Deepening e-Learning through Social-Collaborative Intelligence

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***Abstract*—Traditional education promotes the self as it seeks to encourage learners to acquire knowledge and cultivate individual cognition through memorization and the application of procedures to achieve expected answers. Collaboration in class has been sporadically practiced when major tasks require necessary group-work and coordinated team efforts with clear objectives to instill a sense of collaboration within learners in preparation for demands of the workplace. In this paper we present a case study of how we engage graduate students through new media within our online environment, whereby, instead of memory work they focus their evidentiary work as knowledge artefacts created through digital media. We encourage and value the learners' knowledge representations assembled in the form of rich, multimodal sources employing any of the available media.**

Keywords—e-learning; social collaboration; new learning affordances;

I. INTRODUCTION

Traditional education promotes the self as it seeks to encourage learners to acquire knowledge and cultivate individual cognition through memorization and the application of procedures to achieve expected answers. Collaboration in class has been sporadically practiced when major tasks require necessary group-work and coordinated team efforts with clear objectives to instill a sense of collaboration within learners in preparation for demands of the workplace. However, such activities are not prioritized because they are difficult and time-consuming to assess in a rigorous way. For this reason, the default in education remains individual cognition and in relatively narrow forms. The human mind is intrinsically social [1], and cognitively we are continuously seeking to employ our social memory to accomplish complex tasks. Until recently, these social and collaborative endeavors were not possible to perform within e-learning environments with their traditional content delivery architectures. However, with the advent of Web 2.0 technologies and social networks, new e-learning affordances have enabled a plethora of pedagogic possibilities to engage learners, and to assess the quality of their collaborative engagement.

Novel web technologies permit new learning approaches and new media possibilities that promote real changes to e-learning which impacts learners' configurations of space, their relationships, the textual forms of knowledge to which they are exposed, the kinds of knowledge artifacts that they create, and the way the outcomes of their learning are measured. We argue that this next e-learning ecology, consisting of the complex interaction between human, textual, discursive and spatial dynamics, has pedagogical and epistemic repercussions grounded within reflexive and inclusive education [2]. Such ideologies foster dynamically horizontal knowledge communities that generate collaborations where the value is not in standardized performance according to assessable objectives, but the productive diversity generated in a peer-to-peer dialogue where differences are of greater value to thinking and learning than identical factual or procedural correctness [3].

In this paper we present a case study of how we engage graduate students through these new media within our online environment, whereby, instead of memory work they focus their evidentiary work as knowledge artefacts created through digital media. Our e-learning portal supports, promotes and motivates social collaboration to boost the e-learning process through a combined learners' intelligence where the knowledge of a working group is greater than the sum of its individual members[4]. The environment employs statistical tools to analyze records of social knowledge work, recognizing and crediting for instance the peer feedback that made a knowledge construct stronger, or tracking the differential contributions of participants in a jointly created work. We encourage and value the learners' knowledge representations assembled in the form of rich, multimodal sources employing any of the available media. Such representations are products of distributed cognition, where traces of the knowledge production process are as important as the products themselves, as well as the sources used, peer feedback during the making, and the social - collaborative intelligence employed.

978-1-5386-1174-6/18/$31.00 ©2018 IEEE

II. Literature Review

In our contemporary society, the necessity of developing collaborative skills is higher than ever because the need to work with other people on critical issues has become fundamental (Austin, J. E., 2000; Welch, M., 1998). The way to develop collaborative skills is through education, formal, informal, face-to-face or online. Collaborative learning was first described as an instructional approach of having students work in groups towards a common learning goal, aiming to the ultimate result of enhancing the learning experience and performance for each member of the group (Johnson, Johnson & Smith, 2013; Alavi, 2018). More specifically, collaborative learning incorporates the exchange of ideas, challenges and conversations that lead to mutual understanding and problem solving (Dillenbourg, Baker, Blaye, & O'Malley, 1995). Although collaborative learning has been researched before, the focus has shifted to analyzing groups as the unit of analysis and each individual student as cognitive pieces in a learning network (Dillenbourg et al., 1995). Collaborative learning positively influences learning in groups (Brown, Collins, & Duguid, 1989) and there exists some agreement among collaborative learning research, social constructivism and connectivism regarding the role of learners in learning groups. Each individual contributes past knowledge and understanding and at the same time gather knowledge from others in the group (Siemens, 2005). The benefits of collaborative learning are numerous and according to Laal & Ghodsi (2012), they can be distinguished in four categories:

- Social benefits: development of a support system for students through the act of collaboration, better understanding of differences and, thus, diversity, development of learning communities and creation of a positive environment to perform collaboration later on;
- Psychological benefits: reinforcement of learners' self-esteem, reduction of anxiety, development of positive attitudes towards teachers;
- Academic benefits: development of critical thinking skills, active involvement of students' in the learning process, improved performance results, modelling and practicing of problem-solving techniques, personalized lecturing, higher student motivation;
- Assessment benefits: utilization of a variety of assessment techniques, through teacher's observation of students interacting with each other, explaining their reasoning, asking questions and discussing ideas.

As computers began to be used to aid collaboration, a new branch of collaborative learning research called Computer Supported Collaborative Learning (CSCL) emerged. CSCL research shows that students who are working collaboratively in task-oriented learning activities, develop a better understanding of materials, they are more satisfied, and performance is improved in a group and not only individually in online courses (Resta & Laferrière, 2007). Moreover, as Palloff & Pratt (1999) state distant education relies on the existence and functionality of learning communities, thus collaborative work with peer-interaction can be an effective way to improve learner outcomes and it is important to the discussion of e-learning. The review of past research indicates not only the importance and efficacy of social learning, but also the importance of social collaborative learning in online learning environments. Piaget (1959), Vygotsky (1978) and other researchers found that learning takes place in a social environment and is facilitated by dialogue or interaction (Adair-Hauck & Donato, 1994; Aljaafreh & Lantolf, 1994; Anton & DiCamilla, 1998; Coughlin & Duff, 1996; Warschauer, 1997). Exchange of ideas gives learners the opportunity to internalize the newly constructed knowledge. Learning can be mediated by where it occurs, what tools are used to aid learning, and the involved participation of learners in the learning process (Bonk & Cunningham, 1998). Instructors can facilitate collaboration with hints, prompts, questions, suggestions, and rubrics. This form of learning encourages learner autonomy (Henri & Rigault, 1996), changes the role of teachers and students, and creates scope for students to scaffold, facilitate discussion and promote critical thinking (Bonk & King, 1998). Through collaboration students achieve a higher understanding of tasks or problem solving than they would independently and when this collaboration is through writing and computer-mediated communications (CMC), work shifts from independently performed tasks to a more combined effort through the inclusion of input and reflection from peers.

III. Social-Collaboration Intelligence in Practice

According to Cope and Kalantzis [1], e-learning ecologies refers to the understanding of the learning environment as an ecology, incorporating the complex interactions between human, textual, discursive and spatial dynamics. E-learning ecologies not only impact learner's configurations of space, their relationships, the textural forms of knowledge to which they are exposed, the types of knowledge artefacts that they create and the way the outcomes of their learning and measured. [2] Cope and Kalantzis [2] operationalize the idea of e-learning ecologies by heuristically segmented them into seven "new learning" affordances, ie. e-Learning Affordances: ubiquitous learning, active knowledge making, multimodal meaning, recursive feedback, collaborative intelligence, metacognition and differentiated learning. CGScholar's environment emphasizes how the seven affordances constitute the grounds for the reflexive pedagogical rationale and the learning analytics. The seven affordances represent an "agenda for new learning and assessment" that redefine the relations among knowledge and learning, recalibrating traditional modes of pedagogies in an attempt to create learning ecologies which better serve the current educational needs and goals. This paper particularly elaborates on the fifth e-learning affordance, collaborative intelligence. Collaborative intelligence focuses on learning as social activity instead of learning as individual memory, building skills of collaboration and negotiation necessary for complex, diverse world. [3] There are two fundamental aspects of this new recognition of the sociability of knowledge: a shift away from knowledge memorization toward a culture of knowledge sourcing and developing skills and strategies for knowledge collaboration and social learning. [1] CGScholar teaching and learning environment presents three dimensions of collaborative: 1. The capacity to navigate, critically review and link to the knowledge of the world and the many perspectives on that knowledge that are nowadays

available online; 2. the social work of knowledge making, working collaboratively on the scaffolded feedback process where other people must be credited as knowledge contributors because they have provided formative assessments that improve the quality of the final work; 3. The knowledge work of the learners is oriented to the community of learners, not to the assessing teacher nor standardized with result being not a set of scripts that are evaluated according to their sameness, instead, a class knowledge bank where shared knowledge is valued for the additional and complementary information that different perspective offer. [4]

CGScholar assessment system does not measure the stuff you can remember but the quality of the knowledge work you can do as you reach for available knowledge sources and work collaboratively appears [4]. In CGScholar environment, every student is "talking" all the time, which is a kind of peer-to-peer interactions and feedbacks that scaffolded by teachers. Social knowledge technologies enable the interactions to be nearly silent, no matter how intense and simultaneous. Moreover, all students are involved simultaneously in constructive peer-to-peer learning dialogue. Continuous formative assessment supplements teacher assessments with structured self-and-peer assessments. For weekly or termly assignments, finished works are published for access by the whole class, positioning the knowledge community as audience [2]. CGScholar system creates environments of participatory learning, where learners are knowledge producers as much as knowledge consumers. Participants in CGScholar environment collaborates with peers in knowledge production, co-authors, peer reviewers, and as readers and discussants of finished works shared with other learners. CGScholar transforms the heritatage connotations associated with "teachers" and "students". This is an environment of simultaneous, public contribution. In the Community space of CGScholar, an activity stream like othter social media like other social media, but where the space provided for "Updates" suggested sustained intervention, followed by extended dialogue. "Community" is a space that is dialogical like a social media wall but discursive like a blog. "Community" space alsoe works like a professional profile website, including a bionote and résumé page, and a portfolio of the scholars' publications—works that they have developed in the "Creator" space within Scholar, that have been peer reviewed and then published by the "publishing admin" of their knowledge community who ordinate groups in the collaborative knowledge production workflow, normally but not necessarily the teacher [2].

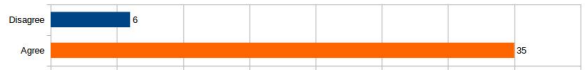
IV. Learning Analytics

To examine the collaborative feature of CGScholar in practice, we have utilized a case study analysis of the graduate level course EPSY408, "Learning and Human Development with Education Technology". This is a required course of students in the Learning Design and Leadership Program at the University of Illinois Urbana-Champaign. The course was offered in the first term of Spring semester of 2018. A total of 97 students joined the course community in CGScholar to do the course activities, and 41 of these students have participated in the post course survey. The aim of this survey was to understand students' perception and experience of using CGScholar as an e-Learning tool that support collaborative learning. Interestingly, quantitative and qualitative data analysis have shown impressive results which we will explain below in more details.

A. Quantitative & Qualitative Data Analysis:

Below are the results from three survey questions about the students' experiences using CGScholar. Findings have shown that almost 85% of students in this course agreed that CGScholar provides a social collaboration space to facilitate learning where students and instructors interact together by posting updates and comments.

Q1: *I felt that Scholar provided me with a good way to interact with peers through Updates and Comments.*

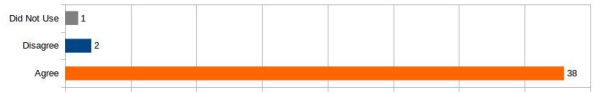


Also, results indicate that nearly 90% of the survey respondents agreed that the peer review feature of CGScholar is a great tool to improve their final project. CGScholar automatically assigns a number of peer reviews tasks to each student. After reviews are completed students can use the reviewers' feedback to complete further revisions of their work. The peer review system also allows students to provide text feedback to reviewers on their reviews and an overall review rating.

Q2: *I felt that the Peer Reviews I received from my classmates helped me make my Work better during the Revision phase of the project.*

Additionally, findings indicate that 92% of the survey respondents indicate that the analytics tool in CGScholar is tool to promote success and push learners to collaborate with other peers (see image ??). Indeed, CGScholar analytics tool provides the learner with essential information about their progress. A learner is be able to view their learning visualization at all times during a unit of work. The central image (image number??) is an "aster plot," where each petal of the metaphorical flower represents one kind of learner activity. At the start of the unit, the plot is a white circle, but as study progresses towards mastery, the colored petals in the aster plot grow using data continuously mined by the software during learning activities.

Q3: *I felt that the Analytics Tool in Scholar gave me useful information about my progress in the course.*



In addition to the quantitative analysis, this study incorporated qualitative analysis of the open-ended questions of the survey. The aim was to provide a deep understanding of students' experience using Scholar as an e-Learning tool built upon collaboration. Data analysis of this section have shown impressive results as of why students like this tool. Also, students indicated some concerns and challenges relevant to the

use of this platform that can be taken into consideration in future implementations. These are some quotes of students' responses regarding the opportunities and the challenges of this platform.

B. Opportunities & Challenges

By analyzing the open-ended question, describe some of the things you learned from your peers while interacting in Scholar, most of the survey respondents indicated positive comments relevant to the effectiveness use of this platform to promote collaborative learning. One of the students commented: "*My peers taught me that it is still possible in today's world to have different points of view and discuss differing opinions with an open mind. I enjoyed the many points of view and personal experiences shared.*"

A second respondent wrote: "*The various perspectives given are amazing. It is much more community driven than teacher driven. While the teacher is facilitating, it is impossible to create this many unique perspectives on your own as an educator. It also allowed me to pick and choose material that genuinely impacted myself as a teacher.*"

Another added: "*There were many useful techniques and strategies discussed in this course by my peers. I learned about the different strategies of conditioning some teachers use with their classroom and what kind of collaborative environments they create. Topics such as the effect of music in the classroom or the benefits of inquiry-based learning were all subjects brought forth by my peers that contributed to my learning.*"

A fourth student responded: "*It was interesting to actually see read all the updates. We all read the same admin update every week, but each person's reaction to that update is so different. It was also great to read about other people's experiences and line of expertise.*"

Another said: "*I wish all my classes used this method. This is my last course that I will be using Scholar in (since I only have one more class to finish and it will use Moodle) and I will be very sad to not be able to use Scholar. It is easy to use and very effective in delivering content while collaborating with my peers.*"

While most of the students valued the collaborative feature of CGScholar, some students have indicated issues of concerns associated in its implementation. Understanding the challenging aspects of CGScholar is important to improve the platform in future iterations. This part of the analysis is drawn upon the open-ended question, what did you find most challenging about using Scholar? What recommendations would you make for further development? Most of the concerns appeared in the data analysis are relevant to the technical aspects of the platform, but not to its pedagogical foundations of collaboration. These are some examples of what the students wrote:

Student A wrote: *"I wish in the Creator section there was some way that it would track misspellings without having to go through Checker. My brain thinks faster than I can type and I know that even with proofreading, I still have some errors that go unnoticed.*"

Student B wrote: "*I think the annotations section needs a scrollbar. When the list gets too long, they are difficult to read.*"

Student C responded: "*I think something that was challenging for me was finding an update or filtering the updates. I also think that the annotations were a little hard and not as useful as the typed peer feedback. They seemed more of a task as opposed to something that was actually like a comment on a google doc.*"

Student D said: "*The newsfeed was sometimes very jumbled and hard to follow. I was also frustrated during the peer review phase when one of the works I reviewed was so short and incomplete that I couldn't meet the number of annotations or words in my feedback which dropped my score for that category. At some points while writing my paper it felt more trouble than it was worth compared to just writing in word.*"

Student E wrote: *"I did not find Scholar challenging, it was very helpful and definitely added to my learning experience.*"

Student F wrote: "*Once Scholar was explained to me and after using it for about the first week, I got the hang of it and it was very easy to use.*"

V. Conclusion

In this paper we have presented a series of big data learning analytics that resulted from a number of authentic online courses over our e-learning platform, that is strongly grounded within a reflexive pedagogy. The education methodologies employed focus on how to better assess complex reasoning skills such as critical and creative thinking, through peer, expert and self-reviews. Additionally, pre- and post- surveys also provided quantitative and qualitative data to supplement our conclusions following the interpretation of the results. We strongly believe that the functionality provided through such a platform, based on Bloom's learning for mastery ideology, together with our new learning affordances model, learners are in a better position to achieve their academic goals through their own pace and their own personal learning approach.

[1] G. Eason, B. Noble, and I.N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," Phil. Trans. Roy. Soc. London, vol. A247, pp. 529-551, April 1955. (*references*)

[2] J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68-73.

[3] I.S. Jacobs and C.P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G.T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271-350.

[4] K. Elissa, "Title of paper if known," unpublished.

[5] R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.

[6] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740-741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].

[7] M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.