Abstract

Current trends and challenges in higher education (HE) require a reorientation towards openness, technology use and active student participation. In this article we will introduce Social Learning Analytics (SLA) as instrumental in formative assessment practices, aimed at supporting and strengthening students as active learners in increasingly open and social learning environments. The analysis of digital traces of students' learning behaviors provides insight into learning opportunities and can raise students' awareness about where to be and whom to join. Against the background of these HE trends and challenges, we discuss opportunities for applying SLA to support open learning practices, that will move students from awareness to productive engagement in learning activities that promote co–construction of knowledge.

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Social Learning Analytics: Navigating the Changing Settings of Higher Education

Higher education (HE) is increasingly seen as needing to change in ways that meet the transformation of our times (Warner, 2006). For HE institutions to remain relevant to the social settings in which they exist, Wiley and Hilton III (2009) argue that creating an institutional culture of openness is the most pressing priority. Massive Open Online Courses (MOOC) development and Open Educational Resources (OER) are demonstrative of the societal movement towards more openness.

Several developments towards more openness are already emerging. Institutions are becoming transparent and are starting to promote open communication and open scholarship (Czerniewicz, 2013). Changing expectations and the adoption of progressive technology challenge HE to replace its model of delivering education with one that promotes a stronger focus on student participation and collaborative learning, shifting the focus to more active engagement in knowledge co–creation, in an attempt to leave the transmission model of knowledge behind. Pedagogical designs are evolving towards providing open access, promoting networked social activities, and linking education with professional learning communities and lifelong learning to provide their students with broader opportunities to access social capital. This means an increased focus on community learning as well as collaborative, interactive and participatory learning (e.g., Tucker et al., 2013; Zhao & Kuh, 2004).

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Some other telling examples of how learning settings are changing are offered by Bayne, Gallagher and Lamb (2014) and Gourlay and Oliver (2013). They explore students' uses and experiences of spaces, as sites of scholarly activity. Bayne et al. argue that HE has taken little account of how space – under the influence of new technologies – is increasingly seen by students as a dynamic entity produced by social practices. Learning spaces have become more fluid, democratic, influenced now by the promises of accessibility to all from the open education movement (see also Knox, 2013), at the same time transforming educational practices (e.g., Ehlers, 2011). The study by Gourlay and Oliver (2013) reveals the complexity

of students' orientations towards technology and also the distributed nature of their learning practices across multiple spaces. Thus, learning practices are changing towards increased connectedness, personalization, participation, and openness; the emergence and popularity of MOOCs as new spaces for learning can be seen as an illustration of this (Macfadyen, Dawson, Pardo, & Gasević , 2014).

We are left, however, with an important question: How do we assess and facilitate productive social connectivity and mobility in these open learning spaces? When learning is designed around social engagement and interaction, there is a need to develop new ways of understanding and assessing student social mobility. We need to be able to promote and monitor student engagement and offer them direct ways to reflect on their learning activities – and that of others – raising awareness about the opportunities these open learning practices have to offer. In this article we explore what a newly developing design discipline (Knight, Buckingham Shum, & Littleton, 2014), called learning analytics, can contribute to address this.

Below we will introduce Social Learning Analytics (SLA) as an instrument in formative assessment practices aimed at supporting and strengthening students as active learners in the process of becoming practitioners. SLA, applied in open HE settings, will help students make informed decisions about where to be and whom to join for their learning , by tracking and visualizing indicators of social learning behaviors and patterns in those behaviors. This will raise awareness and equip students with the kind of orientations necessary to meet the demands of the emerging open networked society.

Trends and Challenges in Higher Education

The changes that HE is facing have recently been substantiated by the NMC Horizon Report > Higher Education Edition (Johnson et al., 2013). This report identifies key trends that influence the HE future agenda, covering use of technology, change in student participation and challenging models for teaching and learning.

Developments in technology use and availability have been a strong driver for change in behavior and learning. The growing ubiquity of social media and an ongoing integration of online, hybrid and collaborative learning are identified trends that already have impacted HE and we have witnessed or are witnessing the effects of it. Social media has opened the traditional organizational boundaries of HE institutions and is changing scholarly communication enabling less formal "two way dialogues between students, prospective students, educators, and the institution" (Johnson et al., 2013, p. 8). Increased social media use transforms HE from institutionalized into more open scholarly practices, with knowledge and content becoming increasingly open and accessible (Czerniewicz, 2013). At the same time, hybrid or blended forms of teaching and learning offer more freedom in interactions with and between students, and encourage collaboration, thus reinforcing real world skills.

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In response to openness, institutions for HE are redesigning physical settings as well, trying to combine the best of both worlds. These modern campuses, also referred to as *sticky campuses* (e.g., Dane, 2014; Lefebvre, 2013), are designed to offer a mixture of formal and informal learning experiences aimed to provide a quality rich environment where students want to be, not only to study, but to socialize and learn. As such these HE learning landscapes are transforming into open learning spaces aimed at becoming a vibrant social hub where people meet and connect 24/7, on and off–line. For example, the University of South Australia recently opened their Jeffrey Smart building on the City West Campus in Adelaide. This building has been designed to be a lively learning hub and open space used by students, staff and professionals. The open space has been developed for students to come and interact with their peers, build networks and communities, facilitate collaborative learning, share experiences and knowledge to enhance and enrich their university learning experience. Engaging in open practices, and the ability to build and utilize rich social networks are essential skills and capabilities students require to be proficient learners in an increasingly networked society.

Inspired to some extent by the technological possibilities, some of the traditional roles in HE teaching and learning practices are changing as well. Education becomes more personalized and students are becoming active participants emphasizing learning by making and creating instead of passively consuming content. Some HE campuses are building living

labs to promote a holistic approach to teaching or are using real built environments for user–centered research and the creation of a collaborative learning platforms (e.g., Masseck, 2013). Through advanced engagement in hybrid learning environments, students also leave an increasingly clear trail of analytics data that can be mined for insights. Utilizing student data for learning analytics in itself has become a new trend, and "there is a growing interest in developing tools and algorithms for revealing patterns inherent in those data and then applying them to the improvement of instructional systems" (Masseck, 2013, p. 12).

Finally another trend is that HE institutions are looking to provide a more diverse offering of opportunities and access to quality education. MOOCs, for instance, are:

> Enabling students to supplement their education and experiences at brick– and–mortar institutions with increasingly rich, and often free, online offerings. Downes and Siemens envisioned MOOCs as ecosystems of connectivism – a pedagogy in which knowledge is not a destination but an ongoing activity, fueled by the relationships people build and the deep discussions catalyzed within the MOOC. That model emphasizes knowledge production over consumption, and new knowledge that emerges from the process helps to sustain and evolve the MOOC environment. (Johnson et al., 2013, p. 26)

Social Learning: Participation, Co–Creation and Becoming

The above trends have among else in common that they challenge HE institutions to embrace social theories of learning. Learning is increasingly seen to be most effective when it is collaborative and social in nature (De Laat, 2012; Siemens, 2005). In social forms of learning, the focus is on the co–construction of knowledge, meaning and understanding. This takes into consideration how the practical, social (learning) situation influences individual and collective outcomes of learning. Learning in a social context is a process of meaning–making, where this meaning can be based upon prior experiences as well as the more immediate social context in which something is learned. Meaning is made through negotiation among the various actors participating in a learning context.

New metaphors describing social learning have gained currency and are used to develop a language for learning that emphasizes important social aspects such as participation, co–construction and becoming (Hager & Hodkinson, 2009; Packer & Goicoechea, 2000). In this context the application of 21st century skills such as collaboration (working in teams, learning from and contributing to learning of others, social networking skills, empathy in working with diverse others), creativity and imagination (economic and social entrepreneurialism, considering novel ideas and leadership for action) is emphasized (see Dede, 2010 for an overview).

Whereas the 21st century skills focus mostly on participation and co–construction, the notion of learning as becoming (Colley, James, Diment, & Tedder, 2003; Hodkinson, Biesta, & James, 2008) has been explored for example by Shaffer (2004). He provides inspiring examples, in which students' identity development is stimulated through the adoption of practices associated with the ways of knowing of particular professional communities. Shaffer developed extended role playing games, simulating professional learning. Professions have their own ways of knowing, of deciding what is worth knowing and of adding to the collective body of knowledge and understanding of a community. Shaffer's studies show that students can incorporate these elements into their identities when engaged in games. One epistemic game Shaffer writes about is SodaConstructor, tapping into the ways of knowing of engineering and physicists' communities. In the game participants can design their own virtual creature, applying (and thereby showing understanding of) fundamental concepts from physics and engineering. They test their ideas through a simulation of how this creature would operate once gravity, friction and muscles enter the equation. This way they can mimic the creative thinking of engineers: creating designs, building them, and then testing alternatives as well.

HE students, seen through the new metaphorical lenses of participation, co–creation and becoming, are thus learning to engage in open educational practices. Open educational practices are implemented through open pedagogies (Ehlers, 2011). There are gradations in how open these pedagogies are (see Figure 1), depending on how much freedom students have to develop open practices and the degree of involvement of others in their learning.

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Figure 1. Diffusion of open educational practice (from Ehlers, 2011).

New forms of assessment also ensue from these changing perspectives on learning; monitoring and openly valuing student engagement and helping students become more aware and able to reflect on productive social learning practices. Social learning analytics are instrumental in this.

Social Learning Analytics

With the new trends in HE come another trend, giving rise to data–driven learning and assessment and paving the way for learning analytics (LA). Some institutions – like Purdue University and Marist College – are forerunners who actively implement LA tools to help manage learning and organizational strategies. Other organizations are still observing these developments, but they are increasingly aware that a data–driven understanding of learning and assessment is an approach they need to embrace. It is evident that LA is an emerging field that, like other areas where analytics is applied, (e.g., HE marketing and management), is drawn to massive computerized activity and big data with the means to improve and support learning. LA concerns the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs (Siemens, 2013).

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A particular area within LA capitalizes on institutional big data used to track and evaluate student behavioral patterns. Learning Management Systems, for instance, enable the collection of data on student demographics, measures of (prior) academic performance and student behavior. These aspects of LA are more concentrated on the management of learning and understanding personal (background) characteristics, whereas another research area concentrates on harnessing data to understand student connectivity and the development of social relationships, and how this can be used to promote learning through social interaction. This work, referred to as social learning analytics (SLA; Buckingham Shum & Ferguson, 2012), is aimed at analyzing ongoing learning and group dynamic processes, course design features and resulting outcomes in terms of collaborative practice, development of learning communities, in formal or informal settings, design and development of social learning systems that utilize networked connectivity and learning partnerships (Haythornthwaite, De Laat, & Dawson, 2013).

Buckingham Shum and Ferguson (2012) make a useful distinction between inherently social analytics, and socialized analytics. Inherently social analytics only make sense in a collective context. Socialized analytics are relevant as personal analytics, but can also be usefully applied in social settings (e.g., disposition analytics; intrinsic motivation to learn lies at the heart of engaged learning and innovation). An important example of an inherently social analytic, as discussed by Buckingham Shum and Ferguson, is social network analysis. Social network analysis can be used to investigate networked learning processes through analysis of the properties of connections, the roles people take in their learning relations and the significance of certain network formations. It can aid in understanding how people develop and maintain relations to support learning (Haythornthwaite & De Laat, 2010).

Although there are some SLA tools available to support micro level social learning, such as support for collaborative learning processes in small groups and community learning, what is largely missing are SLA tools that build on large scale social mobility and help students to become more aware of productive social connectivity. Social awareness about meaningful networked activity on this meso or even macro level within, across and beyond HE institutions (in relation to the trends discussed earlier) is needed to support productive social learning associated with the living social hubs that HE institutions aspire to be (e.g., Hemmi, Bayne, & Land, 2009). Through social learning analytics, based on data about student movements, we might be able to provide a better insight in the social dynamics and networked learning opportunities that these HE social hubs and sticky campuses have to offer. It allows students to become aware of relevant social mobility, important (community) events and networked activity that suits their needs as a learner and helps them to make informed choices about where and when to participate.

Below we discuss a model (see Figure 2) that focuses on what we call social enterprise analytics in an attempt to address these social mobility challenges and we will present a few examples of what such SLA tools might look like. This model is a combination of raising awareness about social learning activity as well as leveraging a culture of knowledge and value creation. We think it is important to not only develop tools but pay attention to the context in which these learning practices take place. We need to pay more attention to the social and cultural aspects that characterize learning, rather than keeping our focus mainly on learning outcomes and products (De Laat, 2012). This will require HE institutes to review their approach to learning and try to move from a results driven culture towards a culture that embraces the value of being engaged in social learning processes. This calls for rewarding engagement in practices where students are connected in networks and communities, and understand and assess how they create value.

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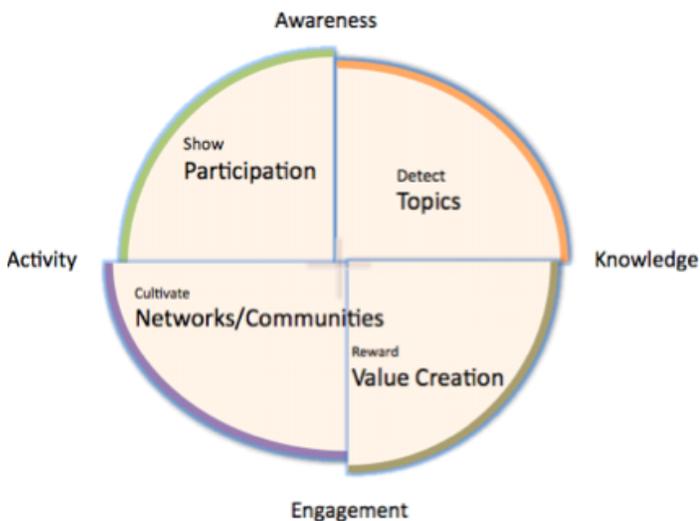

Figure 2. Social enterprise analytics (De Laat, 2014).

Analytics can provide the tools that help detect and visualize real time activity patterns of people (students, staff and professionals) and their knowledge. On the one hand these analytics can help to take the pulse of HE organizations and reveal people's learning activity and movement; this way, learners can find out what is currently going on and who are the main drivers of these activities. Finding ways to identify, access, and assess informal emerging activity and topics will be a way to connect people to learning and make informed decisions about participation and develop learning friendships. The top half of the model is therefore aimed at increased awareness in order to link people to content (and vice versa), whereas the lower part is concerned with leveraging a culture of knowledge. Here the focus is on cultivating networks and communities and promote student autonomy and increased responsibility. More openness means less control and planning by the formal educational curriculum and increases student flexibility and freedom to regulate their learning informally

and engage in (professional) networks that contribute to their learning goals. For this, one might stimulate student engagement by joining associated, active networks and communities in with their courses and optimize students learning and develop new ways to appreciate and reward value creation (Wenger, Trayner, & De Laat, 2011).

Challenges for Social Learning Analytics

As a relatively new field, SLAs have their own challenges to overcome. A critique often voiced about LA in general is its atheoretical nature. It is often incorrectly assumed that data speak for themselves, but it is important to consider that LA and pedagogy are both bound up in beliefs about what knowledge is. "The ways that we assess, the sorts of tasks we set and the kinds of learning we believe to take place (and aim for) are bound up in our notions of epistemology" (Knight, Buckingham Shum, & Littleton, 2014, p. 77). Assessment instruments come with assumptions about the nature of knowledge and how it comes about. For instance, when knowledge is understood as being distributed and co–constructed among actors in a network of practice, student success is reframed as being well–connected to the learning resources within a specific network. Different approaches have different analytic implications (for other examples see Knight et al., 2014), which means analytics can suffer from interpretative flexibility (Hamilton & Feenberg, 2005) when not properly embedded in a theoretical framework.

There are also some challenges related to data collection methods. Not all relevant learning traces can be captured digitally and some indicators are not very reliable; e.g., if a student prints out a resource instead of reading it online, the reading time is not a reliable indicator for how much the student has learned, and having a browser window open does not necessarily mean students are reading either. These problems will either have to be treated as measurement errors, or might in the future be addressed by additional tools, e.g., by applying eye–tracking.

Finally, the use of SLA may sometimes raise ethical issues, which need not be overlooked (Slade & Prinsloo, 2013). With LA becoming part and parcel of educational practice, students should take part in shaping and possibly reshaping this new practice of learning; the use of LA should be transparent to them. In addition, Slade and Prinsloo (2013) point out that student success is a multidimensional phenomenon and rather than applying LA in a routine way, LA should function to continuously improve our understanding of how to reach positive outcomes for students (and we would add, with students). We agree with Nissenbaum (2009) that students have a right to an appropriate flow of personal information. Nissenbaum suggests the concept of contextual integrity for LA, where what is considered appropriate will vary from context to context (depending on local "immediately canonical activities, roles, relationships, power structures, norms (or rules), and internal values (goals, ends, purposes)" (p. 132). For instance, as students engage with online activities (e.g., in a Learning Management System), data are generated as a by product of this activity, including patterns of questions posed and answered (Buckingham Shum & Ferguson, 2012). Frequently student involvement is mandatory in this context, but participation thereby should not be too easily considered a measure of learning outcome. When LMS's are designed to provide students with a stimulating learning environment and at the same time to effectively manage student engagement, these are the values internal to this LMS (its goals, ends, purposes) and these should be apparent.

Contemporary Examples

Through SLA, productive social learning processes and arrangements can be identified and made visible, so that they can be assessed and actions can be taken on them. In this section we highlight some contemporary examples of SLA tools and practices we are working on.

Increase Awareness and Participation

NetMap (De Laat, Dawson, & Bakharia, 2014) is prototype software developed at the University of South Australia in collaboration with the Open University of the Netherlands to provide a medium for students to unlock the potential of previously hidden informal learning networks. The software centers on facilitating the development of collaborative student

In the game participants can design their own virtual creature, applying (and thereby showing understanding of) fundamental concepts from physics and engineering. They test their ideas through a simulation of how this creature would operate once gravity, friction and muscles enter the equation. This way they can mimic the creative thinking of engineers: creating designs, building them, and then testing alternatives as well.

interactions. As such, NetMap serves as a kind of dating system for developing learning relationships in the physical space using GPS location data combined with information about the topics that people are working on. The central idea is to map informal networks and raise the awareness of potential learning ties for situated learning. When one enters the space they can use the software to select the topics they are interested in, browse people's profiles and find out where they are located in the open space as their current GPS position is highlighted on the map. Based on this information one will be able to quickly find peers who are open to sharing and collaboration on this particular topic. NetMap will additionally be used by tutors, university support services, or faculty and could be taken up by industry to open up more informal student engagements and promote stronger connections into specific industry groups.

Increase Awareness and Cultivate Networks

In order to find relevant and up–to–date information, students and teachers in their learning activities are turning to online resources more than ever before. Google Scholar is a popular example, but students can also access online professional communities for the materials they are looking for. Professionals and students meet each other in open practices where they share information and learn from each other. LA can help connect students with content but also with other knowledge workers to connect to. Students, like other knowledge workers, face an ever increasing amount of information. Consequently, it is getting increasingly difficult for them to remain aware of relevant content, people, activities, and events. One could claim that all knowledge workers face similar challenges; they generally are connected with several knowledge communities at the same time. The example below illustrates how social analytics can provide support.

Contemporary knowledge workers are in need of tools and techniques that help them to stay on a high awareness level (Reinhardt, 2012) and thus retain productive connections to their networks and the knowledge developments in their domain. Reinhardt, Wilke, Moi, Drachsler and Sloep (2012) showed that awareness of researchers in research networks can be enhanced by tools employing social analytics. They first explored the semantic connections between content and people in research networks by analyzing social media artifacts and scientific publications, visualizing the resulting networks to show how researchers might be more aware of activities and interactions therein. They then designed a widget–based dashboard that was meant to support researchers' awareness in their daily working routine. Their research showed the dashboard was easy to use, was less time consuming than similar technologies, user friendly and raised the level of awareness, helping researchers carry out their tasks more effectively (Reinhardt, Mletzko, Drachsler, & Sloep, 2011). Finally they proposed an event management system to help strengthen the ties between researchers and lead to enhanced awareness of relevant information.

Cultivate Networks and Value Creation

Engaging in networked learning means that learners need to be in touch with others to participate in constructive conversations (Haythornwaite & De Laat, 2010). To help stimulate, monitor and evaluate such discussion activities an SLA tool was developed to visualize them in real time (Schreurs, De Laat, Teplovs, & Voogd, 2014). This tool was implemented on a MOOC platform to support Dutch teachers' HE training in assessment. The course was introduced through a live webinar in which discussions were held. Forum discussions were subsequently moderated by experts in the field of assessment, emails were sent out to stimulate participation and more live discussions were planned. The tool helped to visualize the learning relationships between users, based on their contributions to the discussion forums. Since the real pay–offs materialize when stakeholders interact with the analytics, thus rendering their connected world more visible (De Laat & Schreurs, 2013), the design allowed the participants to use the plug–in as a social–learning browser to locate people who are dealing with the same learning topics. They could also identify central people in the network; identify the most active ones as well as identify potential experts. Not only does the tool afford reflection by learners on how to interact with peers for learning purposes, their educators can "use the plug–in to guide students in the development of networked learning competences and can gain insight into the ability of groups of students to learn collectively over time, detect multiple (isolated) networks, connect ideas and foster

Some institutions, like Purdue University and Marist College, are forerunners who actively implement LA tools to help manage learning and organizational strategies.

collaboration beyond existing boundaries" (Schreurs et al., 2014, p. 47).

Conclusion and Discussion

HE institutions aspire to be living social hubs, supporting productive social learning and awareness of meaningful networked activity, across and beyond the institutions themselves. When learning is designed around social engagement and interaction there is a need to develop new ways of understanding and assessing student social mobility. Through SLA, based on data about student connectivity and activity, we might be able to provide a better insight in the social dynamics and networked learning opportunities that these HE social hubs and sticky campuses have to offer; supporting students' awareness of important (community) events and networked activity more closely tailored to their learning needs. This will help them make informed choices about where and when to participate.

Assessment instruments come with assumptions about the nature of knowledge and how it comes about…Different approaches have different analytic implications, which means analytics can suffer from interpretative flexibility when not properly embedded in a theoretical framework.

Reflecting on the trends and challenges that HE is faced with, we propose a model that explicitly pays attention to the social and cultural aspects that characterize learning (participation, co–construction and becoming), calling for the rewarding of engagement in practices, where students are connected in networks and communities, and understand and assess how they create value. This model promotes open and transparent information about social learning activity accessible to all participants. This is based on the conviction that learning analytics tools should enrich people's ability to learn and help them to make informed choices about learning opportunities that are available to them.

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