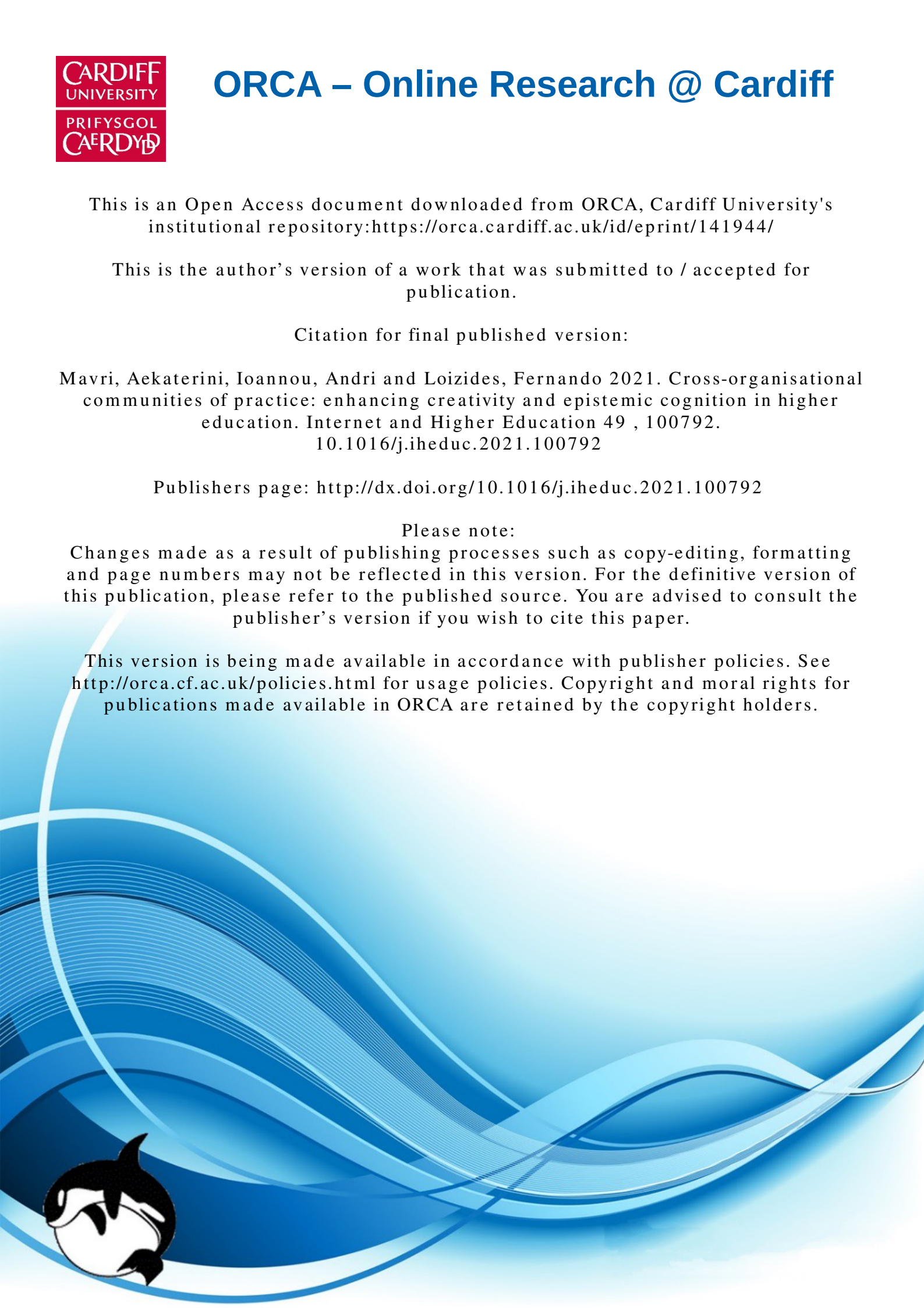

VALUE CREATION AND IDENTITY IN CROSS-ORGANIZATIONAL COMMUNITIES OF PRACTICE: A LEARNER'S PERSPECTIVE.

Abstract

The goal of this work is to evaluate the worth of *learning,* that resulted from student participation in a cross-organizational (industry-academia) Community of Practice (CoP). CoPs are groups of people who share common interest in a field and connect to co-create knowledge and competence. In this study, the CoP was integrated in a Higher Education Design course, following a blended-learning approach. Internal and external collaboration was primarily facilitated through online technologies.

The study employs the Value Creation framework to analyze the types and value of co-created learning and explores these results to draw inferences as to the effects of CoP participation on the learners' *identities*, which were continuously being reformulated.

The resulting CoP interactions indicated a strong *immediate learning* value. These also generated new insights (*potential value*) and familiarized learners with the characteristics of the real-world practice. The effective transfer of knowledge into the academic practice was confirmed by the significant improvements in student performances (*applied* & *realized value*). Finally, CoP participation steered a shift in learner perspectives, by pragmatically transforming their perception of achievement and orientating them towards transitioning and evolving in the professional sphere (*reframed value*).

Keywords: Communities of Practice, Cross-organizational, Value Creation, Identity, Creativity, Collaborative technologies, Real-world relevance

1. Introduction

The motivation behind this work stems from the reported lack of adequate higher education (HE) graduate capital and the mismatch between their actual -versus the expected - competencies in today's industry, particularly in the creative domains (Leung & Bentley, 2017; Mulgan et al., 2016; WEF, 2016). This gap results in lower employability prospects due to the graduates' inability to respond to complex workplace requirements; as these have shifted from basic subject knowledge, to attributes such as creativity, critical thinking and decision-making, life-long learning - and importantly - sound intra and inter-personal skills, such as self-awareness, communication, and collaboration, that are required in diverse work settings (Gilbuena et al., 2015; Mourshed et al., 2014; Scott, 2015).

One of the reasons for this skills gap is reportedly the lack of communication between industry and academia. Sternly designed curricula that are disconnected from the needs and authentic challenges of real-life practice, fail to motivate students to produce innovative outcomes, whose value is socially judged by their intended audience (J. S. Brown et al., 1989; Glăveanu, 2014a; Herrington et al., 2014; Lombardi, 2007). This lack of authenticity suggests a form of education that is distant from reality, driven by artificial objectives, shaped by predictable single-path problem-solving processes, while perpetuating individualistic effort, that is subject to rigid academic evaluation; all of which compromise *creativity* in the learning processes and outcomes (Runco & Jaeger, 2012).

Authenticity in modern-day education involves a high degree of *collaboration* amongst learners and external (industry) stakeholders, facilitated through effective online environments, for the production of innovative end-results that are suitable for real-world purposes (Glăveanu, 2014b). This is particularly true in the creative industries, such as the Design disciplines, incorporating fields like Engineering, Media & Technology, industrial design, HCI, and others (Nelson & Stolterman, 2014), that rely extensively on the social

human infrastructure and the inherent technology-supported collaborations for the development of useful, novel, and technically advanced products (L. Dym et al., 2005). The need for such creative and authentic connections has given rise to a wave of university-industry alliances (Edmondson et al., 2012; WEF, 2016). That said, only a few institutions have so far endorsed such incentives, hence the lack of research reporting on their contribution in learning (Albats, 2018; Ivascu et al., 2016).

This work, proposes that the model of Communities of Practice (CoPs) can support such alliances, bridging the two spheres (academia-industry) and leveraging their joint potential for learning. CoPs are groups of people with common interest and goals in a specific field, who connect to co-create knowledge and expertise (Wenger, 1998). In pursuing *authenticity* as part of a situative learning approach (P. Brown, 2015), in this work we add a c*ross-organizational* dimension to the original model, by inviting stakeholders form both the academia and industry (i.e. experts, mentors, clients) as participants (Iskanius & Pohjola, 2016; Probst & Borzillo, 2008). We do so as we hypothesize that the formal HE curriculum can be augmented through the experience of real-world practices mediated through the technology-supported CoP practice (Bhatnagar & Badke-Schaub, 2017).

Within cross-organizational and blended learning contexts, the role of online technologies is critical. Aside of enabling the necessary social *learning* and *collaboration* (collocated/remote) processes within the academic members, they also interconnect these with the *industrial* members of the CoP, who are inherently disparate in terms of *time*, *space* and *culture*. Thus, as the majority of effective CoP interventions in education evolve within the intra-organizational scope (academia or industry only) (DeChambeau, 2017; Fegan, 2017; Park, 2015; Pharo et al., 2014; Power & Armstrong, 2017; Tight, 2015), this study is significant, as it constitutes a first-time validation of a *technologically-enabled*, *cross-organizational* CoP model, that is directly embedded in the blended HE curriculum (Keay et

al., 2014). Additionally, the study responds to a critical gap in the investigation of CoPs, concerning their contribution to *learning* of *value*, particularly in specific epistemic domains, such as the Design disciplines (Amin & Roberts, 2008; Smith et al., 2017). In this regard, the role of technology gains special significance, in its call to support the particular Design-oriented, epistemic needs, rather than relying on a "one fits all" configuration (Hafeez et al., 2019). Specifically it should cater for processes like conceptual and practical experimentation, the creation of *visual* design (prototypes, flow-charts, sketches) and *programming* artifacts (i.e. interactive applications), that can be accessed or edited via a modular visibility scheme (i.e. private, team-based, class/group-wide, community-wide, public), in different rhythms (synchronously/asynchronously), and across various channels (i.e. audio/video, chat). The respective technology configuration design in this study, is extensively discussed in parallel work (author reference).

To therefore derive results in respect of the abovementioned objectives, we examine the learning processes and outcomes of HE Design students, as CoP members of a self-formed organic CoP that was extended for the purposes of this research, through the addition of external (industry) members, by employing the Value Creation (VC) framework to guide our analysis. This seeks to assess the *value of learning* that is co-created in CoP practice, by connecting "specific activities to desired outcomes" (Wenger, 2009). For clarity purposes, it classifies learning in five distinct cycles, by evaluating the *interactions* of the CoP, the *knowledge capital* created, its *transfer* into the practice, the CoP members' *performance* improvements, and their reframed perceptions of *learning* and *achievement*, as a result.

We then process these VC findings to understand the CoP's effects on the learners' *identities*. Identity is an integral part of social learning and thus its investigation within the graduate social capital can help derive conclusive inferences towards the quest for its viability in today's fast moving industries (Wenger, 1998).

This study is therefore primarily guided by the following questions:

RQ1: What types of *learning* are facilitated through membership in a technology-supported cross-organizational CoP, as classified by the Value Creation framework?

RQ2: How does membership in cross-organizational CoP impact the learners' *identity*, as a constitutive part of learning and professional viability?

The primary focus of this work is to report on its findings, exclusively from a learner's perspective. It hence employs the VC framework, which principally investigates phenomena related to *learners* and *learning*. While other perspectives (i.e. industry stakeholders) can help draw a more conclusive picture of the cross-organizational learning potential, it falls under a larger scope of research and is investigated in different work.

2. Theoretical background & related research

2.1. Communities of practice

Communities of Practice (CoPs) (Wenger, 1998) originate from apprenticeship and situated experience theories (J. S. Brown et al., 1989; Herrington & Oliver, 2000; Lave, 1991). Learning in CoPs presupposes a practice with three constitutive components: *joint enterprise* (common cause), *mutual engagement* and *shared repertoire* (common vocabulary, resources), which constitute the community a "living curriculum" (Wenger, 1998). Legitimate Peripheral Participation (LPP), that is, the entry and gradual enculturation of newcomers through various peripheries of *participation* and *engagement*, builds a *sense of belonging* and generates personalized learning opportunities for novices (Eggleton et al., 2019).

Within the CoP context, *participation* exists even in inactive or peripheral states. Conversely, *engagement* denotes a member's active involvement in the practice to serve the shared enterprise, rather than just 'fit in' (Wenger, 1998). *Engagement*, thus represents one

(of three) dimensions of *belonging* which are responsible for *identity* transformation in CoPs. The other two are *imagination* - the perception of the broader community (real-world) and thus, one's position in it (based on past experience and future potential), and *alignment* - the coordination of actions in order to adjoin and contribute to the broader community (Wenger, 1998).

As learning transforms who people are and what they can do, it is therefore inherently linked to *identity* (Woods et al., 2016), which is not merely an accumulation of skills and knowledge, but rather, an ongoing process of becoming - or a *trajectory*. *Identity* in the CoP is constantly reconfigured through the negotiated experiences at the intersection of the *local* (internal) and *global* (external) dimensions of practice (Wenger et al., 2009). A global dimension is inevitable, as people participate in various communities (fully or peripherally) which have *boundaries*, yet are far from isolated from one-another. In fact, their practice, history, and artifacts are the sum of accrued activity, that is both local, as well as transferable from other practices, what is known as *brokering* (Wenger et al., 2002b).

2.2. CoPs and authenticity in learning

Authentic education can help novices gain access to the professional practice of a community and develop real-world preparedness (Lombardi, 2007, Herrington, Reeves and Oliver 2014). Related studies performed various interventions to achieve this. Morton (2012) for instance, posited that in Design disciplines, the *studio* (for critiquing and social knowledge-building) was seminal in mediating real-world relevance, as it is also a key component in the industrial practice (Adams et al., 2016). Additionally, Gilbuena et al (2015), emphasized the beneficial role of *feedback* in small CoPs of engineering student-teams, by recruiting a researcher to act as the teams' coach. Going a step further, CoPs that emerged amongst students and experts in work-placements, were significant in overall learning (Johnston, 2016). Brown's (2015) study for instance, presents the positive

contribution of a CoP, in a physical professional setting; interns in this case, engaged in LPP, having the chance to observe and follow their supervisors during work.

While these interventions can improve learning, membership in a full-scale cross-organizational community, can arguably help attain critical industry knowledge and skills, while still at university (Jackson, 2016). Unlike on-location placements, this approach can filter irrelevant information and delays (typical of real-world practice) that don't serve to benefit learning. Instead, it allows focus on the essential requisites and challenges of practice, that can be enacted early on as entangled with academic practice (P. Brown, 2015; Herrington & Oliver, 2000).

2.3. Value creation

The Value Creation (VC) framework provides a "foundation for an evaluation process" (Wenger et al., 2011) of learning in CoPs through five cycles, that are neither exclusive or consecutive to one another, nor should they strictly materialize in full to signify learning *value* (Kirkpatrick, 1975). The cycles represent learning of:

- ***Immediate value***: members' activities and exchanges (sharing stories, asking/responding, solving problems) to serve the purpose of the practice.
- ***Potential value***: 'knowledge capital', co-created during practice. Even if this may never be applied, it holds value in itself and is categorized as:
    - ***Human* capital**: knowledge, skills, changes in attitude (i.e. motivation, sense of importance, confidence)
    - ***Social* capital**: networking, relationships, shared understanding
    - ***Tangible* capital**: useful resources (tips, tools, documents) accrued
    - ***Reputational* capital**: perceived significance of CoP membership, the status and reputation that gradually developed

    - ***Learning* capital**: ability to learn socially and transfer meaning to other contexts that evolves

- ***Applied value***. application and integration of knowledge into practice (i.e. exploring ideas, developing solutions)
- ***Realized value***. value of outcomes, performance improvements, quantifiable results
- ***Reframed value***. reformed understanding of learning and success criteria

According to the framework, it is vital for researchers to capture phenomena that evolve in CoP practice, primarily through the stories – or *narratives* - from participants (individual/collective). By linking specific activities in the narratives to respective outcomes, the importance of the framework lies as much in its robust evaluative role, as in its ability to provide *proactive* gear in cultivating VC in learning through CoPs (Wenger et al., 2011).

2.4. Virtual Communities of Practice (VCoPs)

The VCoP framework (Wenger et al., 2009) defines *configuration* as the collection of *tools*, *features* and *platforms* to comprise the technology that supports the practice. The framework proposes three steps for the technology configuration design: a) *understanding* the community's purpose (i.e. learning, collaboration, meetings) b) determining a *technology acquisition strategy* (i.e. selecting appropriate tools), and c) run-time technology *steering* to fix/improve emergent issues. The framework suggests that *orientations* – the particular community activities (i.e. meetings, projects, access to expertise, relationships) should first be identified by CoP administrators and be aligned with *subject-specific* phases and activities (i.e. prototyping, designing, developing, testing*)*. These can then be translated into technology requirements. Typical CoP-supporting technologies include social media and networking applications (i.e. Facebook, Twitter) (Komorowski et al., 2018), learning-management-systems (Park, 2015), generic productivity & storage systems (Google

Docs/Sheets) (Burns et al., 2016), Creativity Support Tools (CSTs) (Cherry & Latulipe, 2014; Shneiderman, 2000) and technical-communication sites (i.e. StackOverflow) (Frith, 2014; Mamykina et al., 2011).

2.5. Socio-emotional factors affecting learning

While willingness to participate in CoPs derives from their members' inherent, shared interest and goals, socio-emotional factors can influence their perceptions, consequent behaviors, and learning processes in practice (Reis et al., 2018). According to Kwon (2014) socio-emotional interactions are emotional externalizations within a social context (i.e. expression, familiarity-building, relationships, trust) that can critically affect the practice. For instance, studies suggest that people may resist *teamwork*, due to the level (or absence) of connectedness between them, as well as the *partial* – versus full - *ownership* of collectively-produced outcomes (Caspi & Blau, 2011). Likewise, knowledge-sharing processes are strongly influenced by interactions of *trust* or *conflict* in teams (especially remote ones) (Nilsson, 2019; Wang et al., 2019). Competitive tendencies between co-workers can impede collaboration and are also bound to have stronger consequences in exclusive online (versus blended) communities (Amin & Roberts, 2008; Nilsson, 2019). *Accountability* may also be more fragile in *virtual* communities, as it is subject to the affordances of technology (i.e. synchronous/asynchronous, communication, visualization), which can sometimes generate tension and feelings of individualism, rather than collegiality (Stone et al., 2017). That said, tension, is not always a bad outcome, as it can trigger new ideas, invite the expression of further exploratory activity (Marcandella & Guèye, 2018) and investigation, in order to support decisions and overcome conflicts (Kwon et al., 2014).

3. Method

3.1. Participants

38 third-year (in a four-year course) undergraduate students participated in the study, while attending the Web Design and Development (WDD) I module (13-weeks - semester 1). The students (age range 21-24, M=22.4) were divided by registration into two groups (**G1**, N=21 and **G2**, N=17) based on their direction (G1:Multimedia, G2:Graphic Arts). Students had previously followed the same curricula and their GPAs - on a scale of 10 - (G1: M=7,279, SD=,912), (G2: M=7,260, SD=,565) bore no statistically significant differences (t(36)=,074; p=,94).

In semester 2, the study involved only students from G1 (N=21), who continued to WDD-2 (consecutive course, 13-weeks), which was compulsory for their direction.

3.2. Procedure

Students in both groups formed mixed-gender teams (of four) and were assigned different real-life projects (see Table 1). Five local industry companies participated as clients in the CoP (see Table 2) by assigning projects to the different teams. Specifically, all briefs involved the design and development of websites based on individual company objectives (semester 1). Each project was thus developed twice - once by a team in G1, and once by a team in G2. Both groups shared identical syllabi and followed a problem-based learning (PBL) class-based approach. However, only teams in G1, had the chance to be part of the extended CoP and to interact with clients and other industrial stakeholders. The teams in G1, also had the chance to progress further (technically) with their projects in semester 2, while sustaining their CoP membership.

Insert Table 1 Here

Insert Table 2 Here

3.3. Research Design

This work, as part of a larger investigation in cross-organizational CoPs, followed a mixed-methods research design, by conducting a combination of qualitative and quantitative data collections and analyses (Creswell & Clark, 2011). In doing so, we sought to understand and triangulate various findings. Specifically, by using a quasi-experimental design approach, we investigated the effects of the intervention on students who participated in the CoP (G1=experimental group) - versus students who didn't (G2=control group), through the epistemic results (final exams) and creative outcomes (produced websites).

Furthermore, we examined various qualitative data (experimental condition only), to derive inferences as to the degree and nature of CoP participation, as well as its effects on learning and *identity*.

3.4. The cross-organizational CoP

3.4.1. Social Infrastructure

Shortly after course initiation the instructor and facilitator field-notes recorded an organically-formed (academic) CoP since the students' year 1 of their studies (see section 6.16.2). The industrial memberships (see Figure 1) were later on introduced to this pre-existing student CoP of the experimental group (G1) only and spanned across an entire academic year (2 semesters). The CoP stakeholders included: a) the *instructor* of the course b) a *floating facilitator*: a graduate student recruited as teaching assistant for in-class and online activities c) three *alumni mentors* with a minimum of 2 years industry practice, who gave feedback on project deliverables d) five *industrial mentors*, as clients who provided the projects, materials and regular feedback and e) three *industrial experts*, who evaluated the

final student websites. The experts were introduced as CoP members and made accessible to students, via a Social Networking (SN) group (Facebook) in semester 1.

Insert Figure 1 Here

The CoP model was slightly transformed in semester 2 (see Figure 2), following participant suggestions. Specifically, experts became more active in the community from the start, to benefit from on-going Design-oriented interactions, rather than merely evaluate student work, at the end of the semester. A different expert was thus invited to attend the class every two weeks and give talks about their academic-professional trajectories (background, transition to industry, challenges encountered in career path, counteractions), as well as provide insights and advice considering the status of the local and global Design industry. The experts were also more actively involved in the social network in semester 2.

Insert Figure 2 Here

3.4.2. ***Technology configuration***

The technology acquisition strategy for the CoP was driven by the following *intra* and *cross-organizational* objectives: a) *availability* (free/low-cost/subscription-based), b) *appropriateness and efficiency* for *epistemic* (WDD) and generic practice *orientations* (see section 2.4), and c) *familiarity* with tools already used by the organic community.

It is important to remind the reader that there was a spontaneously-created CoP by student participants since year one of their studies. This work sees this technology intervention as a 'snapshot' into the life of an ongoing organic CoP, with an expanded cross-organizational dimension (industrial members), supported by tools similar to those used in the pre-existing

community. As such, the technology 'stewarding' was primarily oriented towards avoiding any disruptions to the life of the community, and propagating the organic CoP activities through added tools that could cater for the new orientations demanded for its new cross-organisational practice.

Student teams were thus prompted to use *Conceptboard*, a virtual, real-time canvas, for brainstorming and experimentation (i.e. card-sorting, sitemaps), designing and resource-collection purposes (i.e. links, screenshots, design artifacts). *Google Drive*, *Documents* and *Sheets*, were also used for generic productivity purposes.

Community-wide technologies were introduced to connect the academic and industrial memberships, drawing emphasis on project work. Other than regular emails and conferencing tools, *Adobe's Behance* was used as an online portfolio and feedback forum for UI-design work. *Hypothes.is* was also used as an integrated webpage review tool for the development phases. Both allowed for comments on static and interactive website prototypes. *Google Hangouts* was also suggested for chat and video communication.

Further design-oriented and web-development tools (*Adobe Creative Suite* and *Axure PR*) were used by students, mostly in single-user mode. An in-depth analysis of the full technology configuration and adoption by CoP members is reported in a parallel study (author reference).

3.5. Data collection

3.5.1. Qualitative data

We ran semi-structured focus groups and one-to-one interviews to collect qualitative information in the form of participant narratives, as suggested by the VC framework (see Table 3). Specifically, focus groups were formatively conducted with the teams at regular iterations during the semesters, as we sought to gather real and current information about the team's natural behavior and interactions during group discussions (Bloor, 2001). Conversely,

we aimed at extracting more sensitive information - that doesn't normally surface in teams - through one-to-one interviews at the end of the semester (Gill et al., 2008).

Insert Table 3 Here

Driven by the VC framework (see section 2.3), the data collection focused on a) primarily, the participants' perceptions of their roles and responsibilities, and b) specific framework indicators that could elucidate the *value of learning* based on its five sub-cycles. Specifically students were prompted to talk about the perceived importance of their team-based and community-wide participation (i.e. activities, interactions - Immediate VC). They were also encouraged to talk about their social relationships with other CoP members and their feelings (i.e. trust, confidence), as well as provide insights about the status of their membership and its effects on learning (Potential VC). We also probed about the tools and resources used, how the co-created knowledge was transferred to the academic work (Applied VC), as well as how students perceived their resulting performances and outcomes (Realized VC). Finally, we asked them to elaborate on their beliefs on achievement and success in the Design domains and to talk about how the overall experience influenced them as students and prospective professionals. Instructor observation notes were used as supplementary material.

3.5.2. Quantitative data and instrumentation

Quantitative data was collected via a set of instruments, coding-schemes, and other score-based or frequency-driven methods, to derive evidence on the degree and nature of communication and collaboration in the CoP, as well as its effects on learning and performance.

Web Site Creativity Measurement Instrument (WSCMI). Developed by Zeng et al. (2009), the instrument measures website creativity based on seven factors (28 items), namely: *Aesthetic Appeal, Interactivity, Novelty & Flexibility, Affect, Importance, Commonality & Simplicity,* and *Personalisation* (see Appendix A, Table 4).

By employing a 7-point Likert scale, with responses ranging from "Strongly disagree" to "Strongly agree," the instrument was used to rate the student websites, by the external CoP members (N=11) (industrial experts, industrial mentors, alumni mentors), as well as graduate students and HCI researchers at the department (N=28), to further confirm and corroborate the evaluation findings.

Conceptual Knowledge Gains Assessment. Knowledge-gain scores were extracted via a final course exam (semester 1) in order to detect differences between students in the experimental and control conditions. The exams comprised 16 questions (12 multiple-choice, 4 open-ended) on theoretical and technical topics (see Appendix A, Table 5).

Feedback Coding scheme. Feedback posts (N=132 posts, N=9,939 words, M=75 words pp) were content-analyzed using Cummings' et al (2016) coding framework (see Appendix A, Table 6).

Communication. As inquisitive activity amongst CoP members denotes interest and engagement in the CoP's enterprise and signifies (primarily) an immediate type of VC (Linnenbrink & Pintrich, 2003; Wenger et al., 2011), it was thus important to capture such evidence. We collected communication data from both team-based (both groups) and community-wide emails (experimental group) and examine their frequencies (see Table 8).

4. Data analysis

Transcribed qualitative data was formatted and imported into NVivo, a Computer-assisted qualitative data analysis software (CAQDAS). We used a thematic analysis method in two

coding phases. Specifically, the initial phase of reviewing and coding adopted a *structural coding* method. This method provides a way to categorize text segments by topic, according to the questions asked in the data collection sessions, as a semantic (explicit, surface meaning) approach (Braun et al., 2019; Saldaña, 2015). It is typically used with large, semi-structured data from multiple participants, to get an initial indexing of the text and thus simplify further processing. The initial categories created, reflected topics of learning in CoPs, such as "common goals," "shared repertoire," "co-created knowledge," "perceptions of industry," "perceptions of achievement," then, socio-emotional factors such as "relationships," "trust," "accountability", and "competition," as well as references to technology tools and resources like "Social networking," "Facebook chat", and so on. Additionally, segments were coded under the "positive," "neutral" and "negative" tones.

This step was critical for entering the second coding phase, by using the VC cycles as priori codes, a process which involved *latent* (deeper, implicit, conceptual) coding judgements (see section 2.3). The overview classification by *topic* (phase 1) helped us become familiar with the data, thus accelerating coding phase 2. For simultaneously coded segments (i.e. coded under a *topic* from the phase 1 and a *VC cycle* from phase 2), this tactic also enabled subsequent comparison queries in NVivo and thus facilitated the analysis of data (Saldaña, 2015). This was clearly a complex process for researchers, as segments of narratives, rarely accounted for one distinct cycle; they shared considerable overlap instead (Booth & Kellogg, 2015). Simultaneous coding within more than one VC cycles was therefore applied in such cases.

Following several comparison and coding rounds, data were categorized under the best-fitting VC cycles as Table 7 shows. Some of these were denser, based on student narratives, than others (i.e. *Realized Value* or *Resources/tangible capital*), while some were

mainly informed by quantitative data (i.e. performance scores, number of artifacts), to infer the degree of VC. Detailed explanations are offered in each cycle, next.

Insert Table 7 Here

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5. Results based on the Value Creation Framework

The original CoP authors (Wenger, 1998) assert that the value of the VC framework lies in its ability to detect particular *indicators* in the *narratives* that match specific *cycles* of VC. Combining the two, helps create a robust picture of the value of learning in CoPs. In this study we provide a detailed analysis of findings investigated through the lens of the five VC cycles. We also include tables at the end of each cycle section, to summarize a) the relevant *indicators* suggested by the framework b) the specific *indicators* (positive/negative) extracted from the study and c) the data sources they originate from.

5.1. Immediate value creation

Immediate VC is naturally entrenched into the CoP activities and interactions (see Table 11). In this study these were observed in members' face-to-face encounters, but most importantly, extracted from the *email communication* and *feedback* posts (see Table 8), the *SN group* timeline (see Table 9) and the *group* and *team chats* (see Table 10).

Insert Table 8 Here

Insert Table 9 Here

Insert Table 10 Here

Participant descriptions of the rich interactions that occurred (primarily) in the online environments, showed evidence of the immediate VC in its simplest forms, such as information/resource/news sharing, announcements and clarifications, as well as in more structured forms, such as organizing, coordinating, collaborating, reflecting on work, assessing progress and examining work-based situations.

Several student impressions of the SN group were that it served as a forum, filtered only to the topics of interest (i.e. specific coding tasks), versus generic public Q&A sites, like Stack Overflow for example. Additionally, apart from peer help (highly valued in team-chats), members also relied on the instructor's or mentors' help, that were ad-hoc, versus the pre-defined academic meetings and office-hours. Students did not anticipate considerable input from the CoP experts, due to their "probably overly busy schedules."

Despite the lack of full engagement on behalf of the whole community, the SN group was perceived as a resourceful knowledge-base as much for active CoP members, as for mere observers. Specifically, students stated that even *peripheral participation* was essential, as previous threads between others served as examples for resolving their own issues:

[P1: It doesn't mean that everyone has to participate equally. Some people were indeed more active.. but we were there, watching...]

[P21: we might have had the same question and we solved it through observing… it was helpful.]

Peripherality was also key in collocated settings, as it allowed for observation of peers' effective team processes:

> [P19: […] other projects, how they had different clients, the way that they had to manage and deal with them […] group-wise you learn more… cause you see others' ways of producing work, faster, better… you learn through this just by observing.]

The narratives also provided evidence of the *quality* and *value* of such activities for learners. Primarily, these stemmed from the involvement of *industrial experts* in the CoP, particularly through their collocated presentations and their ensuing discussions with students (semester 2). A strong indicator of *immediate* value, was found in the talks which reflected on the experts' academic and professional 'trajectories' (triggering a process of *identification* for students*)*, rather than simply marketing their work and current statuses:

> [P14: They didn't come here to brag about their achievements… they talked about their beginnings… It's interesting to hear about it from people who were once in our position, how their lives developed and what they did in order to get here.]

Furthermore, participants were able to distinguish the significance of localized types of knowledge, based on the experts' experience in the local industry, versus more generalized information:

> [P5: I am a registered member in online channels and communities, for guidance on building a portfolio of work and talking with clients [...] but it was beneficial to learn about the local industry, since I can't find that information elsewhere […] and I need to know about it!]

Aside of *identification*, a strong indicator of the perceived *value of participation* and *engagement* was realized in the degree of expression enabled in the CoP, suggesting that students felt at ease (by order of preference) in their team-chats, the group-chat (class-wide) and their face-to-face encounters with external members (i.e. through informal discussions with experts). Additionally, there were reportedly several emotional act-outs, like fun remarks and jokes, as well as tensions and conflicts, that occurred in the group-chat. In fact,

amongst other factors, this may have caused the lower student engagement levels in the SN group, since activity was diffused through multiple channels of social communication. While most of such socio-emotional factors fall (conceptually) under cycle 2 (*potential* VC*)*, they are also partially addressed here. They refer to a level of *indifference* or *lack of connection* with other CoP members; some were described as "apathetic" and were the "cause of disappointment" for more active others, who felt eager to leverage the role of the practice to improve their learning:

> [P6: I was disappointed, I provided help and others didn't grab the opportunity… it really brought me down […]. Afterall everyone has to contribute!]

Participants also suggested that engagement may have been hindered by the problematic affordances of the SN platform, as the primary tool for community-wide interactions. Most of code-related posts on the timeline were accompanied by screenshots. Students preferred this over pasting actual code segments, as the timeline lacked code-formatting options. Some students used CodePen (code-snippet testing/showcasing tool) instead, to counteract such issues. However, having to swap between web applications was found cumbersome and thus affected active engagement in the SN group altogether.

Insert Table 11 Here

5.2. Potential value creation (Knowledge capital)

Most of the potential VC indicators (knowledge, relationships, tangible/intangible capital) were linked to the *feedback* from external CoP members (semester 1), and the face-to-face presentations and discussions between students and *industrial experts* (semester 2). The findings are organised in five *sub-cycles* next (for a summary see Table 13).

5.2.1. Human capital (personal assets)

The systematic *feedback* on student work, in terms of *volume*, *tone* and *focus* from *alumni* and *industrial* mentors, augmented the learning processes and outcomes, as reported in a parallel study (author's reference). Students also perceived it to have contributed valuable insights that were definitive of their progress. As feedback was extensive, ambiguous and often conflicting, it caused some initial 'breakdowns', that urged teams to regroup, reflect on their work, identify appropriate solutions, re-negotiate roles and adopt better learning regulation tactics.

Another influential factor behind the shift in learner knowledge and perspectives, were the regular *expert talks*, that presented the experts' career *trajectories*. Specifically, the challenges they faced during the transition into the Design industry and their counter-actions, triggered a degree of "healthy stress" in students and promoted awareness of the imminent industry endeavours:

> [P1: It was a bit stressful, as it was a long journey to get where he is [industrial expert], but it was beneficial to hear about it.]

Reportedly, students identified with them and demystified these endeavours, by acknowledging "that they (experts) didn't find things easy either" and therefore, they (students) "should not get disappointed" in achieving the personal and professional development they aspired to:

> [P20: Everybody was kind of lost (experts at the start of their careers)…], [They pushed us – through their talks – to believe in our work […] they told us that they made it in the end…]

5.2.2. Social capital (Relationships and connections)

Evidence of positive community-wide *relationships* (students, alumni mentors, industrial experts) was discussed in the previous section. We therefore report on the indicators associated with the social relationships regarding the *internal (academic) team* and *group* contexts (chats and face-to-face settings). The amount of time spent together and the degree of familiarity amongst peers, contributed towards a positive environment; as it stood, peers shared a *joint enterprise* in that they all aimed for good results, that could be "collectively achieved" (see section 6.2.1).

Expectedly, negative emotions also surfaced, particularly in two forms of *trust - epistemic and social*. *Epistemic* trust related to the degree of academic competence that was commonly acknowledged in the group. Participants explained that a history of subject know-how and supportive peer activity, helped establish the perceived competence and credibility of others in the community, since "history builds trust." Evidently, the people who had secured a degree of *epistemic trust* from peers were also active in assuming some form of *leadership*. They were also high performers and presented strong accountability towards the community. Nonetheless, the impact of *epistemic* trust was twofold. While it encouraged some to engage more in the practice, it made less confident others hesitate, making unhealthy self-comparisons and feeling vulnerable in exposing their weaknesses, fearing a hit on their self-esteem:

> [P1: 'A' (an active student) was posting (solutions on technical issues) and I couldn't understand most of them!], [Even if I am 100% sure about something, I won't write it…so that it doesn't backfire on me."]

Interestingly, fear of exposure was not caused by the CoP experts, but rather by the prospect of compromising their epistemic status amongst peers. Related to this, came issues of *social trust*, based on the students' social relationships. While they maintained close social

bonds, and collaborated on technical or generic matters, they did not comfortably share *creative* work (i.e. design) . They described this as a mitigating tactic for competition: maintaining the 'surprise technique' (only sharing finished versus work in-progress) and not exposing original ideas, could help prevent others from outperforming them instead:

> [P2: its different when I'm being asked to help… I will do it then. But I will not reveal my original work and allow others to benefit from my ideas… it will compromise the impact of my own work in the end.]

This approach was observed in a few cases and concerned *creative* work only, which was still openly shared between smaller clusters, rather than with the entire class.

5.2.3. Tangible capital

We were able to extract multiple design artifacts - as interim and final project deliverables - as well as files, reference lists, links, visualizations and comments, in the shared tools used in the CoP practice. Additionally, the communication frequencies (see Table 8) and the SN group timeline posts(see Table 9) represent CoP-wide generated artifacts. Students repeatedly attributed the importance of these tools, not only in their capacity to generate and store artifacts, but also to act as searchable indexes during practice. An indicative table listing the boards, design artifacts, chats, tasks & comments, files, projects and artwork pieces is presented below (Table 12).

Insert Table 12 Here

5.2.4. Reputational capital

This sub-cycle refers to intangible assets created in the CoP, such as student acknowledgment of the *reputation* and *status* of the broader professional community, as well as appreciation of their CoP memberships. Specifically, some students presented:

a) a high degree of collegiality and intend of contribution, driven by socio-ethical motives:

[P7: As long as there is interest and willingness to help, we can all move forward (progressing) together.]

b) an understanding and respect of the professional status, the authentic project criteria and required level of outcomes from experts in the field:

[P1: It was inspirational, I would like to be like him (expert), manage big projects and take on serious work!]

[P13: Competition has increased today (design industry), but so has the need for such people (digital designers)… therefore you have to plan ahead with a focus on exactly what you want to do (in order to succeed)]

c) an appreciation of emergent career prospects and reformed future perspectives: strong work portfolios, sound industry repute and promising professional collaborations were now significant:

[P2: I want to become a web designer, and these (experts) belong to professional companies… and I have a portfolio to build… for me this was motivating!]

[P8: I enriched my portfolio with real client work […] I also favor the prospect of this (company) becoming my client.]

5.2.5. Learning capital (learning transfer)

Narratives included several indicators of *reformed learning* attitudes. Specifically, students reported that their involvement in practice, enabled them to identify others' *personality traits* and *skills* and consequently make practical suggestions for learning improvements:

[P5: I believe this is important (managing CoP communication) especially for some who were in the periphery. They could develop their leadership

skills, which are characteristic of project managers […] especially people who are introverts would benefit.]

[P6: I became better through observation and imitation, why can't this way work for others too?]

The ability to detect competencies and weaknesses in a given field constitutes a crucial transferable outcome, enabling people to make effective partnership judgements, a much-needed skill in both academic and professional contexts.

Furthermore, several students emphasized the importance of effective planning and management, reflecting on their project initiation phases, which evidently felt 'quite uncertain'. Conversely, post-intervention narratives indicated increased confidence and significant improvements in terms of learning management:

[P18: It's not a matter of who knows what best, if you invest time you will learn anyway, but it all comes down to planning: let's put everything in order, finish one task, then start with the next one … don't work randomly, we cannot do that anymore...]

Lastly, reframed beliefs about *identity* in learning surfaced, both as an individual and a collective experience:

[P5: I learned that I had to have self-knowledge […] there was definitely an effect on me, a beneficial one. You learn to collaborate with people who are different (referring to industrial CoP members), to hear and respect their opinion and make an effort not to progress alone, but help others too (referring to student CoP members), so they learn from you and therefore everybody moves forward together.]

Insert Table 13 Here

5.3. Applied value creation

Applied value creation refers to the transfer and integration of knowledge co-created in practice, back into the practice. This transfer surfaced in several narratives (see Table 15). Specifically, aside of general *intra* or *inter-team* transfer, the most significant learning transfer was instigated by *feedback*, as a crucial factor of community-wide collaboration. Table 14 presents the findings of the content analysis on *feedback* (Behance posts (N=125), total of 9,939 words), based on the *type* and *tone* categories.

While its effects on learner perceptions and outcomes are extensively analysed in other work (author's reference), some prominent mentions are presented here too:

> [P15: It (feedback) helped us, we did the prototypes and we were stuck […] working on them again and again, non-stop […] they (alumni mentors) gave us a clear perspective (of our work), seen from a different lens.]

Insert Table 14 Here

The *feedback* was not only an *outcome*, but also a *stimulus* for work outcomes. Specifically, it urged students to make *proactive* adjustments prior to submitting work, based on self-forecasts of possible comments:

> [P19: I knew they would mention the buttons. I knew they were problematic, so I wouldn't post it (the prototype) […] we worked further on it instead) […] so that we would get better feedback eventually.]

At the same time, the extensive and challenging forms of feedback, caused frequent confusion and delays. As mentioned, students tried to counteract these through better regulation strategies; thus, both *proactive* and *reactive* responses to feedback, led to improved regulation and better outcomes, which denotes an effective degree of *Applied* VC.

Finally, students verified the importance of the theoretical principles learned in class, as they *concurrently* encountered them in CoP practice. Evidently, having the opportunity to put theory into practice, while working on industry projects, submitting deliverables to and receiving guidance from mentors and clients at the same time, confirmed the value of theory and offered learners a holistic understanding of the subject:

> [P19: UX design: I realized the whole meaning of this field, its branches and what paths we can follow as learners, I realized how diverse it is […] It was when we were working on the time-plan (Gantt chart), and I was responsible for it (i.e. providing the client with the time-plan) in the project)].

Insert Table 15 Here

5.4. Realised value creation

Realized VC refers to the *improvements in performance* as a result of CoP participation (see Table 18). In this case, indicators of realized *value* were discernible in the *epistemic* outcomes of students, such as the *final exam* scores and the *evaluation* ratings of the websites produced. Firstly, statistically significant differences (t(35)=-2,33; p=,025) were detected in the comparison between the experimental (M=66,95, SD =13,04) and control groups' (M=55,71, SD=3,92) exam scores (see Table 16), with a large effect size (d > 1,167; see Cohen, 1988). Additionally, the websites developed by the experimental teams were evaluated (M=4,17, SD=1,34) with significantly higher scores (see Table 17) to those of the control teams (M=3,23, SD =1,64). Participation in the cross-organisational CoP thus

resulted in higher epistemic and creative outcomes, a full analysis of which is presented in a different study (author reference).

Insert Table 16 Here

Insert Table 17 Here

Insert Table 18 Here

5.5. Reframed value creation

This cycle comprises indicators of *reframed success*, *learning* and *practice* imperatives, ensuing from CoP membership (see Table 19). Firstly, reformed achievement criteria were expressed by the entire group. The need for a 'sound academic performance' was now replaced by the desire to fulfill *broader* expectations that emerged through practice. In fact, the advent of experts, their talks and demonstrations of professional work, highlighted the students' perceived humble statuses and affected their self-concept, to some degree:

> [P11: we wanted to investigate… to find solutions for client requirements […]. We had high expectations, that were not met […] we were disappointed by the functionality we could not achieve.]

> [P20: He (expert) has achieved so much… and my portfolio only has two small projects in it.]

This is not necessarily a bad outcome. The transformed perceptions of *achievement* renegotiated the students' objectives, from purely academic (grades-driven), to more professional and community-driven. They were evidently now better able to understand

"what the industry and potential employers were looking for," so they could gear their efforts towards more meaningful directions. This urged them to reconsider their *identities*, both in terms of the skills they had or hadn't already developed, and hence realize where "they currently were" and where they were "headed to." To accomplish desired outcomes, new sets of reformed rules, imperatives and trajectories emerged for many:

[P4: He developed sample webpages on his own to build his portfolio. We will also follow his example this summer.]

[P13: They (experts) didn't worry about their weaknesses, they encountered them and built on them as they went along, they became more competent and thus developed their careers in this way.]

Insert Table 19 Here

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6. Discussion

In this work we set out to understand and analyze the *value of learning*, enabled through participation in a cross-organizational CoP by reporting on categorized findings based on the VC Framework (RQ1). In doing so, we also performed a first-time validation of the cross-organizational model in the HE Design and relevant fields, in purpose of equipping young graduates with creative and social aptitude and thus, work-readiness for their forthcoming transition to the industry.

We begin with presenting evidence that confirms the presence of a CoP, identified by constitutive CoP characteristics , as a basic prerequisite for the discussions that follow. Next we review the VC findings (as five different themes) from the perspective of *identity* (RQ2), which is an integral dimension of CoPs that helps contextualize *learning* based on its particular characteristics.

6.1. Identifying a community

Wenger et al. (Wenger et al., 2002a) state that while CoPs can take on a wide range of forms, they share common characteristics that help confirm their existence, enabling researchers to "see communities of practice" in various social formations. According to foundational theory (Wenger, 1998), CoPs present three critical dimensions: a *domain* (of knowledge), a *practice*, and a *community*. These are also identified in the social group under study in this work.

Specifically, the goals and shared identity of the participants, as scholars and practitioners in the *Design domain*, are the initial indicators of a community, made apparent in the discussion section, initially within the context of the (student-formed) organic community (section 6.2), as well as through its extended cross-organizational dimension (sections 6.3 to 6.7).

The data analysis also indicated rich interactions, strong meaning-negotiation, and competence-creation processes amongst participants (section 5.1), driven by their common challenges and efforts (sections 5.2.2 and 5.2.5), their shared use of technology and resources, and their extensive co-creation of artifacts (section 5.2.3). Respective findings indicated that these were not merely driven by academic objectives, but importantly by the student-participants' urge to access the flowing Design expertise in the practice, motivated by their forthcoming industry transitions (section 5.5).

This study also evidenced (through perceived and actual evidence) the strong learning and social bonds amongst students on the one hand, and their connections, professional relationships, and other career-oriented efforts with alumni and experts on the other (section 5.2.4). These confirm that the members' incentives for CoP participation went beyond the mere interactions of a class-based group, who simply connected with industry stakeholders to fulfil their course assignments. On the contrary, there is rich evidence to confirm the existence of strong intrinsic interest in the practice; that is – primarily - the "practice of being

students" (DeChambeau, 2017), the practice of 'becoming' and forming pre-professional identities (Jackson, 2016) (section 6.66.7), and - from the industrial members' perspective - the practice of cultivating the forthcoming Design workforce, and steering the local Design scene.

All of the above verify the presence of a sustained form of participation in the CoP - from its organic to its extended (cross-organizational) version - through its three-year life cycle. They reflect a community which is driven by the "social process of negotiating competence in a domain over time" (Farnsworth et al., 2016) and confirm that "for a community to form, the topic must be more than just a passing interest" (Wenger et al., 2009).

It is also worth noting that parallel work from the same body of research provides further support of the CoP's presence, by distinguishing it from other social formations (i.e. communities of interest, project teams, informal networks), and by explaining the rationale for its members' motivation and levels of participation in the practice (Author reference).

6.2. Constitutive dimensions of the CoP

In this study, a CoP was also identified through its three constitutive dimensions, joint enterprise, mutual engagement, and shared repertoire.

The pursue of a *joint enterprise*, through *mutual engagement* and a *shared repertoire*, are primary dimensions of a CoP, signifying the coherent relationship between *community* and *practice*, according to foundational theory (Wenger, 1998). We provide brief evidence on how these were reflected in the context of this study next.

6.2.1. Joint enterprise

As discussed (see section 3.4.1), a spontaneous CoP had evolved amongst classmates since year one of their studies, based on their common *status, goals, interests,* and *limitations*. Students specifically mentioned:

[P8: We were all trying, we focused on similar goals, that was, to achieve something (in the context of Design studies) […] yes, this was the goal, for all of us!]

Yet the expansion from an organic to a partially-stewarded, cross-organizational community introduced diverse memberships, rich information, and new relationships, transforming these goals consistently across the academic CoP membership. The *joint enterprise* now entailed not only gaining proficiency and sound academic grades, but also managing prospective industry connections and opportunities that emerged, and working towards professional outcomes for the real-world practice, in accordance to the following statement:

[P2: I am entering the industry while still being a student. I have to face the industry.]

[P7: Being evaluated by industry experts pushes us all to create something remarkable.]

Likewise, similar objectives were pursued by expert CoP members; these being, to have an active role in guiding the learning practices in HE and thus preparing the next wave of graduate human capital to enter the Design and adjacent industries. Both memberships' (academic/industrial) common enterprise was thus geared towards *authentic* learning, to generate skills, outcomes, and prospects that have real-world value.

6.2.2. Mutual engagement

Students participated in a spontaneous group-chat to connect socially and assist each-other on academic matters; for instance they posted course-related information, announcements and technical support snippets and engaged in collective problem-solving processes, as demonstrated in the examples:

[P20: "Anyone having server problems when uploading?"]

[P10: "I can't… it doesn't work for me :("]

[P20: "I cannot view the remote files in order to upload the local ones"]

(attached a screen-shot of the error message)

[P13: "Did you change your folder's location?"]

[P20: "Can I change the path of the folder?"]

[P9: "You can, if you edit the settings in 'manage sites'"]

[P20: "Thanks, I got it working now!"]

Additionally, strong social *connections* and *exchanges* were observed online, in the classroom, during break-times, as recorded in self-reported data. Aside of academic incentives, students interacted in additional dimensions of their socially-shared lives (Wisker et al., 2007). For instance they assigned a few students the rotational responsibility of bringing lunch to the lab, allowing others to focus on their work, especially when project deadlines approached. Such initiatives indicate a high degree of *mutual accountability* towards simplifying each other's lives, with the goal of learning, as part of a *joint enterprise* (Wenger, 1998, p. 87).

Similar engagement was recorded on behalf of external mentors, who provided vigorous feedback throughout the study. Importantly, the large amount of Behance posts as *recommendations* and *advice* (see table 6), rather than brief judgements, indicated sustained *commitment* to the practice (author reference). Additionally, members' efforts to maintain momentum and aliveness at times when participation was low, as acts of 'community maintenance', represent "the kind of coherence that transforms mutual engagement into a community of practice" (Wenger, 1998, p. 81).

6.2.3. Shared repertoire

Aside of collocated expressions and routines (i.e. stories, gestures), the community developed specialized means of online communication (language, symbols, resources). The members' chats revealed an adopted lexicon, containing abbreviated expressions and memes for daily exchanges (Dawkins, 1981). Using greeklish (greek text in latin characters and reverse), allowed for shorter but more inclusive words:

[P10: "Θενξξ," "Ομγκοτ," "NVM"]
(emphasized 'thanks', abbreviation of 'Oh My God' using Greek characters, abbreviation for 'NeVerMind')

[P6: "ipa lathos!!! create → adobe illustrator object to kouti.. je epilegeis curves!!!!"]

(greeklish with abbreviations for: "I was wrong, create a box in Adobe Illustrator and select curves," using deictic symbols (arrow) and communicating emphasis with exaggerated punctuation)

Resources were also frequently posted online; these included software downloads, useful articles, and screen-shots of important artifacts (notes, briefs, photos) (see Table 20). These materialized both on a class-group and a community-wide level.

All of the above represent both the explicit and tacit knowledge that was co-created over time, reflecting a "history of mutual engagement" (Wenger, 1998, p. 89) in the CoP practice.

Insert Table 20 Here

6.3. Activities and interactions: participation & engagement (Immediate VC)

The sum of activities and interactions were inherent in the face-to-face and online collaboration sessions, the frequent one-to-one interactions, communication threads, feedback

posts and overall SN community-wide exchanges. Below we examine these with a focus on *engagement*, that is the immediate active involvement in the community, as well as *participation*, that is the overall CoP membership that perpetuates, with or without *engagement*. Both are inherently linked to *identity* according to CoP theory.

In one aspect, the immediate type of CoP activity implies *engagement* as a *mode of belonging* in the practice. Although it fluctuated across time, it still constituted an important source of learning for the majority of participants (the assertion is reasoned in the next sections). The enabling factors for both *participation* and *engagement*, were a sense of *connectedness*, the degree of *familiarity* between learners, the development of *epistemic trust* and the gratification of *contribution* - as a social responsibility - mostly on a group-wide level (amongst classmates). On a community-wide level, participants mainly saw the immediate value of their participation in their *exchanges with CoP experts* (alumni, industrial mentors and experts).

Conversely, the factors impeding deeper *engagement* in practice concerned *competition*, *distrust* (at the intra and inter-personal level) and a *lack of interest* or *identification* with the community (for a few).

These findings verify two key conceptualizations associated with *identity* based on foundational CoP theory: a) the complementary nature of *individual* and *collective* identity and b) the learning benefits of both *participation* and *non-participation* in the CoP.

Firstly, the existence of both positive and negative factors concerning *engagement* and *participation*, ascertains the balance of individual versus the collective experiences of *identity*. It is unrealistic to assume that learning in CoPs, is of value only if it evolves flawlessly in practice. Aligning with underlying CoP theory (Wenger, 1998), our analysis extracted that for each sign of individuality (distrust, competition), a sense of collegiality (trust, familiarity, sense of accountability) emerged. For each conflict, tension or

disagreement between members, an act of loyalty and contribution (information-sharing, support, leadership, generosity) transpired. Thus *participation* and *engagement* – whether harmonious or conflictual - still enabled the negotiation of meaning and helped co-create knowledge and competence, transforming the learner *identities* accordingly.

Secondly, both *peripherality* and *non-participation* were constitutive of *learning* and *identity* reformation. In the cases of moderate participation, on behalf of a few (SN timeline), gathering 'glimpses' of information and drawing meanings, still contributed to learning of *value (Wenger et al., 2002a)*. *Peripherality* may have been due to difficulty in understanding the level of knowledge co-created, or making unhealthy self-comparisons. Nonetheless, it also suggested one's position and level in the CoP and revealed a path towards *full participation*, by presenting the 'optimum' (i.e. high levels of competence) and the means to get there (*potential*). The beneficial role of *peripherality* as a form of awareness and interest in practice without active involvement, in the gradual development of confidence was prominent in the study (*immediate*, *applied value*).

In other cases, participants simply attributed their failure to engage in practice in their lack of identification with the subject (WDD). Even so, they still acknowledged the value of the practice, particularly through the encounters with experts who motivated them to "consider their options" and "feel better prepared" for their industry transition (*potential, reframed*). Even in the absence of *full participation*, the practice still mediated information from the global community (industry), even for those who didn't fully identify with it. Hence lack of or peripheral participation helped transformed learner *identities* in the CoP.

6.4. Valuable Insights and imagination (Potential VC)

An instrumental factor of *potential and reframed value* creation in learning, was the exposure of learners to *paradigmatic* trajectories, as the "lived models" (Wenger, 1998) of practice, that were communicated by experts in the CoP (alumni & expert mentors). One step before

the onset of their careers, learners appreciated the legitimate access to this information, admitting that it surpassed other forms of learning. By highlighting the *trajectories* - rather than merely publicizing accomplishments - the expert stories stimulated cycles of *identification* and *negotiability* for learners (Wenger, 1998).

Firstly through identification, they became invested in their relationships with experts, they were inspired, motivated, and also cautioned about the realistic challenges lying ahead (Woods et al., 2016). The communication of both *encouraging* and *unfavorable* 'truths', as well as the precise and *localized* guidance, made the majority of participants feel more confident, in terms of vocational *awareness* and the status of their intended profession. It also 'grounded' them, urging them to 'move outside the comfort zones,' initiating a process of *alignment* with the global community (Wenger, 1998). Through the new *meaning negotiations* that transpired through the encounters with experts, they reflected on and reformed their own projected trajectories "towards membership in the professional community of practice" (Morton, 2012).

Anchored in their new industry connections and their improved self-trust (following the implementation of *real-life* projects), career development and partnership prospects became highly plausible. Whether they would – or not - be realized, these aspirations were acts of *imagination*, in progressing from a *local* to a 'global' projected reality "that becomes constitutive of the self" (Wenger, 1998) and transforming, in this way, the *identity*.

Finally, a key aspect of *potential learning value* in the study, was the transfer of boundary objects (see section 2.1). These refer to a) the *artifacts* produced in practice (i.e. briefs, reports, time-schedules, Gannt charts, sitemaps, low/high-fidelity prototypes) and b) the dissimilar member *exchanges,* in the form of posts, chats and other communication elements, as *boundary objects* that traversed practices to reach a diverse audience (students, alumni, expert and industrial mentors). Technology was critical in allowing these objects to

be mediated across boundaries. It thus supported more unified forms of *participation* and *reification* in the practice through objects that carried rich and diverse information with them.

6.5. Influence on practice and brokering (Applied VC)

Amongst other factors, the systematic and rigorous *feedback* on a community-wide level, was constitutive of the *applied learning value* that was generated by the CoP. It highlighted the importance of the interactions between *local* and *global* forms of *identity* in practice. In this regard, the *identity* of CoP members was not entirely local, since it didn't solely focus on academic objectives, but also embedded *understandings* and *aspirations* of fitting into the broader community across *landscapes of practice* (Wenger, 1998, 2013).

It was evident that, although challenging, *feedback* mediated insights, judgements, methods, criteria, directions and expectations, that were key in other communities or constellations of communities (global) into the local practice – what is defined by theory as *brokering* (see section 2.1) (Tierney, 2016). As the experts had established a satisfactory level of *legitimacy* in the CoP, they influenced the teams' practice through *feedback,* which had to be integrated into the work either *proactively* or *reactively*. This required efforts for translation, coordination and alignment in comprehending and reacting upon it. The initial team tensions and breakdowns that feedback caused, "fertilized" (Marcandella & Guèye, 2018) a series of creative *co-regulation* counteractions and led to greater epistemic achievements in the end, as these were made evident in the *realized VC cycle* analysis.

Thus, feedback, as a strong form of *brokering* in the cross-organizational CoP enabled learning in ways that might not have otherwise materialized in traditional HE or *intra*-organizational CoPs. This expanded the learner *identities* significantly through an interplay of *local* and *global* perspectives that had to be understood and managed to achieve alignment with the broader community.

6.6. Effects on performance and boundary experiences (Realized VC)

The emergent social relationships in the CoP and the strive for outcomes of quality that would be valued by experts, generated increased commitment and creative effort in learning. This became evident in the student outcomes, in terms of subject-level knowledge (exams) and the website evaluations. Further, the swapping of roles from *learner* to *educator,* to train less-knowledgeable stakeholders (clients)*,* so as to establish good communication and deliver knowledge (i.e. user-manual and training), confirms the renegotiation of learner perspectives. Understanding the *broader* practice and opening a *window* for others into the *local* practice, yielded a shift in learner *identities*, in order to manage this "rich and complex set of relations" (Wenger, 1998), as a series of *boundary* experiences in the CoP. As these lessen the distance between *identity* in education (local) and *identity* in its pre-professional and professional states (global), they therefore indicate a strong degree of *realized* VC (Jackson, 2016).

6.7. Shift in perspectives and alignment (Reframed VC)

This study set out, with a main goal to inform about and orient novices towards the broader context of their practice (global), by inviting external members to mediate the industry into the curriculum. As verified by narratives in all VC cycles, it has effectively realized this goal. Through the maturation of practice, a lot of the energy in the *local engagement* shifted toward the *broader* community (global). The expert insights steered acts of *imagination*, by expanding students' understanding of the practice, cultivating their aspirations and highlining their professional potential.

Resulting from these, the assessment criteria and the concepts of *achievement* and *success* were also transformed to match those of the global community. This was largely attributed to their influential exchanges with alumni and expert mentors, as well as their *boundary* experiences with industrial mentors (clients), through their collaboration in authentic projects.

Whether these carried a positive (exemplification, motivation) or negative (stress, affected self-concept) valance, they indicate a high level of *reframed* VC, since new understandings and imperatives for learning and practice emerged in both cases. They involved *inter-personal collaboration* skills (i.e. detecting own and others' traits, developing people-skills, co-regulating processes) and *vocational* preparedness (i.e. adopting expert development tactics for work-portfolios, safe-costing, career-seeking and alignment with industry criteria) as efforts of *alignment* (Wenger, 1998). *Alignment* requires learners to autonomously set new work strategies, to coordinate their energy and actions in gradually becoming members of the global (professional) community. These significant indicators of *reframed* VC, strongly confirm the restructuring of learner *pre-professional Designer identities*, through the sum of experiences collected in their CoP memberships (Jackson, 2016).

In effect, this research confirms the realization of the *three modes of belonging* grounded in the principal CoP theory, that are constitutive of *identity* transformation through CoP practice. These reflect modes of *engagement*, *imagination*, and *alignment*, that were cultivated in practice through exposure of learners to paradigmatic trajectories, the transcendence of *objects* across the two spheres, and the valuable *boundary experiences* that were enabled through the CoP (see Table *21*).

Insert Table 21 Here

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7. Conclusion

The objective of this work was to assess the *value* of *learning* and effects on *learner identity*, as the result of participation in a technology-supported, cross-organizational CoP in Higher Education Design studies.

Using the Value Creation framework, findings are classified based on five distinct cycles. The abundant *learning* and *collaboration* exchanges, through full and peripheral participation indicate sound *immediate* learning *value*. A shift in learner perspectives, the emergent relationships, and the co-created artifacts in practice, denote learning of *potential value*, that was subsequently transferred to respective academic outcomes (*applied value*). The impact of this transfer was confirmed by the significantly higher epistemic attainments (*realized value*) between student members (experimental) and non-members (control) of the CoP. Learners underwent a transformation in their perceptions of achievement, that transcended the academic, to appropriate the real-world criteria and standards (*reframed value*). All denote a modulation of *identity*, driven by the prospective transition, enculturation and evolution within the broader professional landscape of practices.

In deriving these outcomes, the study uncovers the critical interlocking of the *technological*, *epistemic* and *social* designs that constitute an appropriate ecology for the complex practices of CoPs in Design and adjacent educational fields. Extensive work on each of these designs is presented in parallel individual studies (author reference).

It should be emphasized that the cross-organizational model lies, in its largest part, on the *learning* and *collaboration-supporting* technology configuration, that on one hand, allows the local activities of learners and faculty in a blended-learning setting, while on the other, transcends *space* and *time* to interconnect and infuse these with *standards*, *practices* and *cultures from* industry practice. Technology is thus an integral part of the cross-organizational CoP model, as *learning* is fundamentally sustained by the affordances of collaboration technologies, while being infused with *authenticity* from the real-world practice.

The findings of this work are important for instructional technologists, educators, researchers and practitioners who wish to integrate this model into their learning processes.

Hence, the significance of this work lies in the reporting of: a) the *design* and *enactment* of the *technological*, *epistemic* and *social* infrastructure of the cross-organizational CoP model b) the *causes* and *outputs* of CoP practice that define and corroborate the *value* of learning and its consequent effects on *identity*, c) its *theoretical contributions* that go beyond over-researched concepts (i.e. *mutual engagement*, *joint enterprise* & *shared repertoire*) to focus on more critical insights of CoP research, such as their *evolution* over time, their learning *value* and their impact on *identity*, (Smith et al., 2017), and d) a first-time validation of the cross-organizational model in conjunction with the Value Creation analytical framework, within the context of Design and relevant studies (Media & Technology, Engineering, HCI).

This work is limited primarily by the type (convenience) and size (N=39) of its sample, which makes it difficult to generalize findings to a population with different demographics. However, to enable the findings' *transferability*, we provide an extensive description of the research context regarding the *technological*, *social* and *epistemic* CoP infrastructure in a parallel study (author's reference), in order to ensure that other researchers are able to transfer the model and explore its potential with different samples in diverse contexts.

An additional limitation concerns subjectivity and reliability issues that often surround qualitative methods, due to lack of objective and replicable findings. Such issues may be partially rectified, by conducting and reporting on inter-rater agreement. This represents what is known as a '*small q*' approach, which attempts to bridge the qualitative-quantitative gap, through consensus-coding and resulting reliability values (Braun et al., 2019). However, the VC analysis in this study follows a purely qualitative paradigm, which prioritizes the researcher's role and depth of engagement and sees *subjectivity* in the observation judgements, not only as valid, but also an asset (Braun & Clarke, 2013, p. 94). The experience of the researcher, as the instructor in the intervention in this case, was the

enabling factor behind the interpretation of data, through the understanding and capturing of ideas that lay "beneath the surface." We thus considered it unjust to subject the worth of this analysis, to a mere value derived between coders who would be limited to drawing *semantic* (surface), rather than *latent* (deeper) observations. Instead, we abide to a situated process, which considers the researcher's role and input as critical in the knowledge production processes.

Finally, following the analysis of the VC findings, future plans involve the extraction of implications for instructional and sociotechnical governance with a focus on Design-oriented cross-organizational communities.

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Appendix A.

Table 1. Experimental group students as study participants

Participant	Team	Role*	Gender
P1	A	M	F
P2		PM	F
P3		M	F
P4		M	F
P5	B	M	F
P6		PM	F
P7		M	F
P8		M	M
P9	C	PM	F
P10		M	F
P11		M	F
P12		M	M
P13	D	PM	M
P14		M	M
P15		M	F
P16		M	F
P17		M	M
P18	E	M	F
P19		M	F
P20		M	F
P21		PM	F

Table 2. Experimental, control group teams & external CoP members

Client/project domain	Law Consultancy	Non-profit	Sports Management	Property Development	Investment Services
Team	A	B	C	D	E
Experimental (CoP)	- 4 female	- 1 female - 2 male	- 5 female	- 2 female - 3 male	- 3 female - 1male
Control	- 4 female	- 5 female	- 5 male	- 3 female	-
Alumni mentors	- 2 female, 1 male				
Industrial mentors (clients)	- 3 female, 2 male				
Industrial experts	- 3 male				

Table 3. Data collection methods, semesters 1 & 2

Semester 1		Group	
		G1	**G2**
Interviews	10 participants (N=253 min, N=8,095 words)	✓	
Focus Groups	5 teams x 3 sessions (N=457 min, N=14,357 words)	✓	
Observation notes	Instructor/interviewer		
WSMCI (Web Site Creativity Measurement Instrument)	39 participants	✓	✓
Final exams	39 participants	✓	✓
Behance feedback posts	5 teams, 3 alumni mentors, 5 industrial mentors (N=101 posts, 9,977 words)	✓	
Emails	G1 N=54 email treads - G2 N=25 email treads (within-team)	✓	✓
	G2 N=14 email treads (with alumni mentors)	✓	
Artifacts in Conceptboard & GoogleDrive	N=1393 (artifacts, chats, notes, boards)	✓	
Semester 2			
Interviews	8 participants (N=360 min, N=12,717 words)		
Focus Groups	5 teams x 1 session (N=318 min, N=18,498words)		
Observation notes	Instructor/interviewer		
Facebook group timeline (SN)	N= 205 posts		
Client Training & manual evaluation	N=5 industrial mentors x 5 teams		

Table 4. Web Site Creativity Measurement Instrument (WSCMI) by Zeng et Al. (2009)

1. Aesthetically appealing design	1. Artistic 2. Colourful 3. Energetic 4. Beautiful 5. Fascinating 6. Entertaining 7. Engaging 8. Attractive 9. Favourable 10. Desirable
2. Interactive design	11. Interactive 12. Animated 13. Multimedia-available 14. Dynamic
3. Novel and flexible design	15. Original 16. Appealing 17. Flexible
4. Affective design	18. Stimulating 19. Pleasing 20. Delighting 21. Exciting
5. Important design	22. Relevant 23. Important 24. Crucial
6. Common and simple design	25. Infrequent 26. Rare 27. Sophisticated
7. Personalised design	28. Personalised

Table 5. Examples of questions in the conceptual knowledge assessment (exams)

Short answer questions	
• Which graphics file type would you choose, if you had to optimise a full-colour image with multiple gradients, to achieve a lossless image compression for the web and why? • Please explain the two main advantages of using a <label> tag rather than plain text in HTML forms.	
Multiple choice questions	
• Please select two of the following options, which reflect correct syntax for the label tag in an HTML form:	**a.** `<label id='student'>` long description `</label>` `<textarea id='student'>` text `</textarea>` **b.** `<label>` long description `<textarea id='student'>` text `</textarea> </label>` **c.** `<label>` long description `</label>` `<textarea id='student'>` text `</textarea>` **d.** `<label for='student'>` long description `</label>` `<textarea id='student'>` text `</textarea>`
Long answer - Essay type questions	
a. Explain the concepts of a) 'grid-based' and b) 'above the fold' design. b. Discuss how these translate to design heuristics for the web.	

Table 6. Cummings' et al. (2016) feedback coding scheme

Domain	Category	Description
Focus	Form	Answers the question "what is it?" Typically a noun and could be an analogy to describe the feature
	Function	Answers the question "will it work." Can typically be identified by verbs. Could also be identified by calculations and feasibility
	Representation	Feedback refers to writing and presentation of the design work
	No Code	Does not fit in any of the above sub-categories
Type	Judgment	When critics reacted to what they saw and rendered some assessment of its quality
	Process Oriented	When critics made statements or asked questions about the student's design approach or process as process-oriented feedback
	Brainstorming	When critics essentially asked questions or made statements about future imagined possibilities for the design
	Interpretation	When critics reacted to what they saw and tried to make sense of the concept or product
	Direct Recommendation (Visual)	When critics gave specific advice about a particular aspect of design using sketching or other visual means
	Direct Recommendation (Verbal)	When critics gave specific advice about a particular aspect of design verbally
	Investigation	When critics requested information
	Free Association	When critics made reactive, associative statements about the design
	Comparison	When critics contrasted the design or design process with something else
	Identity Invoking	When critics made statements or asked questions to suggest that students consider the larger picture of themselves as designers in a future professional community
Tone	Positive	Praise and no suggestion for change. Feedback complimenting the team or design work
	Neutral	Feedback states a fact without any explicit evaluation of work or need for change
	Negative	Feedback implies the design work needs to be changed

Table 7. Value Creation (Wenger, Trayner, & De Laat, 2011) coding scheme & resulting references

Value creation cycle		References
Cycle 1: **Immediate Value**	Networking/community activities and interactions	247
Cycle 2: **Potential Value**		447
a. Personal assets (human capital)	Useful skills, new insights and perspectives	185
b. Relationships & connections (social capital)	Knowledge as a collective good distributed across a community	176
c. Resources (tangible capital)	Access to resources (documents, tools, procedures, links, visualizations)	18
d. Collective intangible assets (reputational capital)	Reputation of community, status of profession, collective voice, recognition	3
e. Transformed learning (learning capital)	Enlightenment in learning, transfer in other contexts	65
Cycle 3: **Applied Value**	Adapting and applying knowledge capital	30
Cycle 4: **Realized Value**	Performance improvement	5
Cycle 5: **Reframed Value**	Redefining success and learning imperatives	144

Table 8**.** Frequency of communication in experimental & control groups

		Faculty members		**Alumni mentors**			**Industrial mentors**	
Group	Team	Team emails (threads)	Team emails (unique)	Alumni mentors emails (threads)	Alumni mentors emails (unique)	Behance feedback posts	Client emails - threads	Client emails - unique
	1	10	20	3	5	27	8	10
	2	9	23	2	12	21	6	15
Exp.	3	9	37	3	13	24	10	24
(CoP)	4	7	20	2	6	26	1	1
	5	19	47	4	9	27	4	8
	Total:	**54**	**147**	**14**	**45**	**125**	**29**	**58**
	1	1	1			n/a		
	2	11	42					
Control	3	8	16					
	4	5	13					
	Total:	**25**	**72**					

Table 9. Facebook (SN) group timeline results by posts, rating, reaction, shares & comments

	N	Maximum (per post)
Posts	205	
Rating	374	73
Reaction	374	12
Shares	0	0
Comments	418	23

Table 10. Team & group (experimental) chat word counts

Team	words
A	33,585
B	9,604
C	8,194
D	27,590
E	2,238
Group Chat	69,263

Table 11. Immediate Value Creation framework indicators (Wenger, Trayner, & De Laat, 2011), themes & data sources

Cycle 1: Immediate Value			
Indicator	Themes		Source
	Positive +	*Negative -*	
Level of participation Level of engagement	Core group participation Peripheral Participation	Low SN group engagement	Self-reported
Level of activity Collaboration	Actual data (see *source* column)	Low SN group activity Technology affordances	SN group Group Chat Team Chats Emails Feedback posts Meetings
Quality of interactions Value of participation Networking Value of connections	Expert trajectories Authentic localized data Emotional expression	Indifference	Self-reported
Reflection	Legitimacy Contribution / social responsibility	Disappointment	

Table 12. Artifacts and resources in tools: Conceptboard, Google Drive & Behance

Conceptboard					Google Drive	Behance		Total
Team	Boards	Objects	Chat messages	Tasks & Comments	Files	Projects	Artwork	
A	3	134	59	17	14	4	14	245
B	2	126	15	7	185	7	16	358
C	1	172	8	28	99	7	49	364
D	3	91	18	9	42	3	12	178
E	3	64	133	4	26	4	14	248

Table 13. Potential Value Creation framework indicators (Wenger, Trayner, & De Laat, 2011), themes & data sources

Cycle 2: Potential Value			
Indicator	Themes		Data Source
	Positive +	*Negative -*	
Human capital Skills Acquired Information received Change in perspective Inspiration Confidence	Trajectories Changes in perspective: encouragement, motivation, confidence	Stress	Self-reported
Social capital Types and intensity of social relationships	Familiarity Trust: epistemic Leadership Competition	Individuality Distrust: social Fear of exposure	
Tangible capital	URLS, resources, artifacts		Actual
Reputational capital	Live projects, clients, mentors Status of profession Career prospects		
Learning capital	Metacognition, co-regulation Intra/inter-personal skills Collaboration		Self-reported

Table 14. Feedback coding frequencies by *Type* & *Tone*, following content analysis using Cumming et al.'s (2016) scheme

Tone	**Negative**		**Neutral**		**Positive**		
Type	instances	%	instances	%	instances	%	Total
1. Direct Recommendation	140	27,3%	77	15,0%	23	4,5%	240
2. Judgment	93	18,2%	8	1,6%	50	9,8%	151
3. Brainstorming	13	2,5%	18	3,5%	10	2,0%	41
4. Interpretation	19	3,7%	7	1,4%	6	1,2%	32
5. Investigation	14	2,7%	14	2,7%	1	0,2%	29
6. Comparison	13	2,5%	4	0,8%	2	0,4%	19

Table 15. Applied Value Creation framework indicators (Wenger, Trayner, & De Laat, 2011), themes & data sources

Cycle 3: Applied Value			
Indicator	Themes		Data Source
	Positive +	*Negative -*	
Implementation of advice/solutions/insights Use of tools and documents to inform Practice Innovation in practice Innovation in systems	Feedback transfer: proactive / reactive Reformed co-regulation	Confusion Frustration	Self-reported
Transferring learning practices	Concurrency in theory & CoP practice (application)		

Table 16. Experimental and control group exam scores' independent samples t-test

	Experimental			**Control**					
	N	Mean	S.D.	N	Mean	S.D.	t	d.f.	P	Cohen's d
Exam scores	21	66,95	13,04	17	55,71	3,92	-2,33	35	,025	1.167

Table 17. Comparison of website creativity evaluations' (WSCMI) independent samples t-test

	Experimental			Control			t	d.f.	P	Cohen's d
	N	Mean	S.D.	N	Mean	S.D.				
Aesthetically appealing design	167	3,89	1,28	143	2,97	1,60	-5,46	271,03	<0,001	0,628
Interactive design	173	4,30	1,20	144	3,30	1,51	-6,37	270,15	<0,001	0,727
Novel & flexible design	173	4,00	1,27	144	2,97	1,50	-6,52	281,67	<0,001	0,742
Affective design	170	3,76	1,30	144	2,73	1,60	-6,21	274,80	<0,001	0,710
Important design	173	4,22	1,17	143	3,47	1,61	-4,66	253,58	<0,001	0,535
Common & simple design	172	3,45	1,31	144	2,81	1,34	-4,23	301,63	<0,001	0,478
Personalised design	173	4,01	1,52	143	3,28	1,72	-3,91	286,39	0,001	0,444
Overall mark	173	5,77	1,67	144	4,34	2,26	-6,31	258,22	<0,001	1.223

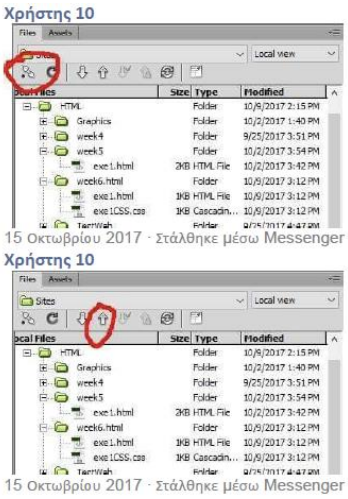
Table 18. Realized Value Creation framework indicators (Wenger, Trayner, & De Laat, 2011), themes & data sources

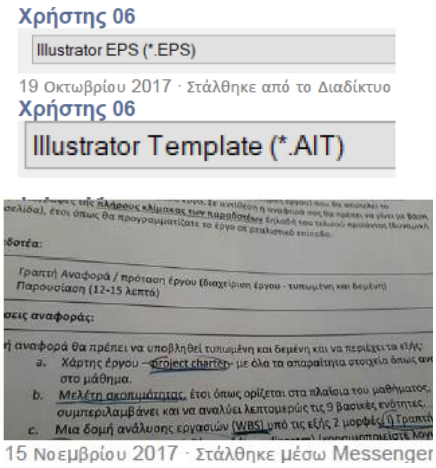
Cycle 4: Realized Value			
Indicator	Themes		Data Source
	Positive +	*Negative -*	
Personal performance			
Organizational performance	Knowledge gains		Actual
	Creative achievements		
Organizational reputation			
Knowledge products as performance	Delivery of knowledge products: user manuals and training	Frustration	Actual Self-reported

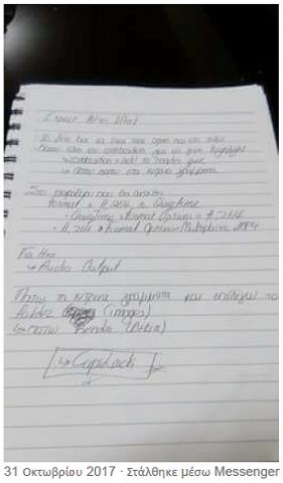
Table 19. Reframed Value Creation framework key indicators (Wenger, Trayner, & De Laat, 2011), themes & data sources

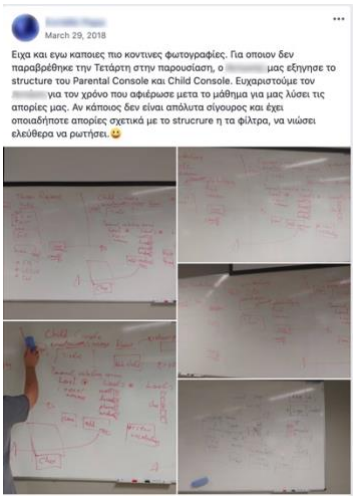
Cycle 5: Reframed Value			
Indicator	Themes		Data Source
	Positive +	*Negative -*	Self-reported
Community aspirations	Understanding of global community needs		
Assessment	New metrics Reformed criteria of achievement	Stress, self-concept	
Relationships with stakeholders	Admiration, adaptation		
Institutional changes New frameworks	Specific pointers & directions		

Table 20. Collective artifacts as indicators of *shared repertoire* in the CoP









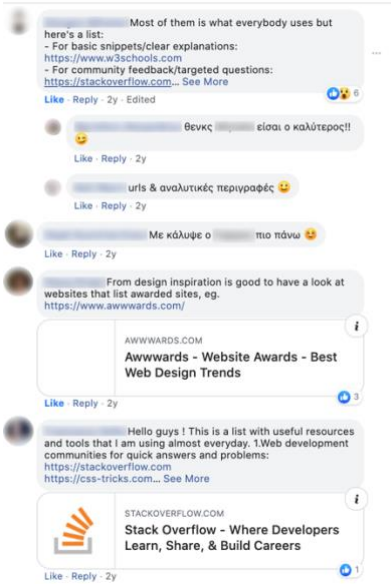
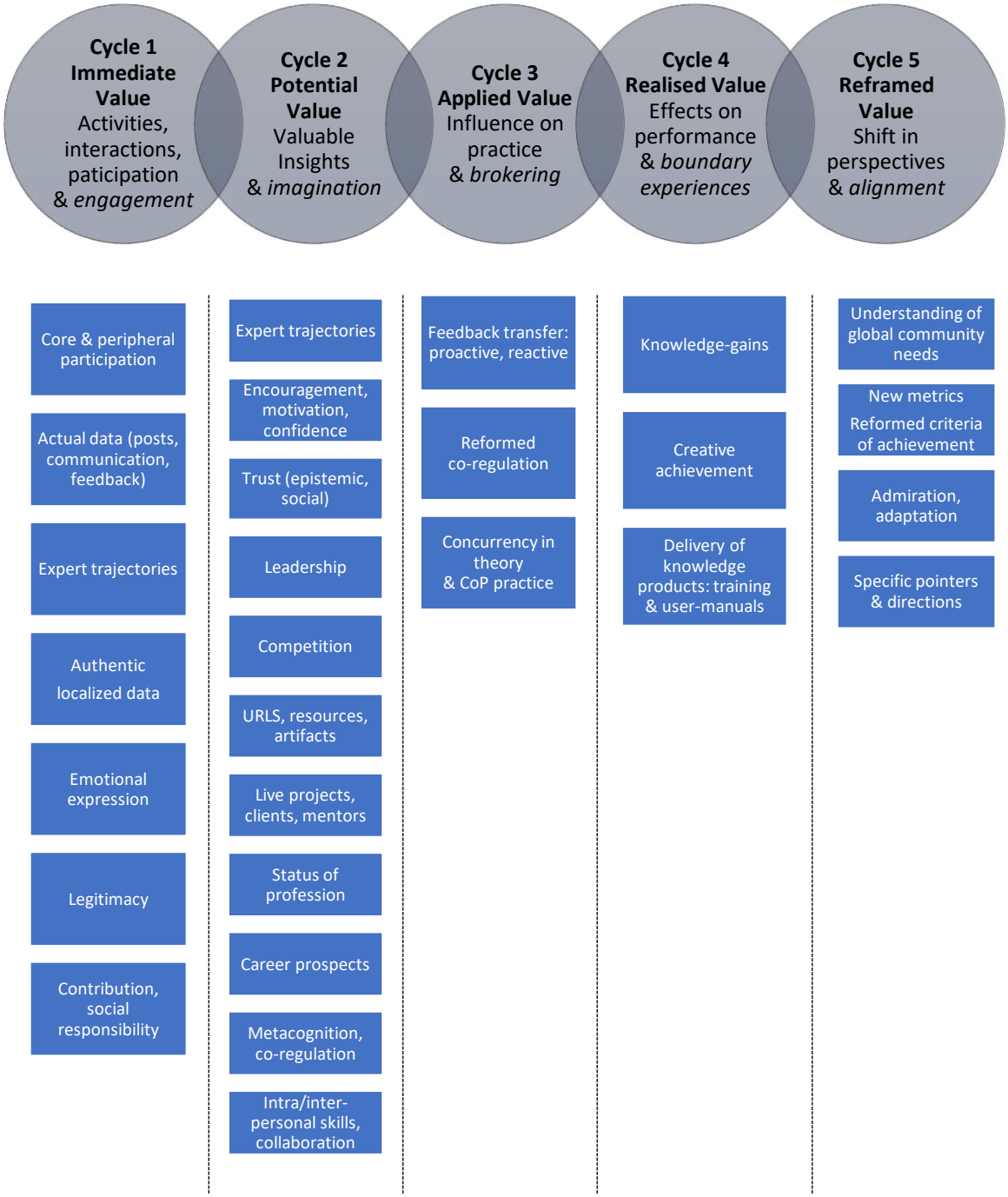


Table 21. Emerging themes (indicators) of Value Creation cycles & effects on identity



Appendix B.

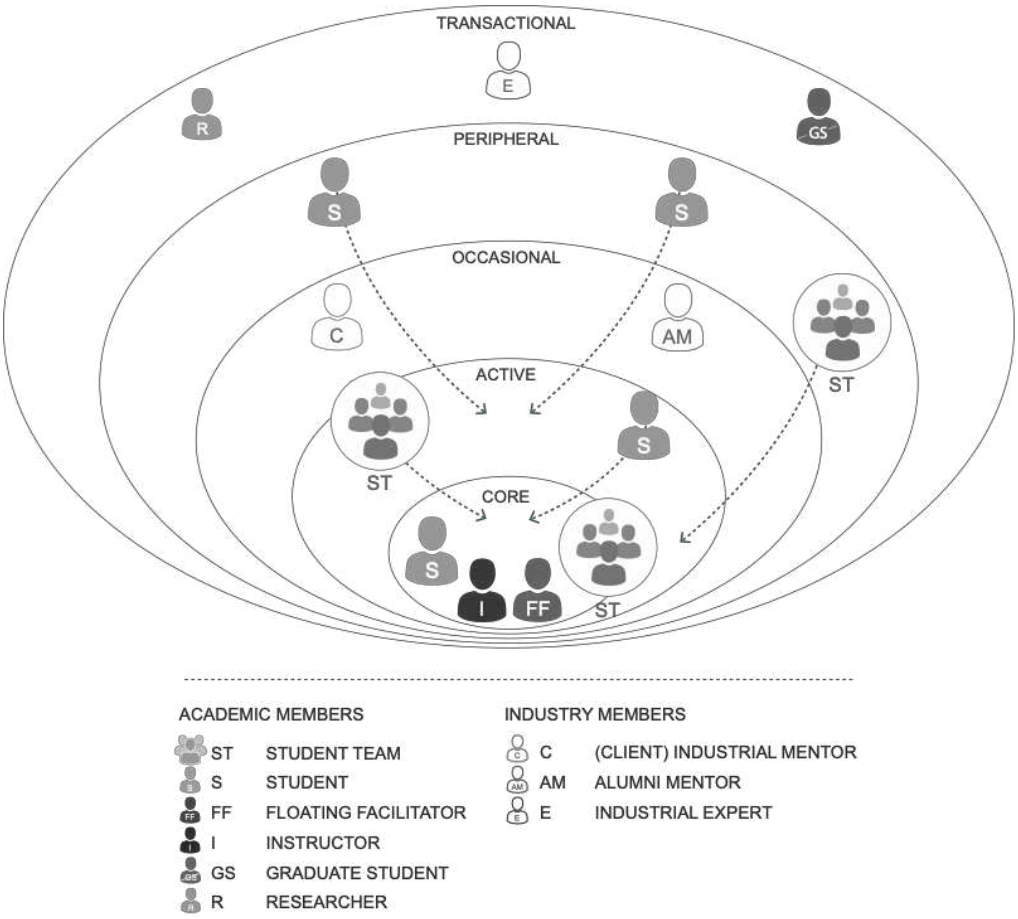


Figure 1. Community of Practice: social structure and levels of participation (semester 1)

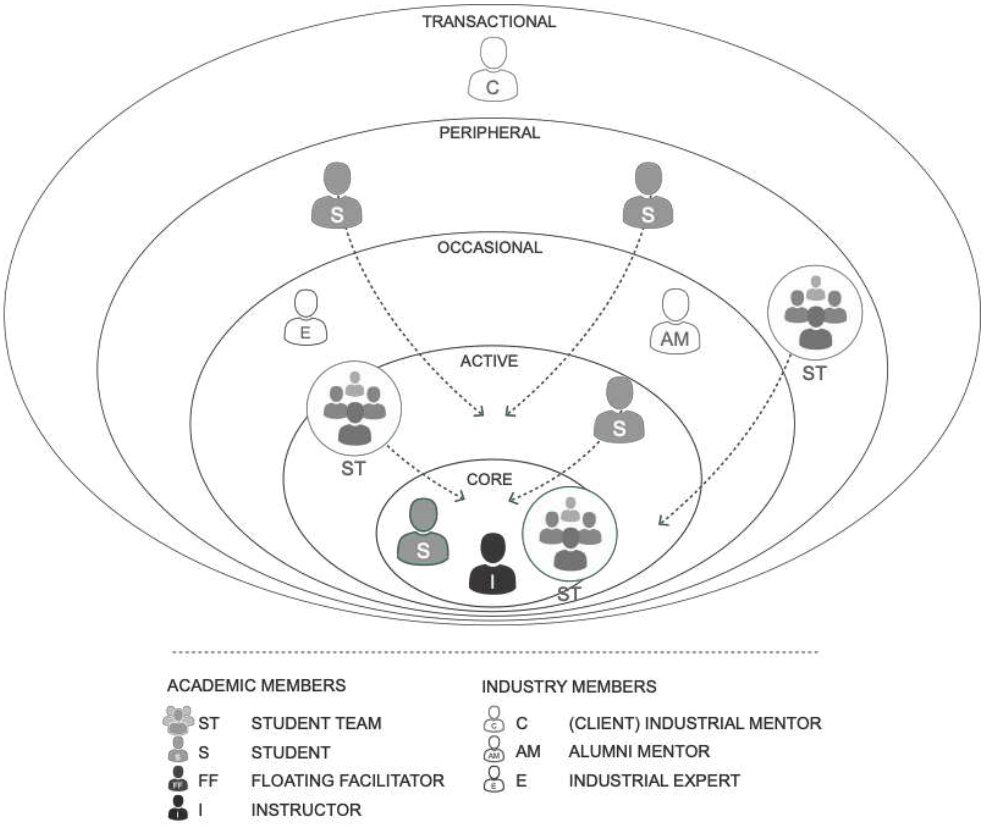


Figure 2. Community of Practice: social structure and levels of participation (semester 2)