In less than a decade, architectural education has, in some ways, significantly evolved. The advent of computation has not so much triggered the change, but Social Networks (SN) have ignited a novel way of learning, interaction and knowledge construction. SN enable learners to engage with friends, tutors, professionals and peers, form the base for learning resources, allow students to make their voices heard, to listen to other views and much more. They offer a more authentic, inter-professional and integrated problem based, Just-in-Time (JIT), Just-in-Place (JIP) learning. Online SN work in close association with offline SN to form a blended social learning realm – the Social Network Learning Cloud (SNLC) – that greatly enables and enhances students’ learning in a far more influential way than any other learning means, resources or methods do. This paper presents a SNLC for architectural education that provides opportunities for linking the academic Learning Management Systems (LMS) with private or professional SN such that it enhances the learning experience and deepens the knowledge of the students. The paper proposes ways of utilising SNLC in other learning and teaching areas of the curriculum and concludes with directions of how SNLC then may be employed in professional settings.
1. INTRODUCTION

Kvan [1] comes straight to the point: “Computers are the problem”. Akin to this, in architectural education of the past, especially in design learning environments, any computational means are considered as either not appropriate or as a tool and often blamed as the ‘problem’. This discussion has been extensively addressed by literature in particular during the latter quarter of the twentieth century. The role of collaborations and social structures for learning and addressing complex problems was critically addressed by scholars during this period [2, 3]. The transformations of the economic and social dynamics in the Information Age and network society has led to an interlink of education and profession through social networks and computation [4, 5].

However, the real issue is that educators need to address how architectural education in the 21st century is taught and, concurrently, why teaching often focuses on individual learning without making use of the rich synergies of Social Networks (SN) by tapping into the way of learners communicate and acquire knowledge.

A common approach to studio or problem-based learning (PBL) is sequential following the conventional method of Albanese and Mitchell’s [6] seven steps model of PBL. Even though this model may not be used in some well-thought-of Schools of Architecture, it is the underlying structure of the general architectural PBL. All seven steps involve collaboration, communication and cooperation among learners; yet, this linear format is limiting and imposes a structure that does not fit with an iterative and reflexive process facilitating deep learning. Flexible interplay between the seven steps improves the social engagement of students of the ‘Net-generation’ [7], especially where social networking sites are used to replace or augment the PBL tutorial or studio. Integration of various aspects of architectural design, services, structure and technologies into the design studio has to follow a non-linear learning pattern.

Moving forward from Salmon’s [8] model of learning, this research argues that learning does not happen sequentially, but is interconnected, allowing cross-referencing and moving back and forth. The social interaction model of learning by Howe and Schnabel [9] presents this clearly. The learning experience is the context surrounding the process of knowledge construction, which is an interlinking of concepts and actions spanning two broad areas of endeavour: educational scaffolding and social interactivity (Figure 1). Access to resources and problem development inform the scaffolding while social interaction and information exchange are facilitated by the potential for interactivity of the learning tasks. All components of the process are intertwined. Since all members of the learning community (teachers, students and other relevant stakeholders e.g. social networks) contribute to knowledge construction, they are not represented as disparate entities in this model. The traditional seven steps of PBL are
subsumed in the educational scaffolding but are modified to suit the learning of core elements of design education within the context of architectural design.

This research argues that this process is at the beginning of novel architectural education that moves SN into the centre of engagement. This is because educators don’t treat students’ (online) social experience as separate to their on-campus social learning experience. Past endeavours to facilitate blended learning environments or to engage students in problem-based learning (PBL) activities have evolved to unleash the untapped potentials in relation to accessing the rich resources that a social learning environment offers through the collective and social intelligence of its members [10].

In the very recent past various studies have been completed investigating the integration of Web 2.0 tools into learning, within and outside of the discipline of the built environment. For example, Wang et al [11] presents applications that employ Web 2.0 learning environments that demonstrate the possibility for effective learning. Skills learned via Web 2.0 can be transferred to other tasks and areas. They advocate that in these environments knowledge is also socially constructed and shared. Moreover, the OIKODOMOS-project [12] explores the use of digital social media within their virtual campus realm to facilitate interaction and learning in and beyond the academic context.

In this article social networked architectural education is presented that provides opportunities for linking the academic with private or professional SN in such a way that it enhances the learning experience and deepens the knowledge of the students in a blended social learning environment. This larger learning environment we call the Social Network Learning Cloud (SNLC).
The focus of much research has been on the role of educational technologies to support, enhance and advance architectural education [13, 14]. Since the initiation of digital technologies into the design studio and other areas of the academy, Smithers summarised the various influencing technologies in an ‘educational technology landscape map’ [15] grouping them around management and content. Yet this map does not focus on the learner itself. Hence it is argued that educational technologies are contingent on, and indeed useless without, an understanding of the social aspects of the educational environment.

The educational realm of the SNLC focuses on social aspects of architectural education and draws on our previous research in the area of the Social Networked Virtual Design Studio (SNVDS) that is reported in a case study that explores particularly the social aspects of the Virtual Design Studios (VDS) [16], and is understood as the interpretation of the traditions of these VDS of the nineties [17] developed further to intertwine computational, collaborational, and socially engaged design studios with the larger context of the architectural curriculum. As such, this research proposes ways of utilising SN, their media and interaction platforms in other areas of the architectural curriculum, such as communications, history, theory and professional praxis. This paper outlines an open system of learning that utilises SN to crowd-source, flatten hierarchies, facilitate social engagement and peer learning and expands the learning experience beyond the academic context to include other institutions, practices and professions. Since the SNLC has no clear borders and floats around the social and learning aspects of the learner it can also be employed in inter-professional environments and hence can contribute to academic and professional education.

2. PRECEDENTS OF SOCIAL INTEGRATION

Key components in the framework for social networked architectural education are peer learning, sharing of knowledge, and flattening hierarchies through the use of digital technologies. Significant precedents exist in these areas of research [18, 19].

Over the past two decades the VDS has evolved as a learning environment that allows students in various locations to engage synchronously and asynchronously in design learning. VDS have long recognized the social dimension of its learning realm, which facilitated collaboration across multiple boundaries and helped re-define the social and cultural contexts of the design studio. New technologies allow the VDS to evolve in new directions – some of which address shortcomings identified in past research. The VDS established virtuality as acting while physically distant, as acting by employing digital tools, or employing virtual instruments or other virtual components. Virtual Environments (VE) were established by the choice of design, way of communication or digital tools; later the VDS
developed into real immersion within a VE, the medium for design interaction being the authors’ immersive VE Design Studio (VeDS) in 2001 [20]. In all these samples, (online) social interaction through the design interaction was important to the learning and engagement with the design. The social communication was enabled through chat windows, emails, blogs and posting sites, wikis and other online communication tools. However, these VDS did not recognise social engagement as crucial or central to the overall process of construction of knowledge.

SN were first used in design, construction technology and inter-professional teaching as a means of engaging students in architectural education socially outside of the limitations of university’s Learning Management Systems (LMS). Ham stated in his research [21] that these limitations include the development of silos of knowledge, lost opportunities for students to engage with each other and industry sources and limited sharing of resources for design decisions.

The Social Networked Construction Technology unit (SNCT) comprises a logical formation of the evolving streams of construction technology education and resource creation for design decision support as a means of engaging students as ‘amateur researchers’ in a way that ensures ‘that student research work is worth more than course assessment’ [22]. The construction of knowledge was brought together within a social network through engagement in online blogs, YouTube™ and Facebook™ (FB). The SNCT is based on ‘authentic curricula…that allows students access to the real world of construction technology whilst utilising digital media and the Internet to enhance the process’ [23].

With the advent of Web 2.0 technologies, the next logical step in developing the VDS was collaboration within a SN [24]. Ease of communication, leadership opportunity, democratic interaction, teamwork, and the sense of community are some of the improved aspects that are offered by SN [25]. Mitchell [26] provides a precursor for the need for an on-going evolution of the VDS towards a fully integrated studio where the borderlines between realms, professions, tools and mode of communications are dismantled. Subsequently the advancement of VDS moves design education beyond conventional boundaries and curricula, and engages participants socially from diverse professional fields.

The Social Network VDS (SNVDS) was subsequently the successor of the VDS and has operated over various design studio curricula since 2009 [21]. The key to the SNVDS is engaging with the nomadic device generation whilst facilitating social engagement in the form of ‘casual interaction online, leading to casual interaction offline’ [27]. Through the encouragement of a flattened hierarchical structure between students and staff, the educator’s role changes from ‘the sage on the stage to the guide on the side’ [28]. These flattened hierarchies create opportunities for collective intelligence, wherein opportunities for information can be shared among social groups,
extending beyond the conventional studio setting. From collective intelligence comes collective social intelligence that relates to both the current design project as well as knowledge in the relevant fields. The SNVDS differs from traditional model of delivery in that the students themselves became the primary contributor to skills, content, and knowledge to support the design project [16]. It also differs from conventional PBL due to the difference of scaffolding and problem framing [9] as discussed earlier.

3. REINTERPRETATION

Simultaneous to the endeavours of explorations of media and realms within the educational setting, architectural design studios offer a platform to investigate new approaches to design learning. In this context Dave [29] argues, instead of focusing on digital tools and information in isolation there is a need to teach and learn within hybrid work environments blending between physical and virtual design and learning realms. The introduction of automated manufacturing processes, the opportunity of directly translating virtual creations into physical artefacts, or vice versa, generated new techniques of instructions in order to intersect digitally conceived, structurally clarified, and directly manufactured studio designs that are communicated between educators and learners [30]. These hybrid realms are used as didactic vehicles to introduce new approaches of design-communication and learning. The reflection of the effects and the implications this has on the tradition of architectural education has not often been aligned with the larger context of the overall teaching and learning of architecture and courses, or methodologies added without much adjustment of the overall curriculum.

There is a growing trend of Architectural Schools all over the world engaging students in exercises of repetitive interactions and re-interpretations from real to virtual and back to real, many of which have been reported, for instance, by Petric and Maver [31], Daubmann [32], and Schnabel et al [33]. The spectrum of new design studio exercises reaches from facsimile re-representations to creative exploration of form, function, and structure, yet they have fundamentally different objectives and pursue different learning outcomes. Petric and Maver [31], for example, suggest that designers/learners are at the centre of the process. They are surrounded and shielded by a variety of media and learning resources, which they apply in their pre-described way (Figure 2 left). The various media and learning processes do not act as exploration tools to further deepen knowledge. Learners are disconnected from peers and there is little engagement with other learners or knowledge. This reflects conventional learning settings, whereby the learner generates knowledge that is dependent on tool and resources and not however connected to design and social intelligence. A different approach is presented by Schnabel et al. [33] where learners
engage in a ‘design-cycle’ (Figure 2 right) in which the design and its learning processes lie at the centre of the development. Students surround the learning aspects and employ the resources they may need to develop their designs and gain collective knowledge about the opportunities that the transformation from one domain to another offers. The different possibilities and aspects of the design become transferable knowledge in each phase; thus, the process of re-interpretation itself becomes a creative act of learning that is embedded in social intelligence as well as specific context of knowledge.

The rapid development of media, their availability, and their possibilities can be explored to determine their full potential and subsequent implementation into conventional educational frameworks. According to Asanowicz [34] studio teaching often adheres to traditional ways of exploration rather than exploring the possibilities beyond their pre-described operation procedures. In this context learners themselves often pioneer and move ahead faster than the educational system reacts to new phenomena. This can only happen however via social interaction between learners. The SNLC offers students and teacher a realm to engage creatively outside the given possibilities that a medium, a technique, or a curriculum suggest, and can make use of the fuzziness of a cloud that circumscribes the learning environment. It is to note hereby that the role of educators has developed from a teacher, a facilitator, to partner in learning and member of social engagements. At the same time the role of the architect will be changing alike to a partner of in a process that is facilitated by social and professional networks.

4. MODELS OF SOCIAL NETWORK INTERACTION IN HIGHER EDUCATION

SN are defined as a ‘theoretical construct useful in the social sciences to study relationships between individuals, groups (and) organizations’ [35]. They form the core of the student University experience and, we argue, are secondary to elements of the educational technology map by Smithers [15].
This research identifies and focuses on four modes of SN related to the university experience; social-physical networks (SP), social-digital networks (SD), learning-physical networks (LP) and learning-digital networks (LD). These social network modes exist concurrently and intermesh with each other synergistically throughout the student University experience.

Social-Physical (SP) networks take the form of social groups of family and friends centred outside of the University environment. These may comprise of immediate and distant family groups, as well as school and work friends. The basis of these networks is normal face-to-face human interactions between the student and other people.

Social-Digital (SD) networks extend social-physical networks into the online environment through a wide range of channels including Facebook™ (friends, ‘likes’, groups, etc.), Google+™, Twitter™, Tumblr™, YouTube™, and Blogs.

Learning-Physical (LP) networks are networks of friends, classmates, group-work colleagues, teachers and others connected to each other within the on-campus university learning environment. The university learning experience forms the basis of these networks through shared design studios, classes, group project work and extra-curricular activities.

Learning Digital (LD) networks are digital networks set up within the university environment for the express purpose of facilitating and enhancing teaching and learning. These are generally centred on a Learning Management System (LMS) such as BlackBoard™, Desire2Learn™ and Moodle™ but also include online learning resources such as web sites and other digital aides to teaching and learning. However, Universities generally enforce a separation between LD and SD networks. Learners are given special and time-limited access to LD LMS systems which prevents a full and open access to learning. However, there are direct synergies between SP and SD networks because of the series of face-to-face interactions that take place in on-campus learning and social activities. SD networks facilitate and enhance these complex interactions between people. The SD network acts as an extension of both the SP and LP networks, thus lines between digital and physical, social and learning networks become blurred. Concurrently, students engage in digital SN to create and extend forms of social interaction with friends, as a news service, to gossip, to voice their opinions and as a form of entertainment. Online SN work in close association with offline SN to form a blended social environment that greatly enhances a
students’ university experience. The blended learning presented here represents mixed modes of social experiences as well as mixed modes of educational technologies and methodologies. Various university teaching and learning settings were studied to assess the effectiveness and efficiency, and the processes has been extensively been reported by the authors [16, 20, 23, 44, 45].

In the current model of social network interaction (Figure 3), interactions between SP, SD, LP and LD networks can be conceptually represented with the student at the centre. Interactions between SP, SD and LP networks are strong, as are interactions between LP and LD networks.

Typically in Higher Education however, through the focus on the corporate LMS, a barrier between the LD network and SP and SD networks has been created. This barrier has been created to deny non-fee paying persons from accessing course material and is intrinsic to the LMS. LMS also separate course and unit structure, hence reinforcing the existence of learning silos [36] and knowledge packages by disallowing linkage between units (Figure 4).

To compound these problems, some universities have failed to engage in the potential of SD networks as an important channel of two-way communication between staff, students and others (including Industry). Failure to engage takes the form of non-engagement or improper engagement in digital SN. Schools of Architecture have set up Facebook-sites as a unidirectional means of communication of news; however this mode of social media use is based on the assumed need to control communication and simply replicates the capacities of a website. True
engagement in SN’s involves a two-way dialogue founded on a flattened hierarchical structure, a factor that presents difficulties within the university environment. Yet this flat and open structure is the realm in which good schools of architecture successfully operate.

Experience shows however, the enforcement of the LMS and email as the means of LD networking is firmly entrenched. Pressures of increasing student numbers, shortened preparation times between semesters and other factors provide a disincentive to engage in the potential of bringing together the SD and LD networks [20]. This research hypothesises that this does not meet the needs or aspirations of social-media savvy students engaged in the learning experience [37].

5. THE SOCIAL NETWORK LEARNING CLOUD

Various educational settings have already explored the re-conceptualisation of the current model of SN integration at universities to increase linkages between the SP, LP, SD and LD networks, this research emphasises that this is achieved by developing a student-centred approach that attempts to break down the barrier between the University LMS and other aspects of the students’ SN and integrates social networking to the core of the curriculum (Figure 5).

Any reconceptualization of the role of social networking in the learning experience can be achieved through ‘just-in-place learning’ systems (JPL) [38]. These are ‘composed of virtual information layered on top of physical artefacts and made available through different social media outlets/technologies. JPL brings together ubiquitous and calm computing models [39]), social and immersive media [40, 41], and situated technologies [42] in
a way that friendship-driven networks and interest-driven networks intersect.

‘Thus, information can now be pulled from various sources and consumed and produced asynchronously and/or synchronously in a chosen place and/or time. In addition, new smart mobile technologies also mean that we now have the ability to retrieve (and expect) just in time, and just in place information’ [43].

Through re-positioning the SP, LP, SD and LD networks through JPL, a framework can be developed based on the evolution of the SNLC. Here, the silos of the LMS-driven curriculum are set aside through the integration of the concurrent learning streams in the curriculum. Through active engagement in multiple SN, learning becomes a two-way experience: students act as both learners and researchers contributing to the body of knowledge in a way ‘that student research work is worth more than course assessment’ [22]. Figure 6 shows how a SNLC enabled learning environment facilitates seamless learning between the rigour of various units or years and the construction of knowledge in a larger context. SNLC enables life-long learning and authentic learning experiences, because content, participants and other (outside) sources form the network that has no boundaries of a specific course or subject. The expanding social learning cloud in certainly not only simply integrating between the different years of the curriculum as pictured in Figure 6, but infiltrates at every moment of the learning without boundaries.
6. CONCLUSION

Through the creation of, for example, online virtual galleries of student work [23] and the various student engagements within the SNLC a vast body of project resources are crowd-sourced. Given the issues of complexity of an architectural design brief, operation outside of the cultural and environmental context and the requirement to integrate multiple aspects into an authentic learning environment, which the SNLC proves to be.

Following the traditions of the VDS, a SNLC forms the core of a learning environment that intersects on-/offline learning and social networks. This research explored the SNLC in various university teaching and learning settings presented earlier, and reported and evaluated the processes in detail [16, 20, 21, 44, 45]. It was found that the SNLC blends the boundaries of individual units, courses, years and the lifelong learning in authentic contexts, subsequently greatly enabling and enhancing students’ learning experiences.

Hence the SNLC facilitates cloud learning – the interaction of particles within cloud, flow – the seamless acquisition of knowledge, synchronous and asynchronous learning modes –enabling of JPL Learning, ‘knowing is there’ and ‘knowing it’ – both access to knowledge and deep learning, and identity – the need of learners to belong to an environment that matches the level, skills and communication of the individuals.

The social engagement of learners is vital to successful learning. Students and professionals alike also engage with their activities socially. Current online social communication system can become devices to facilitate the learning. Subsequently all aspects of architecture can become central to
design activities. Blended learning environments, social communication platforms, and cloud-based instruments make a substantial contribution to the learning outcome and the collaboration between stakeholders, although more development is needed to integrate such systems into other aspects of architectural education. Building information management systems employed in the professional praxis are already moving in the direction of more integrated and holistic collaboration within the construction industries.

SNLC engaged learning as a form of interaction with peers, friends and teachers, is shaping architectural education more than any other means of learning. Due to the positive experience gained by integrating the SNLC into the curriculum of the architectural degree at undergraduate as well as graduate levels it is proposed to transfer the SNLC to other disciplines, which lays in the nature of SN acting independent of core-subjects or academic or professional realms. LMS, blogs or interest groups have failed since they do not offer seamless interaction from the individual to the network and only act as point to point or point to group communication.

In further development of this research we are planning on a set of experiments that explore how the profession can be linked into the learning environments and contribute to the learning of both students and professionals. Our next research needs to prove the importance of seamless integration that can be developed out of our findings, which sits in the context of related research that connects realms of e.g. BIM practise or gamification as incentive [46]. It also would include specific assessment of the SNLC model including the crosspollination of academic and professional environments as well as further discussions and assessment of the interlink between academic and professional ethos that is only vague be dealt with in the SN communities.

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