situation, and its artifacts. As described in Kimbell and Stables (2007), these conceptions of design do not readily lend themselves to large-scale quantitative