Activity theory and technology mediated interaction: Cognitive scaffolding using question-based consultation on *Facebook*

Patient Rambe
University of the Free State

Studies that employed activity theory as a theoretical lens for exploring computer-mediated interaction have not adopted social media as their object of study. However, social media provides lecturers with personalised learning environments for diagnostic and prognostic assessments of student mastery of content and deep learning. The integration of *Facebook* into educators' pedagogical intentions potentially scaffolds students cognitively, leverages their understanding of content and ameliorates limited mediated learning experiences. Using activity theory as an interpretive framework and a multi-method data construction process involving in-depth semi-structured interviews, in-class observations, post observation debriefing and data mining of student and lecturer-generated *Facebook* postings, the study explored *Facebook's* potential to scaffold student cogitative processes and promote academic engagement. Findings suggest that the academic value of *Facebook* is contingent upon the extent of its integration into the pedagogical design of courses, student academic maturity and their level of ICT competence. The unintended effects of *Facebook* were its reproduction of peer-based academic hierarchies, and its revelation of cognitive tensions and power differentials between academically gifted and cognitively challenged learners during lectures.

Introduction

Social networking sites (SNSs) are valued for their ability to generate communities based on users' shared interests rather than kinship or locality (Kuswara, Cram & Richards, 2008). More so, their networked effect engenders distributed learning and fosters personalised learning environments for university students. SNSs sustain highly distributed user-bases and enable the convergence of users with shared interests, mutual trust, and seeking access to similar resources (Athanasopoulos, et al., 2008). Cherished attributes are their user-friendliness, support for flexible communication, and collaborative engagements through memberships of multiple groups (Baatarjav, Phithakkitnukoon, & Dantu, 2008). The enhancement of an architecture of participation and informal knowledge sharing by SNS such as *Facebook* make them ideal spaces for mediated intellectual engagement. Norgrove & Bean (2007) articulate that the *Facebook* environment requires users to develop self-narratives on their profile pages, which activate academic contact from peers and sustenance of discursive communities based on shared academic topics.

Dissenting voices on the adoption Web 2.0 tools for education foreground the dilemmas they bring to bear upon institutions: the challenge of using unproven technologies, risk aversion and security of networks, fears that social media are

potentially a technological fad (Armstrong & Franklin, 2008), and their deliberate masking of power in order to effect control (Jarrett, 2008). In spite of SNSs' usability for convenient web based research, they are blamed for reinventing new techniques for cheating in assignments and examinations (Seitz, Orsini & Gringle, 2011).

Mindful of SNSs' virtues and vices, their productive use lies in users' (educators and students) motivations, self-regulation and reinforcement of academically rewarding behaviour. An advancement of this hypothesis necessitates an exploration of their potential to mediate the cognitive scaffolding of students. Consequently, this study addresses the following questions:

1. How do lecturer-student and student-peer engagements using *Facebook* cognitively scaffold students?

2. How does *Facebook* academic mediation improve student democratic access to learning resources and knowledgeable peers?

The adoption of *Facebook* as an object of study was informed by these justifications: a. It constituted the most popular technology among students at the university where this study was conducted; b. The Commerce Faculty at this university had adopted it as a supplement for student lectures and the learning management system (LMS), hence had potential intellectual significance; c. For some previously disadvantaged students (PDS) with limited self-esteem and communicative competence, Facebook embodied a prospective 'mouth piece' for their democratic self-expression. Previously disadvantaged students are learners from historically underprivileged backgrounds who attended impoverished high schools and often had limited ICT backgrounds. At the institution studied, they were normally enrolled for the Academic Development Program after failing the ICT proficiency test for their admission into mainstream classes.

Literature review

Academic appropriation of *Facebook*

SNSs are reported to foster a sense of community in online environments where students do not have opportunities to meet face to face with peers or educators (Brady, Holcomb & Smith, 2010). Therefore, *Facebook's* intellectual potential lies in its affordances for sustaining user-generated discursive communities bound by shared artefacts, communally-generated social objects and common academic interests. The *Horizon Report* (2008) maintained that Web 2.0 technologies like *Facebook* enable users to build shared collections of academic resources, make comments on friends' web pages, share personal information, make detailed annotations, and discover peers' perspectives on interesting topics. These observations resonate with the pedagogical usefulness of *Facebook* for meaningful learning.

Barbour & Plough (2009) articulate the consequence of Odyssey Charter School's (Las Vegas) academic adoption of *Facebook* as improvements in the quality of intellectual discussions in *Facebook* groups. This is notwithstanding discernible challenges that included a lack of incentives for students to join *Facebook* groups and the confinement of interaction to discussions and wall comments. Yet socio-cultural and contextual influences play out profoundly in productive appropriation of *Facebook* for sourcing

academic resources, locating knowledgeable peers and seasoned academics in the field. For instance, Santos, Hammond, Durli & Chou's (2009) survey on Singaporean undergraduate and Brazilian Masters student use of SNSs reports qualitatively different results. The majority (60%) of Brazilian learners used SNSs to exchange learning resources, information, and solicit support for their studies from peers, while Singaporeans emphasised social interactions. Santos et al. (2009) attribute the differentiated use to the Brazilian group's limited opportunities for face to face encounters, hence their dependence on exchanging bibliographies and web sites. Unlike their campus-based Singaporeans counterparts who met occasionally for academic discussions, the Brazilians were off campus students with limited access to libraries, conferences and educational centres.

Application of activity theory to technology-mediated learning

Studies that applied activity theory (AT) as their theoretical and analytical lenses examined: academic application of computer-based video games (Amory, 2010; Ang, Zaphiris & Wilson, 2010), computer supported collaborative learning (CSCL) (Collis & Margaryan, 2004; Lipponen, Hakkarainen & Paavola, 2004), mobile learning (Uden, 2007; Sharples, Taylor & Vavoula, 2007) and explicit and tacit knowledge sharing by teaching communities (Baran & Cagiltay, 2010). These multiple studies have emphasised among other issues: technology's mediation of knowledge construction, emergence of reflective and expansive learning from explicit play, the complexities arising from the lack of a unifying theoretical and methodological framework in CSCL and use of AT to inform the design of new environments and support mobile learning.

A handful of studies that employ AT to examine the needs and outcomes of designing constructivist learning environments have emerged (Jonassen & Rohrer-Murphy, 1999; Jenlink, 2008; Fullick, 2005). Jonassen & Rohrer-Murphy (1999) employed AT to demonstrate how human consciousness emerges from socio-cultural contexts and transforms through their engagement in activity systems. They argued that AT provides a powerful framework for analysing the needs, tasks and outcomes of designing constructivist learning environments, due to the consonance of the assumptions of AT with those of constructivism and situated learning. Similarly, Jenlink (2008) demonstrated how conversations mediate the design of educative human activity systems. He located design conversation in an activity systems framework to illustrate its dynamic relationships with subjects, purpose, artifacts, community, design work, and socio-cultural rules governing design.

Despite their demonstration of AT and activity systems' mediation of knowledge and learning, these studies are not anchored in social networking environments (SNE). Consequently, studies that deploy an AT framework to unravel collaborative knowledge development in SNEs are disappointingly low (Masters, 2009; Rambe &Ng'ambi, 2011). Given university students' domestication of social networking technology coupled with "their willing[ness] to invest a significant amount of time in learning and teaching skills […] within informal networks" (Bell, 2011), an examination of student support structures in SNEs potentially illuminates our understanding of collaborative knowledge building in collective activity systems. Consequently, Engestrom's (1987) framework is employed to provide unified theoretical and analytical lenses for deconstructing the influence of *Facebook*-enhanced educator-student and student-peer interactions on the cognitive scaffolding of Information Systems students.

Theoretical framework

Vygotsky and semiotic mediation

Vygotsky's (1978) conception of cultural development is that human interaction with the social world is not direct but rather is mediated by semiotic tools (language, text, speech) and signs (symbols, numbers, formulas). His stimulus-response theorisation of human action mediated by cultural tools constitutes the basic activity system. Kozulin (2003) distinguished *human mediation* that traces the effectiveness of the adult/ experienced person in enhancing the child/ novice's performance from *symbolic mediation,* which foregrounds the changes in a novice's performance instantiated by the use of symbolic tools.

Scaffolding entails an adult/ expert/ knowledgeable peer's use of tools to assist the novice in more complex problem solving, which the novice may not otherwise achieve independently. Vygotsky (1987) hinted the kinds of assistance desirable for children [or learners]: "demonstration, leading questions, and by introducing the initial elements of a task's solution" (Vygotsky, 1987, p. 209). Human agents (instructional support), symbolic tools (texts and symbols) and technological tools (*Facebook* applications, interactive pages, queries, questions, and answers) potentially scaffold learners in meaningful learning in SNEs.

Third generation activity theory

Engeström (1987, 2001) broadened the scope of Vygotsky's triad model of psychological development and Leontiev's (1981) hierarchy of activity system by including societal and contextual elements namely, rules, community and roles. In AT, each activity is analysed as part of the collective and with a socio-historical context of the individual and the collective, and hence *Cultural Historical Activity Theory* (CHAT) (Koszalka, 2004).
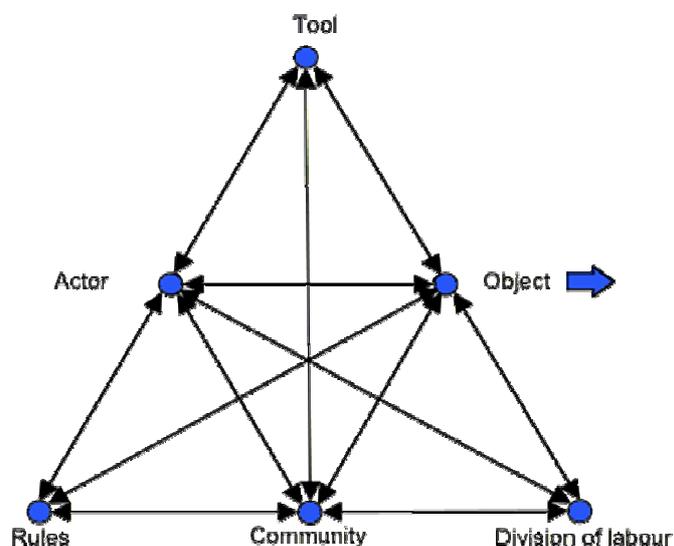

Figure 1: Activity system diagram (redrawn from Engeström, 1987).

An *activity* is an outcome of an interaction of the participating subject, tools used in the activity and actions and operations that affect the outcome (Nardi, 1996). It describes the minimal meaningful context for individual actions, which must be included in the basic unit of analysis (Kuutti, 1995). The *Facebook* environment, therefore, constitutes an activity system through which intellectual consciousness about disciplinary discourses emerges through subjects' engagements via in different interactional spaces (private inbox conversations, forum discussions, wall postings).

For Nardi (1996), a *subject* is a person or group participating in an activity while the *object* is held by the subject and motivates the activity giving it a specific direction (p. 73). On *Facebook*, individual students reflecting on their own or participating in collaborative activities (contributing some postings, commenting on peers' views, engaging in collaborative discussions) constitute the *subjects* who jointly participate in knowledge building and meaningful learning (*object*). The educators' *object* on *Facebook* is to harness self and co-generated artefacts (leading questions, hints, props, explanations) on discursive spaces to scaffold student understanding and engagement with complex concepts and problems.

Tools mediate the reciprocal relationship between subjects and the object of activity and they are the material artefacts through which the historical development of relationships between subjects and object of activity are condensed (Kuutti, 1995). On *Facebook*, *technological tools* involve aforementioned interactional spaces and applications through which academic and social conversations emerge. Textual language and resources (text messages, emoticons, symbols, pictures and graphics) constitute *semiotic tools* for communicating messages and intentions in the networked community. In classrooms, multimedia technologies (data projectors, interactive whiteboards) and broadcast equipment (microphones, loudspeakers) constitute technological tools that support transmission of knowledge to learners (another *object*).

The *community* negotiates and mediates the rules and customs that describe how it functions, what it believes and the ways it supports different activities (Jonassen & Rohrer-Murphy, 1999). In a *Facebook* environment, the *community* comprises students, their peers, senior students, educators and the broader learning community they share information and knowledge with on *Facebook*. Peer-coaching, peer commenting, endorsements ("likes," informal voting for desirable persons), tagging of textual resources are ideal instantiations of academic networking and shared repertoires in *Facebook* activity systems.

Drawing on Engeström (1987), Collis & Margaryan (2004) project *rules* as implicit and explicit norms and guidelines of the community that constrain [/enable] the activity. In the *Facebook* environment for the present research, all subjects (students) were expected to sign up on *Facebook* and to join the discussion group for networked interaction to happen. Its academic application also necessitated the subject's adoption of the appropriate netiquette and communication medium (English language) for the sustenance of productive engagements among all subjects. Given the constraints on bandwidth in this university, *Facebook* use was restricted in some laboratories and libraries.

Collis & Margaryan (2004) present *division of labour* as horizontal and vertical roles and relationships within the community that affect task division. The multiple, intersecting roles that educators and students undertook during their collaborative engagement

included information seeking, knowledge dissemination, information synthesis, academic networking, and critical inquiry through questions, queries and explanations.

Value of activity theory

Baran & Cagiltay's (2010) findings on how in service teachers' communities of practices enable explicit knowledge and tacit knowledge sharing affirm that AT presented a crucial analytical tool for grasping the mediating role of technology (i.e., discussion lists) in teaching communities' practices of tacit knowledge sharing. For Bazerman (1998), AT's analytical value lies in its capacity to mutate the boundary between the artefact and the social agent making both constitutive elements of consciousness, which transcend the cognition of individuals. Its interpretive power unfolds through its illustrations of the materialisation of consciousness through socially and culturally mediated emergent activities (Bazerman, 1998). As such, AT affords the understanding of cultural development as a process of both social exchange and an instantiation of human cogitation. AT allows for the progression from individual activity towards collective activities through considering object-oriented, tool-mediated collective activity system as its unit of analysis (Daniel, 2001).

Methodology

Critical ethnographic approach

Critical ethnography is adopted as a methodological approach for this study. Critical ethnographic research is [an] emergent process involving dialogue between the ethnographer and the people in a research setting (Myers, 1999). The ethnography involved in-depth interviews, de-briefings, and in-classroom observations of first year commerce students and their lecturers, which afforded deep conversations that illuminated understanding of *Facebook*-enhanced learning. A critical ethnographic stance necessitates consciousness about hegemonic discourses and communicative repertoires that are controlling and alienating to research participants. Simon & Dippo (1996) warn critical ethnographers of the need for reflexivity:

> We should turn to a consideration of how the discourse we use to talk with others and through which we write and think, silences as well as articulates [...] At times we have a tendency to universalize our discourse, forgetting its regulatory impact (Simon & Dippo, 1986, p. 201).

To this effect, reflexivity was applied to different levels: a. revisiting research assumptions and theoretical lenses for authenticity as the research evolved; b. assessing research data by re-interrogating respondent views in light of competing permutations that explained their responses; and c. allowing independent researchers to validate the data analysis categories.

Research context

To supplement lectures and the LMS, the Information Systems (IS) department expected first year IS students to sign up on *Facebook* and join the IS *Facebook* group. Students who accomplished these requirements earned an additional 2% towards their term mark. One of the five lecturers who taught this module adopted an online administrator role of addressing student queries on *Facebook*. The 850 students in this

module were grouped into three clusters - two clusters each comprising 400 students from privileged backgrounds, and the third cluster with 50 previously disadvantaged students. While they attended separate lectures, these clusters were taught the same content by two regular and three guest lecturers. The *Facebook* administrator who taught all clusters addressed all students' queries on theory, practicals and course administration through private messages via her *Facebook* inbox, wall and forums posts.

Triangulation

Yin (1994) recommended multiple sources of evidence for case study designs to enable the development of converging lines of inquiry. In data triangulation, findings or conclusions are considered as convincing and accurate if they are based on corroborative evidence from different information sources.

The research combined online ethnography of mined *Facebook* data, direct observation of lecturer-student and student-peer interaction in *Facebook*-enhanced lectures, and in-depth, semi-structured interviews with educators and students.

The data construction processes involved:

- Observations investigating the influence of *Facebook* on lectures;
- Interviews on lecturers and students' experiences of using *Facebook*;
- Occasional debriefings with the online administrator whose classes were observed;
- Mining and examining postings by lecturers and students on *Facebook* during online consultations.

Observations
The IS lecturers gave consent to the researcher to observe their classes, allowing him to attended all lectures and lab sessions. The participative approach bolstered mutual trust between students and the researcher and naturalistic observations provided direct contact that leveraged dependability of results. Live observations illuminated understanding of:

- The academic impact of *Facebook* on in-class interactions and student learning;
- Other contextual factors that influenced in-class interaction;
- The authenticity of lecturers' interview responses on *Facebook's* impact on in-class relations.

Each lecture observation lasted 45 minutes, the average duration of a lecture. A total of 15 in-class observations were conducted. Audio recording of lectures was conceived as less distractive than video recording. While lecturers consented to these recordings, progressively, students became oblivious to these recordings as they were less intrusive and did not target any individuals.

Although in Figure 2 the six Academic Development Program (ADP) class and six mainstream class observations appear in succession, this is just for illustration purposes. In reality, both sessions were conducted in alternation on Mondays and Wednesdays. Mainstream class observations were not conducted in the second semester as these students took the course for a semester. Also, note that IS and IT are used interchangeably.

Interviews

The course convenor introduced the researcher to the students in lectures, explained his research intentions, solicited and secured student support of his admission to the IS *Facebook* discussion forum. Subsequently, the researcher created his *Facebook* page and the convenor invited him to join the *Facebook* forum, thereby authorising his social presence and access to student's profiles.

Of the 850 students who created *Facebook* accounts and joined the *Facebook* forum, only 165 students posted at least one posting on *Facebook*. Given the research's focus on understanding *Facebook's* potential to scaffold learners, *Facebook* non-participants were naturally excluded from the interviews. A total of 85 *Facebook* users were selected and contacted via *Facebook* for scheduled in-depth interviews. Of the 50 students who responded and were interviewed, 39 were mainstream students while 11 were from the ADP class.

Interviewing process

Three phases were adopted namely: 1. opening in-depth interviews; 2. follow-up interviews; and 3. closing interviews. In AT, the dialectical relationships between the *subjects*, *object* intended, and multiple activities which subjects are involved in continually changes over time as new *objects* are sought and *communities* co-evolve. Mindful of these dynamics, follow-up interviews were considered necessary. Opening interviews with two IS lecturers investigated their motivations for introducing *Facebook* consultations and the interactions activated by its adoption. These interviews lasted about 45 minutes. Student interviews explored their use of *Facebook*, their *Facebook*-mediated relations with academics, and structure of their online and offline networks.

In total, five in-depth follow-up interviews were conducted with IS lecturers, which solicited information on the academic support they rendered students on *Facebook*, nature of *Facebook* lecturer-student relations, and how their teaching strategies were influenced by *Facebook*. Follow-up interviews lasted an hour. Follow-up interviews with 5 students interrogated the academic value of using *Facebook* and the inclusivity of their academic environment. Since students interacted in the same *Facebook* spaces and raised almost homogenous issues in their opening interviews, only students who articulated the most distinctive, culturally dynamic traits and raised differentiated issues were considered for follow-up interviews. This evidence was corroborated with mined *Facebook* data, in-class observations and debriefings with the lecturer (see Figure 2 and the section on application of CHAT).

Closing interviews provided a synthesised perspective on outstanding issues from previous interviews, and were corroborated with evidence from second phases of observations and researcher reflections on his participatory observation in *Facebook*. These interviews examined the impacts of *Facebook* on lecturers' pedagogical styles and they lasted 30 minutes.

Data analysis

Mined *Facebook* postings

After the second semester, the online administrator downloaded all her original consultations with students via her *Facebook* inbox, wall and discussion forum, and authorised the researcher to conduct an in-depth analysis of them. Identity markers on

individual postings were eliminated to protect students' personal identities. Student-peer interactions via their private inboxes were considered inadmissible, for privacy reasons.
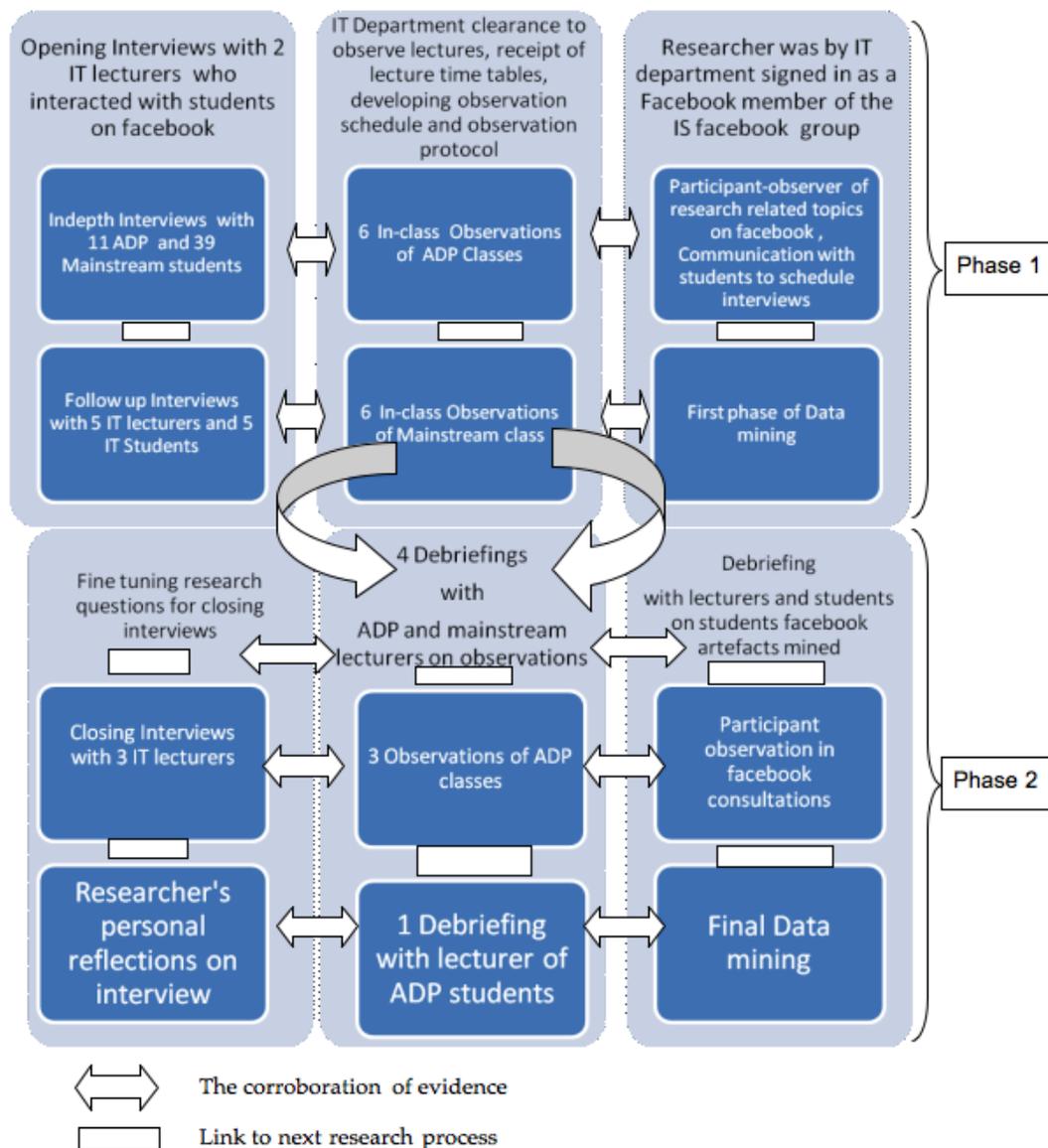
Figure 2: Detailed research process

The *Facebook* lecturer-student and student-peer discussions comprised questions, queries, elaborations and answers posted by the lecturer and students. The 165 participants had posted 121 messages to the administrator's inbox, 139 discussion forum and 154 wall posts. Their quantitative analysis involved the counting and tallying of different postings based on their academic or social nature. Since *Facebook's*

scaffolding and mediation potential were the foci of this investigation, detailed elaborations of quantitative analysis are not reported in this paper. However, Burnard's (1991) thematic content analysis (see the next section for its application) was used to examine qualitatively the learning that unfolded via these spaces.

Analysis of semi-structured Interviews and post-observation debriefings

The development of the questions and subsequent analysis of activity system elements were informed by Jonassen & Rohrer-Murphy's (1999) AT analytical framework. Their analytical framework, which draws on Engeström's (1987) work, emphasised an understanding of *socio-cultural contexts* in which *activities* occur, the *subject*'s motivations and interpretations of perceived contradictions in the system, the *community-communities*, *object*, activity, *rules* and *roles* of the activity system (see the Appendices). This framework was then drawn into conversation with Burnard's (1991) thematic content analysis.

Burnard's (1991) analysis was adopted for coding and analyses of the three interview data sets. His content analysis involves:

1. Close reading of data to identify main themes;
2. Re-reading of transcripts to identify specific loadings and categories, and shedding irrelevant material (open coding);
3. Resorting categories and grouping with similar headings to develop a formal list;
4. Blind validation of research findings by two colleagues and discussion of three lists of categories and their adjustment. A seasoned researcher of social media and a senior academic were requested to validate the list of categories and preliminary findings;
5. Transcripts and categories are [re]examined identifying data relating to each category and data is linked to category headings;
6. Transcripts are coded according to the developed categories and sub headings;
7. Respondents are asked to validate and check categories and adjustments are made. Three undergraduate students, and the two lecturers (cited in 4) validated the findings; and
8. Write up is progressively conducted with reference being made to transcripts.

Application of CHAT in technology-mediated environments

Lectures
In understanding lectures as activity systems, the study examined lecturer-student in-class interactions and how *Facebook* interactions affected classroom activities. The classes comprised the two clusters learning IS and the ADP class on an extended IS program. This is critical to grasping how *Facebook* mediated the cognitive scaffolding of students.

Socio-historical context

The lecturers taught multicultural classes which comprised students with varying cognitive development, English language mastery, questioning skills, and ICT literacy. In class interaction patterns and ICT background questions illuminated understanding of some students' limited ICT background and online networking skills, which led to a sub optimal adoption of *Facebook* (see Observation protocol and interview guide in the Appendices).

Table 1: Summary of activity elements

Element of activity	Extracts of observation and interview transcripts and *Facebook* postings	Researcher's comments
Socio-cultural and historical influences	*My classroom friends are black because I was socialised to blacks and I am reserved.* It's very difficult for me to understand and interact with coloureds, whites and Indians as we don't share similar interests. *We don't connect because we have different problems, interests and see things differently* [...] (PDS interview).	Prior socialisation processes and personality traits precluded this PDS from broadening her network to embrace other racial groups. Entrenched racial perceptions reinforced the alienation and seclusion of PDS with limited communicative competence.
	I am content with basics like *Yahoo* and short message service, and I will not go for *Facebook because I am comfortable with basics. I am conservative and cannot keep pace with new things* (PDS interview).	Self-contentment and conservatism is employed to mask a limited ICT literacy background that complicates online academic networking.
	I started using the Internet when I came to university. My sister opened an email account for me and I had no idea how to use it. Literally, I was stranded [...] (Student Interview).	ICT literacy background questions expose the PDS' limited access to computers in high school.
Object of activity		
1. Effective design of learning by the lecturer.	A student number, student name and address are attributes of an object, they are fields. So a database must have tables and table consist of records [...] (Observation transcript of an in-class demonstration)	Demonstration of *Access* concepts is one strategy of instructional delivery.
2. Meaningful inter-action in class that drew upon *Facebook* and familiarised students with IS disciplinary knowledge.	One issue I want to note is that I am always on *Facebook* [...]. I know if you have IS problems some of you can't talk here or come to my office. So call on *Facebook* [...] (Observation transcript).	*Facebook* acknowledged as complementary learning space to lectures.
3. Mastery of *Excel* and *Access* practical concepts and discourses.	*We are trying to create a database, which captures the following information.* When you are given a story like this in the exam [...] (Observation transcript).	1. Database development is the object of the lecture. 2. Application of lecture content as a basis for exam preparation.
Subjects of activity		
Student X	*I have never shared information on the department Facebook group. It was just a departmental requirement* (Student interview).	1. Student scepticism about academic value of *Facebook*.
Student Y	I haven't posted anything [...] *I don't know if students are taking Facebook seriously because everyone is up for social applications and I have not seen anyone who used it positively* (Student interview).	1. Social networking is not conceived as learning. 2. *Facebook* 'flippant' use by peers shapes negative perceptions.

Student Z	I use *Facebook* to interact with the IS online administrator. *If I don't understand any material discussed in lectures, I discuss it with her.* [...] *Students also comment if I have a problem* [...] *so I speak to more people and get more solutions to a problem* (Student int.)	1. *Facebook* complements classroom learning. 2. Supports collective generation of resources and information support.
Introverts	*I do not ask questions in class because I'm very shy* [...]. I would rather send messages to her *Facebook* inbox than go to see her. I know when I ask a stupid question I don't want to see on her face that she is saying, "It's a silly question!"[...] *On Facebook she would just answer it.* (Student interview).	Timid, shy students preferred sending private *Facebook* messages to consulting face to face. *Facebook* perceptibly leveraged the expression of muted voices as lecturers' responses were guaranteed.
Hyper-communic-ators	I use the IS *Facebook* group to send questions and read peers' questions and responses they got from the administrator [...]. *At times it's about knowing how other students are thinking, and questioning myself whether I am also thinking in that direction* [...] (Student interview).	For hyper-communicators, *Facebook* served multiple functions: inquiring about information, engaging with peers' contributions and personal reflections on one's thoughts.
Tools mediating activity		
Material artefacts	Lecturer: In the next quiz, you are doing forms and reports [...]. For this section *I expect you to have completed everything in my handout* [...].	1. Handout is used as a scaffolding tool.
Psychological tools Direct questions	Lecturer**:** Why should we change from Microsoft *Excel* to databases**?** Student: To keep afloat. L: No. Why would a company need a database? (Mainstream class observation transcript).	1. Lecturer uses questions to diagnose students' current knowledge. 2. Questions are psychological tools for supporting topic-based reflections.
Prompt questions	*(Lecturer scaffolds students in working out an Excel problem)* Lecturer: The raw materials are 60% of the salaries so what formula do I use? *It's equal to*? Students : Salaries L: *Salaries is in which cell?* S : V6 L: *V6 X?* S : V6 X 60% + L: *You then say what?* [...] (ADP class observation transcript)	1. Question prompts scaffold student learning by connecting prior knowledge to current complex tasks. 2. Questions assess student understanding of problem solving.
Human tool	*Sweetheart!* (*Lecturer picks on a student to demonstrate a concept to peers*). Come over here and change the credit cards. The scenario here is that no one in this household will use credit cards […] (ADP class observation transcript). My observation is that if someone posted a message on *Facebook*, the next day *the lecturer revisits it in class. She explains the message to the entire class* (Student interview).	1. Lecturer uses peer demonstration as a mediating tool to lever student learning. The lecturer is a cognitive bridge that connects *Facebook* and lecture practices.

Technological tool	I answer student queries on theory and practical aspects on *Facebook* […]. If they have practical sessions and cannot ask their tutors or come in person, so they consult via Facebook (Lecturer interview transcript)	1. *Facebook* recognised as a scaffolding academic tool.
		2. Elaborations, emphases and explanations harnessed as cognitive levers.
	Student query: What does BPR involves? (Wall Post 82) BPR=Business Process Re-engineering: it is a systematic, disciplined improvement approach that critically examines, rethinks, and redesigns mission-delivery processes in order to achieve dramatic improvements in performance […] (Wall Post 83).	*Facebook* provided a democratic space for elaborate discussion on IS concepts.

Notes: PDS = previously disadvantaged student; ADP = Academic Development Program.

Object of activity

The *object* denotes the goal-directed nature of human consciousness. It is realised through a series of goal-directed actions and underscores that goals are formulated precisely in the service of realising activities (Roth & Lee, 2006). When teaching and learning Microsoft *Access* and *Excel* are conceived as an *activity*, the focus shifts from rote participation in mundane tasks to understanding structural forces that support/constrain the subject's goal directed action. The learning *objects* involved meaningful social/ academic interaction on *Facebook*, effective design of learning tasks, participation in IS discourses, mastery of concepts and complex IS problem solving.

These *objects* were affected by the interplay of individual and collective meditating factors that impacted lecture delivery and online collaborative networking. Lecturers' ability to articulate learning objects clearly was instrumental to student learning, given that learners with limited 'prior mediated learning experiences' (Feuerstein et al., 1980) often conflate the learning object with materials harnessed to achieve it, leading to goal displacement.

Subjects mediating activity

First year IS students and their lecturers constituted the *subjects* of activity. They had different learning experiences and conceptions about learning in class and on *Facebook*, which were shaped by broader structural influences (see Table 1) and immediate contextual factors like instructional design. In spite of the integration of *Facebook* academic activities into lecture activities, students held potentially conflicting notions of the implications of *Facebook* for their learning. Sceptical mindsets (Student X and Y) negated *Facebook* use while the academically motivated (Student Z) ones tailor made it to suit their information needs. Therefore, different orientations towards the intent of *Facebook* use (the *object*) invariably activated skewed academic empowerment between learners due to their asymmetrical positioning with regard to access and deployment of information resources.

Tools mediating activity

Student scaffolding on *Facebook* involved the administrator's elaboration of concepts, directing student attention to critical aspects of problems, providing background

information to the solution, and giving relevant examples. *Facebook*, therefore, compensated for questioning opportunities lost in large classes due to time constraints and teaching workloads. This complementation of classroom interaction is evident in one student's account of lectures (see student interview transcript under 'Human tools' in Table 1). The porosity of offline and online interaction boundaries ensured that classroom interactions fed into and enriched online interactions and vice versa. However, the situated nature of *Facebook* interactions implied that students who had participated most in online discussions were more empowered psychologically by the lecturer's elaborations in class.

Social dimensions of activity

Table 2: Summary of activity elements

Element of activity	Extracts of observation, interview and debriefing transcripts and *Facebook* postings	Researcher's comments
Explicit rules	Lecturer: Some students asked me on *Facebook* that: With what we have done so far can we attempt Project 3.2 [...] (ADP class observation transcript) L: (*Two students are freaking and laughing...*). *Can you keep quiet. What's exciting?* (ADP class observation transcript) (*The boys are speaking in Xhosa about a student the lecturer picked on to demonstrate a concept*) L: *Why are you guys speaking in that language? If I hear you speak that language again you will go out* [...] (ADP class observation transcript)	1. *Facebook* is a department-sanctioned consultative space. 2. Student consultations with their peer network broadened their resource base. 3. Student silence entrenches lecturer's regulative authority and mutes peer-based networking. 4. The lecturer enforces the use of English, the institution's language of discourse.
Lecturer's roles	Lecturer: *The notes for doing the assignment are on Vula.* L. [...] *You understand, No. Did you understand?* S: No. L: *I will repeat.* [...] *So we want to find the fields* [...] (Mainstream class observation transcript) L: *Today we are going to cover the stuff on page 1, 3, and 5. It is the same stuff that you are going to do so you should pay attention* [...]	The lecturer's in-class roles are: 1. Locating prime academic resources. 2. Explaining and elaborating technical processes. 3. Demonstrating and assigning tasks.
Student roles: Information seeking	On *Facebook*, I am freer and more comfortable to ask. *When I want to ask something in lectures, I have to think twice, is this appropriate? [...] classmates would say, "stop wasting our time." But on Facebook gee! I can ask any question because no one hears what I say.* [...] (Student interview).	1. *Facebook* broadened access to knowledgeable peers and the lecturers' support. 2. Classroom discourses imposed dominant discourses as some voices were muted.
Peer demonstration	This is why I like the ADP class, *they are co-operative, and they want to show me what they think. Like that girl who proposed a different method whom I asked to go in front and try that method to prove her point* [...] (Lecturer debriefing)	Peer demonstrations allowed for peer mentoring and externalisation of students' knowledge.

Peer-based networking	*Noise levels in my classes were high because students were discussing answers I posted on Facebook.* I heard several students who did not understand discussing my *Facebook* responses and they wanted some further explanations [...] (Lecturer debriefing).	*Facebook* interactions recruited and sustained in-class collaborative engagements.
Resource person	I am struggling with my literature review [...] I have topic 9.7, cyberthreats and there is hardly any information on the topic in itself. Could someone help me (Wall Post 109] Cyberthreats covers practices like hacking, dos [denial of service attacks], social engineering, viruses, spyware, identity theft etc thanks (Wall Post 105)	Student provision of information resources supports informal peer mentoring.
Community	*Students know Kingston (pseudonym) and me from Facebook. If it's a guest lecturer who teaches and goes, and students don't see them until their next chapter. Students tend to keep quiet in class, interaction is less. So they tend to ask me and him more questions* (Lecturer Interview).	Regular and guest lecturers teaching IS constituted the teaching community.
Outcomes	*Facebook empowers students because many already knew and used it before entering university. They feel like they brought it into university, and it's not an imposition by the university.* (Lecturer interview transcript)	Student academic empowerment.

Rules mediating activity

Rules mediating the teaching and learning for *Access* and *Excel* were explicit and implicit norms and values that governed engagements between academic actors on *Facebook* and in class. *Implicit rules* are culturally ascribed and premised on teaching as a professional praxis. These included respect for lecturers and acknowledgment of their power as authoritative voices. One *non-verbalised* rule was the front position of lecturers in classes, which signified their imbedded authority over their audience. *Explicit rules* in class were student maintenance of silence, being seated, and raising hands to pose questions. While student silence and raising of hands helped to maintain order and regulate classroom conduct, these controls imposed vertical discourses that entrenched lecturer dominance over students.

On *Facebook*, explicit rules were the Departmental requirements for students to create *Facebook* pages, join the *Facebook* group and use of academic language during engagements. *Facebook* rules were both democratising and constraining. Sanctioning *Facebook* as a Department consultative space implicitly imposed rules of engagement in a perceivably "student controlled" space. In contrast, the freedom of students to consult with an extended academic community potentially subverted the monolithic voice of the educator.

Roles mediating activities

Traditional roles
Roles involved *divisions of labour* which students and academics assumed to realise the learning objects. Student *roles* in large lectures were often limited to asking questions, seeking elaborations on issues, peer-demonstration of concepts and note taking. Students rarely participated in collaborative group tasks during. On *Facebook*, their

roles shifted to information disseminators, knowledge generators, resource persons, reflectors and information acquirers.
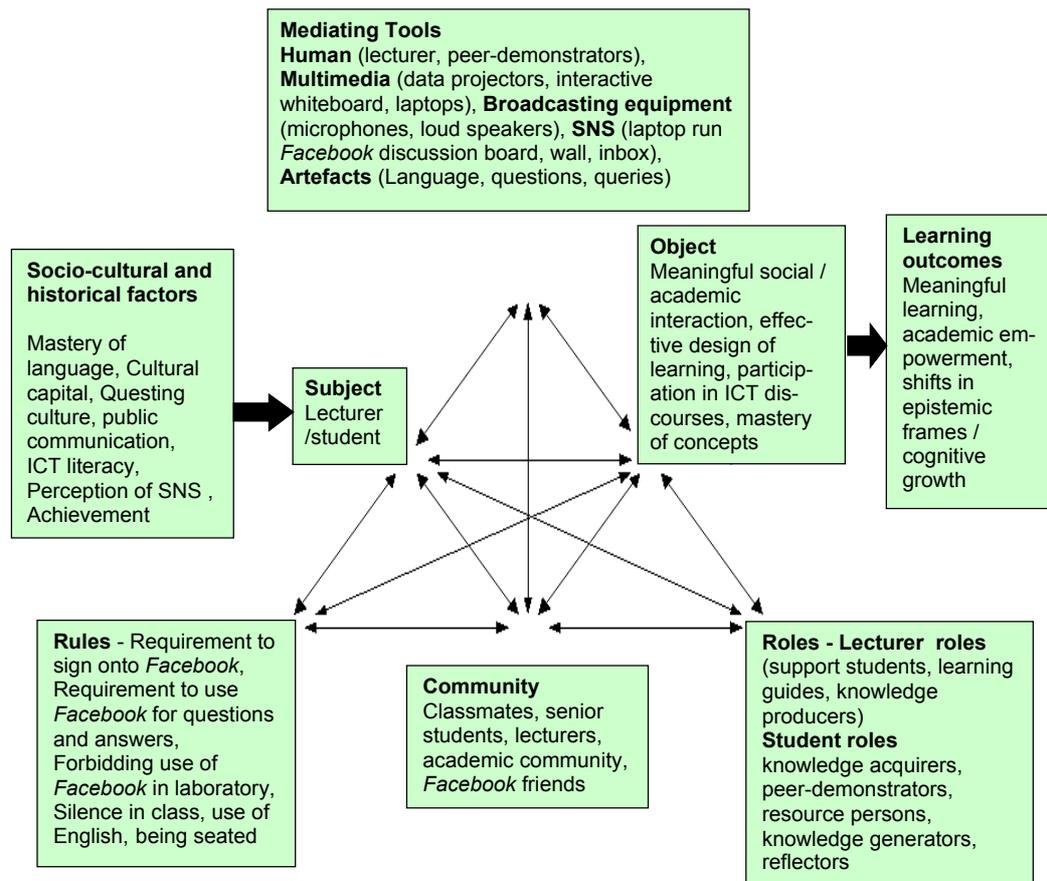
Mediating Tools
Human (lecturer, peer-demonstrators),
Multimedia (data projectors, interactive whiteboard, laptops), **Broadcasting equipment** (microphones, loud speakers), **SNS** (laptop run *Facebook* discussion board, wall, inbox),
Artefacts (Language, questions, queries)

Socio-cultural and historical factors

Mastery of language, Cultural capital, Questing culture, public communication, ICT literacy, Perception of SNS , Achievement

Subject
Lecturer /student

Object
Meaningful social / academic interaction, effective design of learning, participation in ICT discourses, mastery of concepts

Learning outcomes
Meaningful learning, academic empowerment, shifts in epistemic frames / cognitive growth

Rules - Requirement to sign onto *Facebook*, Requirement to use *Facebook* for questions and answers, Forbidding use of *Facebook* in laboratory, Silence in class, use of English, being seated

Community
Classmates, senior students, lecturers, academic community, *Facebook* friends

Roles - Lecturer roles (support students, learning guides, knowledge producers)
Student roles knowledge acquirers, peer-demonstrators, resource persons, knowledge generators, reflectors

Figure 3: Diagrammatic summary of Microsoft *Excel* / *Access* teaching and learning activity system

Peer demonstration
Occasionally, in ADP lectures students were presented with opportunities to demonstrate technical problem solving to their peers. This collaboration shifted participating students' role from recipients of educator-generated content to resource persons and informal assessors of peers' level of understanding of content issues. Peer demonstration instantiated experiential learning, and enabled lecturer-student power sharing through the showcasing of student abilities and knowledge. Demonstrations allowed student assumption of lecturer responsibilities of leading the discussions, explaining concepts and summarising technical processes.

Peer-based networking
Peer-based collaboration was noted in one observation where students were required to contribute words they knew that related to the Internet. This engendered intellectual dialogue and peer-based generation of knowledge. Systematic integration of in-class

interaction with online engagements afforded cross-fertilisation of meaningful discussions across different platforms (see Table 2).

The resource person role on *Facebook* involved knowledgeable students rendering intelligible advice to peers during discussions, which cognitively supported their counterparts (see Table 2).

Community involved in activity

Facebook community comprised lecturers, students, and senior friends, and student international networks that they interacted with online. The higher levels of in-class engagements noted between the regular lecturers and students seem to suggest that *Facebook* provided familiarity, trust and rapport necessary to sustain academic interactions offline (see peer-based networking in Table 2). Therefore, *Facebook* provided a quasi-formal rendezvous for sustained in-class engagements and possibilities for deeper reflections on shared content.

Outcomes

Lecturer-student and peer-student interactions on *Facebook* were envisaged to support meaningful student learning, academic empowerment and shifts in epistemic frames. The attainment of outcomes was hinged on student conceptions of the academic value of *Facebook*, quality of networked interactions and their willingness to contribute to peers' queries.

Discussion of findings

Facebook's impact on cognitive scaffolding

Embryonic networked learning
Embryonic expressions of student networking on *Facebook* affirmed the significance of 'learning networks' for information sharing. Students exploited *Facebook* networks to consult with peers on technical and theoretical problem solving, access learning resources, execute tasks and for general course administration. In AT, the *first principle* is that a collective, artefact-mediated and object-oriented activity system, seen in its network relations to other activity systems, is taken as the prime unit of analysis (Engestrom, 2001). The pedagogical alignment of *Facebook* with in-class activities enhanced its conception by students as a cognitive scaffold *(tool)* for engaging with knowledgeable peers, heightening critical questioning practices, and participating in collaborative tasks. Academically inclined students conceived their peers and lecturer as a collective learning community for accessing on-demand assistance during complex problem solving. Therefore, lecturer-student and peer-based collaboration on *Facebook* broadened student access and use of collectively generated resources, stirred multiple perspectives, timely academic support, and shifts in cognitive frames which expanded students' learning horizons. Expanded learning involves a "thoughtfully mastered learning activity" (Engeström, 1987, p. 210).

For Engeström (2001, p. 136) another AT *principle* is the multi-voicedness of activity systems [because] an activity system is always a community of multiple points of view, traditions and interests. The different roles students assumed on *Facebook* combined with their multiple *historical backgrounds* (ICT backgrounds, linguistic backgrounds, confidence in public engagement), eclectically shaped their

understanding and commitment to learning objects as envisioned by lecturers. Prior student exposure to *Facebook* in high school activated differential perceptions towards its academic value. From a developmental perspective, *Facebook* catalysed cross-pollination of ideas by reinforcing in class the rich discussions initiated on *Facebook*. Spontaneous, informal learning on *Facebook* was often transformed into structured, systematic formal learning through migration of debates into lecturer-regulated spaces. It also rendered students the agency to hold academics accountable as legitimate knowledge builders and givers, and to intermittently neutralise their exercise of authoritative power (Rambe, 2012). However, the lack of in-depth dialogical discourses on theoretical concepts further demonstrates that as multi-voicedness is multiplied in networks of interacting activity systems, actions of negotiation and translation (Engeström, 2001) become necessary.

Camouflaging reserved identities
Facebook private messages afforded secret consultations with the lecturer and knowledgeable friends, which rendered shy students protection from inconsiderate peers' reprimands or censure. Through *Facebook* messaging, under-prepared students' confidence to participate in critical questioning practices was bolstered, allowing their progression to public communication via walls and forums. Although individual activities unfold in a highly complex, power ridden community mediated by different rules and roles, Engeström (2009) acknowledges that it is not easy to depict and analyse hierarchical power relations within a single activity system. Yet the lecturers' insistence on student use of *Facebook* public spaces (wall and discussion forum) for the benefit of the entire *Facebook community* further supports the entrenchment of hierarchical power in online collaborative knowledge building.

While the convergence of dynamic academic interactions in *Facebook* mediated pedagogy (*activity*) recruited student attention to the *object*s, the existence of serendipitous social interactions on *Facebook* often compromised the optimal attainment of meaningful learning. This explains some students' sceptical views on the academic value of *Facebook*, notwithstanding others' improved critical questioning practices and collaborative discussions. The use of an activity theoretical approach helped unravel students' different orientations about the *object* and *Facebook's* mediating effects. As Engeström (2009) suggested, AT is a theory of object-driven activity whose objects are generators and foci of attention, motivation, effort and meaning, and through their activities, people constantly change and create new objects.

Contingent academic empowerment
Facebook's scaffolding potential was dependent on purposes for which it was appropriated. Strong, academic identities adopted it as a personalised learning environment for accessing lecturer and peer-generated content, knowledge sharing and question-driven consultation. The majority of students, however, classified *Facebook* as a social interaction tool for procrastination and chatting, or resisted it wholesale, hence the general apathy. A converse of academic scaffolding in *Facebook* is that this SNS activated differential empowerment through the reproduction of vertical, super-tutor roles among knowledgeable students which wielded social status among peers. As AT suggests, the roles in an activity create different positions for the participants [based on] their own diverse histories, and the activity system itself carries multiple layers and strands of history (Engeström, 2001). Such subversion of democratic participation challenges the traditional hype about the equalisation potential of SNSs.

Democratic access to learning resources

Achievement motivation
Facebook and lectures were ecological environments that mutually reinforced each other. Student's prior familiarity with lecturers on *Facebook* coupled with instant expert feedback, which *Facebook* generated, all leveraged students' in-class interactivity. As Engeström (2009) suggests, the purpose of an activity system is to provide effective feedback from and exchange among the participants acting on the object.

This breaching of social distance potentially democratised access to content as academic hierarchy was disrupted by a broadened community, and roles were reversed through heightened interactivity. *Facebook* mediates academic learning through establishing online connections through random searches, participating in online groups and communicating with online participants (Kim & Jeong, 2009). For the academically motivated students, the use of a familiar, ubiquitous technology recruited and retained their motivation to excel in IS. As such, the object, which lies at boundary of the legitimate and illegitimate, must yield useful intermediate products, yet remain an incomplete project (Engeström, 2009).

Augmented consultations
Facebook augmented the academic consultation space by dispersing classroom discursive practices to private and public conversations. *Facebook* mediated learning when students adopted it as an information repository by browsing peers' questions and engaging with them prior to formulating alternative perspectives. Besides creating a virtual classroom that took classroom practices to novel spaces, *Facebook* broadened student access to different academic resources that supported students in their learning curve.

Implications for pedagogy

Student ability to make connections between *Facebook* and classroom practice was not an automatic reflexive activity. Rather, pedagogical practice that tightly coupled these two learning environments assisted in making this a reality. For example, lecturer's in-class reinforcements of their academic discussions on *Facebook* assisted students to make sense of fragmented learning and to employ *Facebook* as a virtual classroom. Therefore, it is pedagogical design of the technological architecture that improves student physical and intellectual access to learning resources, through creating contexts for meaningful collaboration, tapping on prior knowledge, and transfer of relevant knowledge. The constructive alignment of learning tasks and *Facebook* use, designing learning tasks that require student use of *Facebook* and mutual reinforcement of classroom and *Facebook* activities would produce high yielding academic outcomes.

Differential empowerment activated by varied use of *Facebook* needs to be addressed through providing incentives for reinforcing and rewarding creative application of *Facebook*. Students should engage critically with theoretical matters and epistemological questions, so that they become active generators of scholarly knowledge. Van Rensburg (2006) articulated the insufficiency of institutions socialising students into dominant practices [on SNSs] without allowing them to negotiate different voices in written texts, explore voices to own, and unlock talk-back spaces. Empowering students to talk back in theory and argument building is one sustainable way of building critically engaging academic mindsets.

Conclusion

The paper employed AT as a theoretical and analytical framework for understanding the potential of *Facebook* to cognitively scaffold learners and to democratise student access to knowledgeable peers. The findings suggest that meditational effects of *Facebook* are an oxymoron, which is both empowering and constraining. Firstly, AT modelling illustrated that productive *Facebook* usage was premised on students' *socio-cultural and historical backgrounds* like racially imposed social distance, linguistic barriers that frustrated communication fluency and divergence of interests among students, which constrained face to face communication. More so, it illumined the disrupted power distance between educators and students that bolstered democratic communication and productive engagement. Moreover, the computer mediated nature of *Facebook* communication and its accessibility for discursive interactions presented an academic networking tool that bridged the multiple divides (racial, linguistic and digital) imposed by differentiated academic histories. Therefore, activity systems do not emerge from a vacuum, but are dynamic, dialectic products of and are mediated by complex socio-historical environments. Since activities are dynamic, cultural context-induced, historically-mediated creations, contextual factors that impact differential use of SNS should be strategically considered to heighten productive use of online educational resources. *Subjects* who had accessed *Facebook* in their high school were more inclined to have a smooth transition from social to academic networking than their counterparts. They comprehended the *object* of *Facebook*-mediated learning, were less inclined to engage in off-task activities, and were more pragmatic in their exploitation of peer-based networks than their previously disadvantaged peers.

The *Facebook* activity system was mediated by *technological* (*Facebook's* interactional spaces, applications, textual resources) and *conceptual tools* (symbols, questions, queries, explanations, and answers). Conceptual tools dominated *Facebook* interactions essentially because lecturer-student and peer-based interactions were question and answer based. They enhanced cognitive scaffolding of learners through prompt questions, direct questions, fading and provision of background materials during problem solving that recruited student on-task behaviour. At the social interactional level, *Facebook* interaction unfolded through a set of *rules* like the creation of *Facebook* accounts, joining group forums, development of "friendship", recognition of the rule of engagement, and contributing to peer-generated postings. Collectively, these rules were both enabling and constraining.

Academically motivated students assumed multiple *roles* as information seekers, information disseminators, collaborative networkers, resource persons and reflectors. Academics also served as instructors, knowledge brokers, mentors and sympathetic coaches. These vertical and horizontal roles were often complementary and inherently conflictual at times. For example, educators had to constantly balance between provision of background information (guide on the side role) and withholding information to exert academic pressure on student independent thinking (disciplinarian coach). Given that learning *objects* were uncodified and heuristic, and aimed at supporting student independent learning in their own spaces, serendipitous social objects and social interactions often militated against optimal their realisation. This is notwithstanding educators' reinforcement of academic discussions on *Facebook*.

AT therefore, provided rich theoretical and analytical insights into collaborative learning in information rich, student-controlled learning environments. In these spaces

where meaning is socially negotiated, lecturers' cultural roles and significance shift from knowledge disseminators to facilitators, power brokers and mentors. Activity theory's capacity to marry theory to practice is mirrored in the constructive alignment of actors' roles with tools in use, rules, community, and object objects.

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Appendix 1: Structure of the opening interviews with two IS lecturers

(adapted from Jonassen & Rohrer-Murphy, 1999)

Activity element	Relevant questions	Actual questions that lecturers were asked

Understand the context in which activity occur	What participants or groups are involved in the implementation of activity?
	
	Where and when do these interactions occur? Examine communication that surrounds the activity.
		(a) Do you use *Facebook*?
		(b) For what purpose do you use it?
		(c) Can you describe for me the activities that you engage in via *Facebook* with:
		    (i) Your students
		    (ii) Tutors
		    (iii) Other Faculty staff
		    (iv) When and where do you engage in these activities?
		(d) What kinds of information do you exchange with your students via *Facebook*?
		(e) Which students normally consulted with you on *Facebook*?

Understand the subject, his or her motivations or interpretations of perceived contradictions in the system	Generate a list of subject driven goals for each of the groups involved that might drive the activity. What expectations are there of the performer? Who sets those expectations?	What motivated your academic use of *Facebook*? Which student interactions / activities do you consider as desirable for their meaningful learning on *Facebook*? What *strategies* and *activities* have you put in place to support student learning on *Facebook*? Has your teaching strategy been affected by your use of *Facebook*. If so how? How have you maintained *academic contact* with students beyond lecture sessions and office consultations?
Define the subject	Who are the participants in the activity system? What are their roles? What are their beliefs? What is the expected outcome of the activity? What criteria will be used by the community to evaluate its utility? What perceived rewards await the subject if or when it accomplishes its goal?	Besides students, who else do you interact with on *Facebook*? What is your role(s) on *Facebook*? What is your teaching philosophy and in what way has it been supported by your academic use of *Facebook*? How has student learning been affected by your use of *Facebook*. Which learning aspects have been most affected? How has your use of *Facebook* impacted: (a) Your face to face consultation with students during office consultations? (b) Your relations with your students in class? (c) Your online consultations using collaborative tools (like discussion board) on the institutional learning management system?
Define the relevant community-communities	How formally are the rules stated? What is the structure of social interactions surrounding the activity? How do other communities	What rules and norms have you instituted on *Facebook* to promote on-task behaviour among students? How formal are these rules? How have the following interactions been affected by your academic use of *Facebook*: (a) Student-peer interactions?

	in which participants are involved view the task? Do they value the goals of activity?	(b) Student interactions with learning materials? (c) Student decision making about appropriate content? (d) Student critical thinking
Define the object	What is the expected outcome of the activity? What criteria will be used to evaluate the quality of the outcome? How will completing the object move the participant towards fulfilling the intentions of individuals?	What qualities or traits would you conceive to constitute effective application of *Facebook* by students? How has your use of *Facebook* impacted the following: (a) Student understanding of concepts and constructs considered as critical in the course? (b) Their ability to learn independently (c) Their ability to self-pace their learning? What other educational benefits have student derived from using *Facebook*?
Define the activity itself	How is the work being done in practice? Identify the activity in which subjects participate? How has the work (actions and operations) been transformed over time? What historical phases have there been on the work activity? What are the goals-motives of the activity and how are they related to other concurrent goals?	What does effective student-peer engagement on *Facebook* involve? How has your engagement with students changed over these two semesters? How have your intentions of using *Facebook* influenced or shaped student's learning goals?
Analyse mediators Tool mediators and mediation	What tools might be used in this activity? What are the physical and cognitive tools used to perform the activities in different settings and across different activities? How readily available are those tools to participants?	What are the popular *Facebook* features that students use to: (a) Reflect on their own? (b) Engage with peers on *Facebook*? (c) Engage with you? (d) Engage with learning content? Which applications do student use to access learning resources during their learning? How accessible are these applications to students?
Rule mediators and mediation	What formal or informal rules, laws, or assumptions guide the activities in which people engage? How might these rules have evolved? How widely understood are these rules?	Are there any specific and expectations that guide student consultations with you on *Facebook*? In what ways do students demonstrate the understanding of these rules?
Role mediators and mediation	Who traditionally has assumed the various roles? How does that affect work group assignments or breakouts?	What different roles do you play during *Facebook* with your students? How have these roles impacted on student collaborative work on *Facebook*?

Appendix 2: In-depth follow-up interviews with IS lecturers

(adapted from Jonassen & Rohrer-Murphy, 1999)

Activity element	Relevant questions	Actual questions that lecturers were asked
Define the relevant community-communities	How mature is the group? How formally are the rules stated? What is the structure of social interactions surrounding the activity?	Beside you, who else do students engage with on *Facebook*? How can you describe the nature of academic relations that merge on *Facebook* through the following: a. Your interactions with students b. Student engagements with their peers c. Student engagements with content d. Student engagement with *Facebook* applications
Define the object	What is the expected outcome of the activity? What criteria will be used to evaluate the quality of the outcome?	What do you expect student to gain from their consultations: a. With you on *Facebook*? b. With peers? How will you establish that these goals have been achieved?
Define the activity itself	How is the work being done in practice Identify the activity in which subjects participate? What historical phases has there been on the work activity?	What are the different forms of support that you render students on *Facebook*? Please describe the nature of academic consultations that you have with students on *Facebook*. Have your teaching strategies changed from the time you started using *Facebook*? Explain.
Role mediators and mediation	Who traditionally has assumed the various roles? How does that affect work group assignments or breakouts?	What different roles have you assumed on *Facebook* to support student learning? Which group activities do you expect your students to engage on *Facebook*? Explain. How have your different roles been affected by these group assignments student participate in on *Facebook*?

Appendix 3: Student interviews

(adapted from Jonassen & Rohrer-Murphy, 1999)

Clarify the purpose of activity system		
Activity element	Relevant questions	Actual questions that students were asked
Understand the context in which activity occurs	What participants or groups are involved in the implementation of activity? Examine communications that surround the activity. Where and when do these interactions occur?	1. (a) Do you use *Facebook*? (b) What do you use this site for? (c) What information do you have on your *Facebook* profile? 2. (a) What information do you share during your interactions via *Facebook*? (b) Can you describe for me the activities that you engage in via *Facebook* with: (i) your peers; (ii) tutors; (iii) lecturers. 3. What kinds of information do you exchange with your lecturer via *Facebook*? When and where do you share this information?

Understand the subject, his or her motivations or interpretations of perceived contradictions in the system	Generate a list of subject driven goals for each of the groups involved that might drive the activity. What expectations are there of the performer? Who sets those expectations?	What prompted /necessitated your academic use of *Facebook*? What do you expect to get from your academic interactions on *Facebook*? What does your lecturer expect you to be doing on *Facebook*? How have you maintained **academic contact** with your lecturer beyond lecture sessions and office consultations?
Define the subject	Who are the participants in the activity system?	1. Do you have any of these as your *Facebook* friends: (i) Classmates? (ii) Tutors? (iii) Would you accept if a lecturer invited you to be a *Facebook* friend? Why so?
	What are their beliefs?	2. (i) What do your face-to-face interactions involve? (ii) How does this interaction relate to your *Facebook* interactions?
	What is the expected outcome of the activity?	3. (i) What are your personal interests? (ii) In what ways do these personal interests influence your use of *Facebook*? (iii) What other personal needs or feelings necessitated your use of *Facebook*?
	What criteria will be used by the community to evaluate its utility?	4. How has your use of *Facebook* impacted on: (i) Your understanding of concepts and content taught in class? (ii) Your ability to construct new knowledge? (iii) Your ability to learn independently?
	What perceived rewards await the subject if or when it accomplishes its goal?	5. (i). How do your classroom face to face interactions relate to your *Facebook* interactions? (ii) In what ways does your use of *Facebook* enhance (or hinder) face to face consultations with lecturers in lectures? 6. What influence does *Facebook* have on: (i) Your access to peers who share knowledge with you? (ii) Your consultation with the lecturer during consultation time? (iii) Online consultation with the lecturer?
Define the relevant community- communities	How mature is the group? How formally are the rules stated? What is the structure of social interactions surrounding the activity?	Which groups are you a member of on *Facebook*? What information do you exchange in these groups? What rules and norms guide: (i) Your interactions with peers on *Facebook*? (ii) Your consultations with the lecturer on *Facebook*? How have the following been affected by your academic use of *Facebook*: (i) Interactions with your peers? (ii) Interactions with learning materials? (iii) Your decision making about appropriate content? (iv) Your ways of thinking about content?

Define the object	What is the expected outcome of the activity? What criteria will be used to evaluate the quality of the outcome? How will completing the object move the participant towards fulfilling the intentions of individuals?	Do you think *Facebook* could be used to (i) Pace learning? Explain. (ii) Influence your choice of learning content? (iii) Broaden academic support from lecturers? Explain. (a) How does your use of *Facebook* relate to the following: (i) Your understanding of concepts and constructs considered critical in the course? (ii) Your ability to learn independently (b) How has your Facebook usage promoted (or hindered) the following: (i) Self-empowerment? (ii) Your autonomy in learning? (c) What other educational benefits have you derived from using *Facebook*?
Define the activity itself	How is the work being done in practice? Identify the activity in which subjects participate? What historical phases has there been on the work activity? What are the goals-motives of the activity and how are they related to other concurrent goals?	What forms of *Facebook* interactions with your peers do you describe as ideal for your learning? What forms of *Facebook* interactions with your lecturers do you describe as ideal for your learning? How has your learning changed since you started interacting with peers and educators on *Facebook*?
Analyse mediators Tool mediators and mediation	What tools might be used in this activity? How readily available are those tools to participants? What are the physical and cognitive tools used to perform the activities in different settings and across different activities?	Which *Facebook* features do you use to: (i) Engage with peers? (ii) Engage with your lecturer? (iii) Engage with learning content? Which applications your use to access learning resources in your learning? How accessible to you are these applications?
Rule mediators and mediation	What formal or informal rules, laws, or assumptions guide the activities in which people engage? How widely understood are these rules?	Are there any specific rules and expectations that guide your consultations with: (i) Peers on *Facebook*? (ii) Lecturers on *Facebook*? To what extent do you understand these rules?
Role mediators and mediation	Who traditionally has assumed the various roles? How does that affect work group assignments or breakouts?	What different roles do you play during *Facebook* with: (i) Your peers (ii) Your lecturers How have these roles impacted on collaborative work on *Facebook*?

Appendix 4: Class observations

1. Classroom contexts	• Sitting arrangements – influenced by the interactive patterns possible and their meanings.
	• Noise levels, illumination levels and space layout.
	• Where is the teacher is situated.
	• Different technologies and tools in use.
	• Classroom as contexts for conducting research.
2. Relations of interactants	• Student and teacher social roles-how these roles are negotiated, articulated and changed.
	• Forms of academic support available.
	• Interaction patterns possible and their meanings.
	• Sequences of interactions.
	• Student-peer interaction in class and how it relates to *Facebook* presence/interaction and vice versa.
	• Student-lecturer relations in class and references to *Facebook* as a resource and vice versa.
	• Lecturer pointing to resources accessible beyond the classroom.

Author: Patient Rambe *PhD (UCT)*, Postdoctoral Research Fellow
Department of Computer Science and Informatics, University of the Free State
205 Nelson Mandela Drive / Rylaan, Park West, Bloemfontein 9301, South Africa
Email: RambeP@ufs.ac.za, pjoerambe@gmail.com