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Influences on virtual pedagogical designs

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KEYWORDS

Digital design, curriculum, teacher satisfaction, education, cognition, instruction

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INFLUENCES ON VIRTUAL PEDAGOGICAL DESIGNS

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ABSTRACT

This is an analysis of the relationship between teachers' digital design, appreciation of curricular contents and self-assessed job satisfaction. Traditionally contents and method influence student learning and consequently teacher satisfaction. The more the students learn the happier the teacher. People assume that student experiences of digitally "designed" teaching and learning influence significantly teacher satisfaction. Digital design solutions externalize the teachers' intentions, primarily providing a social game for the students. Questionnaire results suggest that teacher satisfaction is an outcome of instruction *and* curriculum. But does either of the two have an added effect on the other, e.g. does curriculum reinforce the digital design or is it the other way around.

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1. INTRODUCTION

It is an old contention that subject matter, instruction and learning engage students with information and communication technology (ICT). The actual experiences about using the technology affect the way teachers feel about their job. Some virtual applications promote wellbeing, some increase efficiency and others inspire innovation. In order to adopt digital platforms to classroom routines teacher curiosity, creativity and confidence is needed. Outcomes of technology-driven designs depend on the teachers' ability to integrate pedagogical competence, digital competency and subject knowledge. Innovative teachers' designs offer a challenge for the students, different from student challenges in social media. This study focuses on the teachers' appreciation of such antecedents to learning that generate teacher satisfaction. We cover analysis of teacher-controlled software designs and a statistical analysis of 295 US-teachers' self-assessed ability to design and apply online coursework in Ohio, North Wisconsin, Iowa, Indiana, South Wisconsin etc.

New technologies seem to inspire teachers to try out new solutions by hardware like *Smartboard* or *IPhone* or by software like *Twitter, Google* or *Blogs*. These products, however, apply for the open market rather than for education. Therefore innovative teachers re-design the marketed applications before inviting

the students to use them. Teachers need to learn about virtual designs, i.e. relations between contents and method. Teachers do their best to offer the students a stimulating learning experience, a challenge different from Facebook-egoism, YouTube-sensationalism or Wiki-fragmentation. This text covers analysis of teacher-controlled software design processes for a formal high school learning context.

Digital design is an infected subject because it strikes at the heart of teacher professionalism. Scanlon and Isroff (2005) say disagreement between teachers and students appear on organization, delivery and evaluation of curricular contents and methods for teaching and learning. As to the actual design for teaching and learning, Friesen (2011) highlights the academic lecture as a preferred "transmedial form" saying locally situated lectures cannot be "done away with because new media develop that are supposedly superior or more efficient." On the other hand, Sheard et al. (2010, p. 9) comments on lectures saying: "Many students fail to show up at lectures and/or tutorials [...] and would rather communicate with e-mail."

As far as background information on educational design issues are concerned, *Ofsted Gradings for ICT*, evaluates the use of digital media in education. The U.K. body evaluates *The curriculum in ICT* at levels of design and performance, headlines covering Achievement in ICT; Quality of teaching in ICT; The curriculum in ICT and Effectiveness of leadership and management in ICT. *The curriculum and ICT* illustrates teacher input by *Outstanding* design.

> The curriculum in the subject provides memorable experiences and rich opportunities for high-quality learning and wider personal development. The subject curriculum may be at the forefront of successful, innovative design. […] The subject's contribution to relevant cross-curricular themes including, as appropriate, literacy, numeracy and ICT, is mainly outstanding. As a result, all groups of pupils benefit from a highly coherent and relevant curriculum which promotes outstanding outcomes.

This is all and well from an administrative perspective, but there seems to be a gap in the literature on what happens when teachers plan, try out and evaluate digital designs (on contents and instruction) for teaching and learning.

2. PREVIOUS RESEARCH

There is some research set on studying variation in instructional quality. On the negative side, Morris and Hiebert (2011, p. 5) say teacher and student classroom interactions have changed little "over the past century". In exploring the quality of teaching and learning they refer to variations in teaching and learning designs (Raudenbush 2009) and ineffective instruction (Stuhlman & Piuanta 2009).

By definition many ICT-solutions offer a pre-packaged interactional design for learning. In the lucky cases flexible designs like old-school *Moodle* transform the teacher's and the students' thinking, reflecting and learning. Teachers acting as competent 'cultural brokers' (Van Oers 1998) may support formal schooling activities and turn the students into technologically empowered, self-controlled and socially capable agents. The point is that leadership, communication and social skills decide the efficiency of the technology. From a US-perspective Roth (2007, p. 2) argues that studies of interaction, communication and education are rewarding activities, especially regarding "the dialectical nature of production and the inner conflicts of human activity." In a complementing note Kobbe et al., (2007, p. 215) highlights design processes for sequencing, contents and instruction which help analysts understand designer objectives and arguments. However, the technology imposes restrictions on construction of meaning ("constructivism" in Papert 1991) between teachers and students. Hirst and Vadeboncoeur (2006, p. 206) say outside school social spaces and media are "most easily defined by conversation, speech and intention." As long as virtual spaces in schools and elsewhere cover a collective approach, any combination of design, contents and method offers transformation of the participants' objectives, relations and identities. Standardized social spaces form a short-lived situated practice, a one-off opportunity. Gieryn (2000) suggests that the actual design for conservative, hierarchical and continuous classroom contexts is different from informal (and possibly virtual too) learning contexts. In explaining behaviour in ICT-settings Cress and Kimmerle (2008) suggest designers build on Piaget's (1977) theory on cognition ("cognitivism"). However, in doing so, they downplay the relevance of the medium. On the other hand, Nardi (1996, p. 70) finds generalizing results in digital contexts, saying: "It is especially difficult to isolate and emphasize critical properties of artifacts (hardware, software, digital design) and situations (subjects in a shared activity) in studies that consider a full context."

In assessing the power of a digital design, goals, indicators and criteria enter the picture. For digital designs, Breen et al., (2001, p. 100) say evaluation should cover efficiency, cost, failure, interactivity and control. According to Scanlon and Issroff (2005, p. 431) a "learning setting" primarily includes the teacher's design of related materials and the teachers' ability to integrate learning materials with the curriculum. Crucial check-points include implicitly shared goals that students should attain, learning the curriculum and fostering by interaction rather than by discipline. Friesen (2011) provides a plea for the academic lecture as a preferred "transmedial form" saying lectures cannot be "done away with because new media develop that are supposedly superior or more efficient." On this theme Sheard, Carbone and Hurst (2010, p. 9) add: "Many students fail to show up at lectures and/or tutorials with pens, show an unwillingness to put pen to paper and would rather communicate with e-mail." Scanlon and Isroff's (2005) activity theoretical analysis suggest that disturbances as to organisation, delivery and evaluation of lectures cause clashes between stakeholder goals, rules and regulations plus division of labour.

Further research is needed on digital designs for flexible-constructive-productive group interaction, especially in an emerging activity which inspires teachers to commit themselves to a shared object, a learning object (Hansson 2010; 2011), an objective, an objectified motive or an object of activity. In outlining contextual learning processes for boundary crossing objects like digital designs, Keller and Keller (1996, p. 103) say "tools may well be used in multiple ways even within a given constellation." Thus, the configuration of ICT- artifacts harboring contents and method is a unique context in and by itself, a fact which enables for mediating processes between objects, media and people. There are formats or designs for tutoring, lecturing, testing, guiding, informing, discussing etc. by means of objectives, contents and methods. Engeström (2007, p. 34) suggests a framework for separating between mediating processes going from (a) tool usage via (b) production of pre-empted results to (c) fully fledged designs for co-construction of learning objects. All in all, for any design, flexibility with the specifics of the "mirrored" context is a prerequisite.

3. CONTEXT OF INVESTIGATION

According to Wikipedia, curriculum means "the range of courses from which students choose subject matters to study". Curriculum also means "a specific learning program" including the instructional method for delivering contents. Both meanings cover contents to be taught, studied and learnt plus method defined as instruction or pedagogy. Kemp et al. (2009) interpret curriculum as a combination of prescribed contents and teacher–centred method. Research from Dewey (1916/1985) onwards (Hansen 2007, p. 177) oscillates round democracy, illustrating that "intellectual and moral aspects of educating are too often treated separately." Breault (2009) and Connelly and Xu (2007) expand on the need to study relations between pedagogical theory and instructional practices without exploring the teacher's experiences of planning, delivery or evaluation of the curriculum.

For this study focus is on questions related to digital design, curriculum and satisfaction. The respondents reported on their ability to put together and develop digital-age learning experiences; model digital-age work, promote digital citizenship and actively engage in professional leadership regarding digital-age instruction. We asked how they know when to unplug from using digital tools, how to identify valid sources of information, distinguish appropriate from inappropriate sites and sources of information, practice safe, legal and responsible use of information. Finally we asked about the teachers' personally designed curriculum, their approach to instruction, their learning environments, assessment of student learning and professional development. Data on the teachers' *personal characteristics* cover leadership, instruction, assessment, control of data, design creativity. Data on the teachers' *collective characteristics* cover communication, collaboration, cooperation, support, citizenship and cross-cultural skills.

Self-assessment along the indicated lines equals clarification of the relation between objectives and outcomes. For digital designs, Breen et al., (2001, p. 100) say such evaluation should cover efficiency, cost, failure, interactivity and control. According to Scanlon and Issroff (2005, p. 431) a "learning setting", here translated as digital design, comprises of software, the teacher's inclusion of related materials and the teachers' ability to integrate learning materials with the curriculum. Crucial check-points cover shared goals that students should pass, learning the curriculum and fostering by social interaction. Scanlon and Issroff's (ibid.) analysis of digital designs suggest that if combined with Breen's et al (2001) classroom situated dimensions, contradictions are bound to surface.

4. THEORY

4.1 Design-oriented Analysis

There is a need for integrated *and* comprehensive theory on formal and informal learning facilitated by interactive and collaborative designs. The theory must harbour a scope of pedagogical theorizing by adaptation to a US-audience and accounting for a European tradition. The theory should be able to describe and explain how a particular design on web-based teaching and learning help the students (i) access conceptual explanations; (ii) offer questions and answers; (iii) display their explanations; (iv) provide tasks; (v) provide feedback; (vi) allow for problem solving; (vii) reflect "lessons learnt"; (viii) discuss with peers and teacher; (ix) articulate ideas; (x) present learning objects (Hansson 2010). In separating between two kinds of constructivism Salomon (1998, p. 4) opts for the "situated" alternative, emphasising individual cognitions and "collectively constructed social systemic" constructivism. In choosing between Vygotsky and Piaget, Shayer (2003) tends towards exploration of similarities rather than differences.

(a) A *curricular* North-American tradition goes well with *cognitive* and *social systems* theory. The former emphasizes a design (Hansen 2007) based on Dewey-inspired ideals, suggesting e.g. a Maths teacher is something else, other or extra than a 'civilian' teaching a subject. In fact a good teacher thinks, speaks, acts and embodies Maths, life, knowledge, work etc. in a special way. "New curricularists" in Breault (2009) represent another branch of the tradition. However, both approaches apply extreme conceptions of "knowledge" by means of social engineering and dubious course objectives related to *instruction*, a failing procedure where focus is on the teacher presents a concept, defines a goal, designs a task, provides feedback and supplies additional tasks. Sadly, instructionist approaches tend to focus on the teacher's actions rather than on student learning.

(b) *Constructionism* emerges from Piaget's conception of cognitive processes like accommodation and assimilation. First Papert (1991) say any teacher's challenge regarding digital design (method) and curriculum (contents) lies in constructing a learning object which the technology supports and the students accept. Constructionist approaches and outcomes ideally allow for simulation and modelling of (learning) objects. Second, teachers follow the learners' progress and adapt input to the learners' needs. Third, they improve on presentation, facilitation and evaluation of a given digital design relative to the sought contents and learning processes. The approach pre-supposes that the students are able to consider discoursed-logical relations between goals, concepts and actions.

(c) In order to complete a theoretical design for analyzing a "core curriculum" for ICT, *cultural-historical activity theory* (Vygotsky 1978; Wertsch 1985; Kaptelinin & Nardi 2006) offers an alternative solution. Tool mediation, externalization of ideas plus discussion with peers makes up the practical features of cultural-historical activity theory (CHAT). The teacher's role is to stay in the background and introduce a theme, define an issue, topic, theme, subject, providing a setting for dialectic negotiation, mediation and discussion based on natural contradictions and individual zones of proximal development (Vygotsky 1978). Eventually the design will generate synthesizing-dialectical (thesis-antithesis-synthesis) agreement between the students.

The suggested – and argued complementary – tripartite theories contain key features which properly structured, combined and assembled enables for in-depth analysis of how teachers perform (= think, imagine, reflect, act, create) during digital design processes. In fusing (a) curricular instructionist, (b) cognitive constructionist and (c) collaborative activity theoretical approaches and in forming pedagogical rather than technological influences into the analytical framework, some concepts need to be highlighted.

4.2 Theoretical Framework

The teacher's digital design process is hard to follow because it is a stepwise procedural and formative journey inside the teacher's head. Users can merely observe the result of the teacher's endeavours with managing a lesson, preparing a syllabus or designing a pedagogical interface. For any modelling of the pedagogical design processes it is necessary to account for the teacher's awareness of the need to learn how students think and act. In considering the potential of a specific medium, the teacher must decide on a valid goal, initiate a process, ensure that the design enables for the students to receive and provide feedback, engage in and make time for reflection, adapt behaviour, attitudes and understanding related to the goal, adjust method and contents to meet the students' needs. In short, the teacher needs to (a) prepare for, design

and revise the students' actions; (b) help students share practices; and (c) support student reflection on knowledge and experiences. Those would be the prerequisites for understanding the teacher's construction of a pedagogically valid digital design.

A reasonable analytical framework should clarify which components relate to each other; how they interact and influence conceptualization, adaptation, action, reflection, mediation, sharing and production of methods, contents and knowledge. More specifically, all kinds of learning take an object, i.e. people learn *something*. Kobbe et al., (2007, p. 215) cover a design process, promoting understanding (sequencing, contents and application) of individual teachers' opinions, arguments, ideas and connections: "justifying opinions and constructing arguments; comparing, evaluating, elaborating ideas; negotiating and constructing arguments; explaining and justifying opinions; summarizing and making connections." But in spite of the details, the approach would still offer a merely superficial account of the teacher's pedagogical design process.

John Dewey's (1909) conceptualization of pedagogy involves thinking, memory and learning. Emphasis, however, is on interrelatedness between dualist thinking about school-related aspects of discursive theory and experiential activity. The goal of any digital design is similar to any classroom activity, combining adaptive-disciplinary and reflective-liberating aspects of teaching and learning, be it for virtual or for real life purposes. Therefore, focus is on the teachers' ability to design digital learning objects.

4.3 Analysing Pedagogical Designs

Ten years ago McInnis (2001, p. 13) said: "We simply do not know enough about the changing motives, values and expectations of undergraduate students in relation to their level of engagement." Today Sheard et al., (2010) provide empirical data on how young internet-users perceive of the media, suggesting a mismatch between teacher demands and student needs but also between teacher ability and student resources. A combination of the given teacher and assumed student behaviours adapted to a virtual environment reflect Dewey's (1909) ideal, i.e. teachers supplying integrated theory for memorizing data as well as providing for constructive practices on "learning by doing" and reflection. Eventually we will validate the given pedagogical theories to what the students say by complementing Deweyan theory with survey data.

Functioning pedagogical designs for Internet contexts suggests that the teacher's design process begins with a curricular and/or personal relation to concepts, theory or/and an experience of phenomena, events, procedures or facts. The teacher shares knowledge and experience with the students by means of a *curricular relation* to the studied contents. The teacher's and the students' conceptions meet in an activity fuelled by *social relations*. The result of such "scaffolding" is emerging queries between teacher and students. By interacting, providing feedback, supplying questions, modelling ideas and providing summaries the teacher learns how the students think; the teacher becomes guardian of a *pedagogical relation*. Figure 1 applies equally for virtual and situated contexts. For the former the design aims at conceptual understanding based on experiences and for classrooms the design aims at developmental practices which influence the students' conceptions about practice.

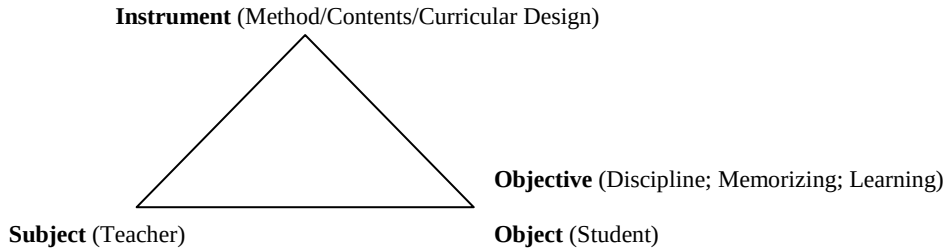

Figure 1. Modelling the teacher's design process

Figure 1 provides a framework for describing relations between Subject, Instrument, Object/Objective/Object of Activity. The teacher's choice of virtual pedagogical design (Instrument) benefits from a task goal and (a) *instructionism* if emphasis were on self-contained teacher development. On involvement and investment in subject studies, an Australian student (Sheard, et al., ibid., p. 10) praises the

medium but equals the teacher's method as merely providing tasks, marking tests and supplying feedback on grades.

> Computer systems are interesting but I don't like the assignment [work]. There are a lot of assignments for just little marks. There are around four assignments two assignments are only 5% and the other two are 10%. It's time consuming. The lecturer keeps giving assignment week after week. It's hard for me to have time to prepare for other subjects.

Furthermore, the digital design benefits from (b) *cognitivism* and attempts at reaching an Object/Objective (Figure 1.) if focus were on students learning delineated curricular knowledge. Sheard et al. (2010, p. 8) provide a sad picture on attendance and participation marked by the students' poor understanding of the potential of long studying hours.

> The university mandates twelve hours of work per subject, per week. Realistically students tend to do just what is assessable, and unless something is assessed it will not get done. It would be ideal to think that students read material because they feel it was necessary to read, but that is simply not the case. Students will only read material if it is explicitly indicated that it is necessary to read it and there are marks allocated to it.

The digital design provides resources of (c) *cultural-historical activity theory* (CHAT) if the purpose were to develop a shared activity for teaching, studying and learning by means of discussion between teacher and students. A valid combination of analytical components, i.e. Subject, Instrument, Object and Objective (Figure 1.) enables for qualified suggestions about the characteristics of objective, goal, purpose, ambition etc. of a particular design. But the choice of components also enables for suggestions about what would be a reasonable outcome of a particular design. On attendance and participation, another Australian student (Sheard et al., ibid., p. 8) provides an example of how personal commitment by self-control, time management, entrepreneurship etc enables for successful *campus studies* with traditional lectures.

> I go to tutorials and classes. I don't miss any classes and that helps me a lot. When I go to lectures, I understand better, and then I have more time to do other things. I make sure that I don't miss anything. But many students – they don't really come to class.

For a *virtual design* applies that the students' attendance and participation are key prerequisites for learning. One teacher in Sheard et al. (ibid., p 10) identifies a challenge to design a shared context for creative discussions based on the students' engagement.

> Students are all keen to learn the application and the process in which these things [foundational material, comment by this author] are used, but the drudgery of having to go through and learn the fundamentals is something they are not altogether interested in and do not cope well with. This makes it difficult and a challenge for teaching.

Virtual and real life designs equally should encompass disciplinary goals, self-controlled learning and national objectives for citizenship and curricular knowledge equally. This is also true for the suggested model describing the teachers' options. If the design were based on (a) *instructionism* the objective/outcome would be curricular knowledge and methodological awareness as defined by national goals. If the design were a result of (b) *constructivism* the objective/outcome would be similar, but at an advanced level, signifying awareness of the disciplinary features of a specific subject. If the design were on (c) *cultural-historical activity theory* the objective/outcome would be self-controlled learning. Put differently, the students' and the teachers' affective and cognitive commitment enables for the teacher to provide feedback, require presentations, show interest in the learning object, build relationships; care for differences and ultimately facilitate for the growth of an evolving activity system.

5. CONTEXT OF JUSTIFICATION

Teachers manage work and care for young people either as managers of classrooms or as designers of distance education. Regardless of context, the teachers automatically consider "pedagogical pillars". They do so in order to be able to account for relevant objectives, method and contents. The pedagogical pillars contain consecutive steps of planning ahead of delivery, performing during moments of truth and evaluating outcomes of learning. The teachers' procedures harbour national objectives, adaptation of local methods and analysis of the means for exploring what goes on in the students' heads. Table 1 illustrates the teachers' assessment of how instruction and curriculum inform digital designs.

Table 1. Contingent parameters

Actors	**First Pillar**	**Second Pillar**	**Third Pillar**
Student	**Curriculum**	**Digital design**	**Assess**
Teacher	**Instruction**	Fostering	Perform

Concepts (bold) in Table 1 suggests an analytical framework for studying the teachers' ability to adapt digital designs to web-based teaching and learning, bringing curricular knowledge to the students. The suggested framework provides a format for displaying US-teachers' self-assessed competence to design a pedagogically valid ICT-interface. The deployed questionnaire covers: a technology plan, professional development, curriculum, instruction, learning environment and assessment. Undoubtedly, curriculum relates to digital design (comprising of instruction and learning environment). Obviously, it is hard to follow the teachers' assessment process of their work as it is a stepwise procedural journey inside the head of each teacher. As outsiders we can merely observe the result of the teachers' endeavours at managing a pedagogical interface. Therefore, in modelling assessment of digital designs it is necessary to account for the teacher's awareness of the need to learn how students think and act. Figure 1 shows the components of a digital design; their relations; influences on the students' conceptualization, adaptation, reflection, sharing of methods, curricular contents and personal knowledge. Based on the purpose of study we developed hypotheses about influences on teacher satisfaction. They cover design, methods, curriculum and self-esteem.

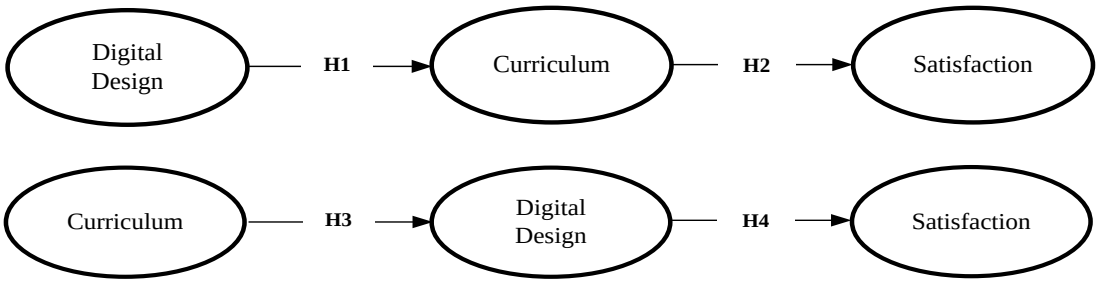

Figure 1. Hypotheses developed

H1: Digital design affects curriculum: Digital design is the result of a process aiming at facilitating teaching and learning through digital applications. Digital design is an externalizing expression of the teacher's preferences, projections and objectives. Any digital design aims at matching reflective processes with digital opportunities. Digital design is a constructive and tangible activity, which empowers teachers in their work. Co-ordination, cooperation and co-construction are an effect of meaningful learning activities.

H2: Curriculum affects satisfaction: Satisfied teachers' are confident about their performance and contribution to meaningful and productive student results, i.e. attention, motivation and understanding. This assumption is anchored in studies of the relationship between curriculum and satisfaction (Fuchs, et al., 1988). As teacher satisfaction is a goal oriented measure it correlates with curriculum and use of technology (Stecker, Fuchs & Fuchs, 2005). One logical justification of such findings lies in a need for balancing technology with curricula.

H3: Curriculum affects digital design: Due to contradictory evidence there was a need to test a competing model suggesting the method for delivering teaching and learning affects the students' perception and conception of curricular themes. Therefore, testing if the curriculum has an effect on the teachers' digital designs is a prerequisite for a valid study.

H4: Digital design affects satisfaction: While curriculum is a prerequisite to students' learning some people may argue that the effect of a digital design is projection/mediation of the curriculum. However, most people would claim that digital leaning is an effect of meaningful processes, which in turn affect the teachers' level of satisfaction. Also, curricular considerations influence the teachers' choice of digital designs and consequently satisfaction. Social construction is a major motivator for learning and teachers' pride themselves for exercising pedagogical leadership. Such control reduces uncertainty and contributes to satisfaction.

In testing H1-H4 hypotheses focus turned to digital design (method); curricular achievement (contents) and job satisfaction. There are 13 variables subsumed under three factors. The underlying rationality of the operation is to identify three types of antecedents (independent influences) to ICT-facilitated teaching and learning. The measured parameters in Table 2 contain questions on Digital design (experiences, citizenship and growth); on Curriculum (disintermediation, sourcing, discernment and responsibility) and Satisfaction.

Table 2. Pearson correlation all N=295

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
Q1	1.00												
Q2	**.84****	1.00											
Q3	**.69****	**.78****	1.00										
Q4	**.70****	**.78****	**.71****	1.00									
Q5	.26**	.26**	.20**	.22**	1.00								
Q6	.22**	.25**	.24**	.22**	**.81****	1.00							
Q7	.18**	.17**	.21**	.18**	**.68****	**.73****	1.00						
Q8	.18**	.18**	.21**	.23**	**.59****	**.57****	**.73****	1.00					
Q9	.14*	.18**	.14*	.17**	.31**	.31**	.30**	.30**	1.00				
Q10	.15**	.17**	.16**	.15*	.28**	.28**	.30**	.34**	**.83****	1.00			
Q11	.18**	.23**	.21**	.23**	.30**	.30**	.30**	.42**	**.72****	**.81****	1.00		
Q12	.08	.15*	.14*	.14*	.28**	.31**	.31**	.38**	**.72****	**.78****	**.80****	1.00	
Q13	.13*	.17**	.16**	.22**	.33**	.33**	.27**	.35**	**.69****	**.72****	**.73****	**.69****	1.00

**p<.01; *p<.05; Q1-4: Digital design; Q5-8: Curriculum; Q9-13: Satisfaction

6. RESULTS

Table 2 contains correlations for individual items among 295 respondents. Three latent constructs form a theory for testing if curriculum or digital design breeds teacher satisfaction. First examination is on bivariate correlations in Table 2. Inter-correlation within each proposed latent construct (factors 1–3) is strong, significant and robust. Each latent construct contains inter-correlation which is stronger than any individual correlation to another construct.

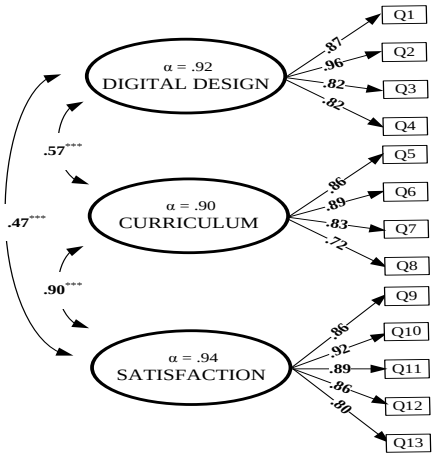

Figure 2. Confirmatory factor analysis

Designing and using a structural model (AMOS 20; IBM, New York) helped finalize the confirmatory factor analysis. Figure 2 reports the factor structure of the three deployed constructs. Observed variables (i.e. questions) are depicted as rectangles and latent theoretical latent constructs as ovals. All loadings and relationships are significant at .001 levels. Inside each theoretical oval we report a reliability measure (Cronbach's alpha) denoted with Greek alpha (α). The threshold is at .7 illustrating that all measures exceed the measure. This finding reflects the fact that each factor loading is balanced and substantially loaded to each construct - all loadings exceed .7. Figure 2 also implies a slight overlap between satisfaction and curriculum. Goodness-of-Fit indexes show that the proposed measures fit the sample. Chi square (χ^2) measure 197.17 is significant with 62 degrees of freedom. As Chi square is sensitive to sample size other indexes are included. Three of them pass the recommended levels. According to Bentler (1990), Comparative Fit Index (CFI) should exceed .90. Also, Standardized Root Mean Square Residual (SRMR) and Root Mean Square Error of Approximation (RMSEA) should be below .08 before claiming acceptable Goodness-of-fit. The model passes on two out of three recommended indexes.

Table 3. Confirmatory factor analysis (CFA); Goodness-of-fit indexes (n=868)

Index	Findings	Expected
χ^2,	197.17	Positive
d.f.	62	
(p-value)	(.000)	
χ^2, / d.f.	3.18	
CFI	.96	>.95
SRMR	.04	<.08
RMSEA	.08	<.08

After establishing the factor structure focus was on the proposed sequential paths. This is a test of four (H1-H4) hypotheses, excluding a report on the factor structure. It is basically the same as the one received for CFA in Table 3. Find an illustration of the actual strength of the coefficients in Figure 3.

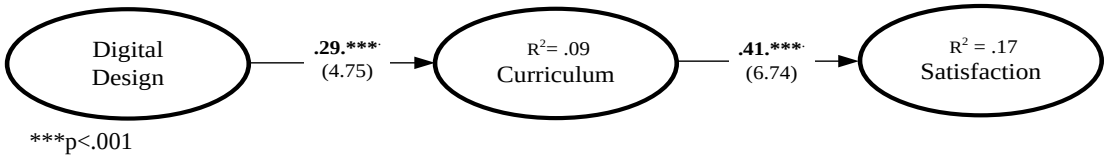

Figure 3. Focal model; H1 and H2

Figure 3 reports on the tested hypotheses with standardized beta (bold) and t-values (parenthesis). First, one would expect that the digital design (H1) should affect curriculum and there was support for this (β =

.29; p<.001). Second one would expect that curriculum should affect satisfaction (H2). This was confirmed as there is a significant relationship, saying that key curricular contents affect the teachers' attitude towards the design (β = .41; p<.001). R-square of the model explains between 9 and 17 % of variance in both dependent constructs. Finally, the H1-H2 model show that the digital design indirectly affects satisfaction (β = .07; p<.002). This means that curriculum significantly mediates the effect of digital design on satisfaction. Since this indirect effect appeared, the conclusion is that if teacher satisfaction is to develop, delivery of curriculum must strengthen (mediate) the effect of a digital design on perceived satisfaction.

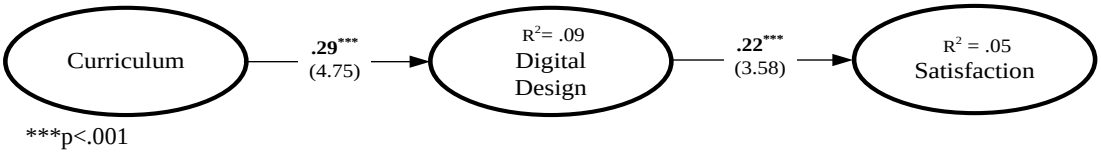

Figure 4. Competing model; H3 and H4

Elaborating on the primary result by means of a competing H3-H4 model enabled for reversal of the effect, hypothesizing that well planned curriculum affects a digital design, further affecting the teachers' satisfaction. H3 confirmed that curriculum affect teachers' perception of digital design (β = .29; p<.001). As expected with H4, digital design affect teacher perceptions of satisfaction (β = .22; p<.001). The R-square of the model explain between 5 to 9 % of variance in both dependent constructs. The competing model in Figure 4 show that curriculum indirectly affect satisfaction (β = .03; p<.002). This is a weak and indirect effect, meaning that digital design does not strengthen fundamental ideas of curriculum on perceived satisfaction.

7. ANALYSING THE PEDAGOGICAL DESIGN PROCESS

This study brings light to the discussion of "the hen and the egg". Teachers' mindset on curricula is a prerequisite for them to be confident and satisfied with the technology. Thus, functional pedagogical design processes begin with a curricular and/or personal relation to students, theory and practices. As teachers' share knowledge and experience with the students their "curricular relation" becomes central to the quality of teaching and learning. The teachers' and the students' conceptions ignite cultural-historical activity fuelled by social relations. The result of the teachers' supportive scaffolding is emerging queries between teachers and students. By interacting, providing feedback, supplying questions, modelling ideas and providing summaries the teacher learns how the students think. The teachers become guardians of a pedagogical relation, learning how the student understands the taught/displayed assignments, contents and problem solving tasks. Pedagogical leadership (for a digital context) by design, presence, authority or other is central to the effectiveness of the digital design. So is the teachers aim to bring curricular understanding based on design and student experiences of objectives and practices.

The deployed analytical framework applies for any virtual context as it portrays crucial characteristics and relations between teacher, digital design, students and objectives. Implications of the display suggest that the teachers' choice of digital design is the result of urgent tasks, goals and objectives. On the issue of teacher investment in curricula by "instructionism", the digital design equals the teacher's method by way of providing developmental tasks for the students. The teachers' digital design benefits from "cognitivism" and cultural-historical activity theory by repeated attempts at construing, i.e. striving for and reaching, an object of study (goal) and a learning object (process) with the students.

8. SUMMARY

Many teachers provide stimulating ICT-based interfaces for the students. Here we study the perceived curricular effect of such designs on teacher satisfaction. Results suggest that digital designs reinforce the impact of curriculum. Furthermore, teacher designed interfaces for teaching and learning mediate and

strengthen satisfaction. By reversing the relations, it is reasonable to assume that curricula affects digital design and breeding satisfaction among US teachers. However, there is weak support for the hypothesis. One implication of the results is that teachers benefit from outlining for themselves a search for the rationality of a relation between contents to be taught and learnt, then considering the method for doing so by digital design.

REFERENCES

Bentler, P. M. (1990). Comparative Fit Indexes in Structural Models, *Psychological Bulletin,* 107, 238-246.

Breault, R. (2009). The fundamentalist tendencies of the new curricularists, *Curriculum and Teaching Dialogue*, 12(1/2), 37-51.

Breen, R., Lindsay, R., Jenkins, A., & Smith, P. (2001). The role of ICT in university learning, *Studies in Higher Education*, 26, 95-114.

Connelly, M., & Xu, S. (2007). On the state of curriculum studies. A personal practical inquiry, *Curriculum and Teaching Dialogue*, 9(1/2), 3-19.

Cress, U., & Kimmerle, J. (2008). A systemic and cognitive view on collaborative knowledge building with wikis, *International Journal of Computer Supported Collaborative Learning*, 3(2), 105-122.

Dewey, J. (1909). *How we Think*. Boston: Heath & Co Publishers.

Dewey, J. (1916/1985). *Democracy and Education*, Carbondale: Southern Illinois University Press.

Engeström, Y. (2007). Enriching the theory of expansive learning: lessons from journeys towards co-configuration, *Mind, Culture and Activity*, 14(1), 23-39.

Friesen, N. (2011). The lecture as transmedial pedagogical form: a historical analysis, *Educational Researcher*, 40(3), 95-102.

Fuchs, L. S., Fuchs, D., Hamlett, C. L., Stecker, P. M., & Ferguson, C. (1988). Conducting curriculum-based measurement with computerize data collection: Effects of efficiency and teachers satisfaction. *Journal of Special Education Technology*, 9, 73-86.

Gieryn, T. (2000). A place for space in sociology, Annual Review of Sociology, 26, 463-96.

Hansen, D. (2007). John Dewey and a curriculum of moral knowledge, *Curriculum and Teaching Dialogue*, 9(1/2), 173-181.

Hansson, T. (2010). Co-construction of Learning Objects: Management and Structure. S. Wallis (Ed.). *Cybernetics and Systems Theory in Management: Tools, Views and Advancements*, New York: IGI Global.

Hansson, T. (2011). ICT, learning objects and activity theory. *Social Sciences and Humanities – Applications and Theories*/Book 1, InTech (in press)

Hirst, E., & Vadeboncoeur, J. (2006). Patrolling the borders of otherness: Dis/placed identity positions for teachers and students in schooled spaces, *Mind, Culture and Activity*, 13(3), 205-227.

Kaptelinin, V., & Nardi, B. (2006) *Acting with Technology. Activity Theory and Interaction Design*. MIT Press.

Keller, C. M., & Keller, J. D. (1996). *Cognition and Tool Use: The Blacksmith at Work*. Cambridge England: Cambridge University Press.

Kemp, A., Blake, B., Cooper Shaw, C., & Preston, J. (2009). A conversation about content versus pedagogy, *Curriculum and Teaching Dialogue*, 11(1/2), 103-119.

Kobbe, L., Weinberger, A., Dillenbourg, P., Harrer, A., Hämäläinen, R., Häkkinen, P., & Fisher, F. (2007). Specifying computer-supported collaboration scripts, *International Journal of Computer-Supported Collaborative Learning*, 2(2), 211-224.

McInnis, C. (2001). *Signs of disengagement? The changing undergraduate experience in Australian universities*. Paper presented at inaugural professorial lecture. Melbourne. Melbourne University.

Morris, A. & Hiebert, J. (2011). Creating shared instructional products: an alternative approach to improving teaching. *Educational Researcher*, 40(1), 5-14.

Nardi, B. (1996). Studying context: A comparison of activity theory, situated action models and distributed cognition. B.

Nardi (Ed.). *Context and Consciousness: Activity Theory and Human-Computer Interaction*, Cambridge: MIT Press, 69-102.

Ofsted Gradings for ICT. Accessed October 27, 2011. http://www.teach-ict.com/teacher/ofsted/ofsted.htm#curriculum – and referring to http://www.ofsted.gov.uk/resources/generic-grade-descriptors-and-supplementary-subject-specific-guidance-for-inspectors-making-judgemen

Papert, S. (1991). Situating constructionism. I. Harel & S. Papert (Eds.). *Constructionism: Research Reports and Essays*. Norwood NJ: Ablex Publishing Corporation. 1-11.

Piaget, J. (1977). Problems of equilibration. M. H. Appel & L. S. Goldberg (Eds.). *Topics in Cognitive Development*, New York: Plenum, 3-14.

Raudenbush, S. W. (2009). The Brown legacy and the O'Connor challenge: transforming schools in the images of children's potential. *Educational Researcher*, 38(3), 169-180.

Rogoff, B. (2003). *The Cultural Nature of Human Development*, New York: Oxford University Press.

Roth, W-M. (2007). Emotion at work: A contribution to third-generation cultural-historical activity theory, *Mind, Culture and Activity*, 14(1/2), 40-63.

Rueda, R., Gallego, M., & Moll, L. (2000). The last restrictive environment: A place or a context? *Remedial and Special Education*, 21(2), 70-87.

Salomon, G. (1998). Novel constructivist learning environments and novel technologies: some issues to be concerned with. *Research Dialogue in Learning and Instruction*, 1(1), 3-12.

Scanlon, E., & Issroff, K. (2005). Activity theory and higher education: evaluating learning technologies, *Journal of Computer Assisted Learning*, 21, 430-439.

Shayer, M. (2003). Not just Piaget; not just Vygotsky, and certainly not Vygotsky as *alternative* to Piaget. *Learning and Instruction*, 13(5), 465-485.

Sheard, J., Carbone, A., & Hurst, A. J. (2010). Student engagement in first year of an ICT degree: staff and student perceptions, *Computer Science Education*, 20(1), 1-16.

Stecker, P. M., Fuchs, L. S., & Fuchs, D. (2005). Using curriculum-based measurement to improve student achievement: review of research, *Psychology in the Schools*, 42, 795-819.

Stuhlman, M.W. & Piuanta, R.C. (2009). Profiles of educational quality in the first grade. *Elementary School Journal*, 109, 323-342.

Van Oers, B. (1998). The fallacy of decontextualization. *Mind, Culture and Activity: An International Journal*, 5(2), 135-42.

Vygotsky, L. (1978). *Mind in Society. The Development of Higher Psychological Processes*. Cambridge: Harvard University Press.

Wertsch, J. (1985). *Cultural communication and cognition: Vygotskian perspectives*. Cambridge: Cambridge University Press.