

## **Managing learner interactivity: A precursor to knowledge exchange**

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### **Abstract**

Our exploratory research involving information and communications technologies (ICTs) which enable accessibility, flexibility and online support for learning communities within and across classrooms has demonstrated the potential to transform student learning through increased engagement and interactivity. For many teachers, however, the increasing challenge of managing the attendant techniques and processes of ICTs introduces a set of dynamics which can undermine the relationships that prevail in archetypal classroom workspaces. We found that the use of ICTs altered the principal social relations – in particular, the interpersonal dynamics that exist in traditional classroom settings. We have also found that ICTs enhance student interactivity and engagement, resulting in a need for teacher management of information overload and increased task complexity. Further, we argue that management effort by the teacher is required to maintain a critical balance between that which is to be taught and that which is to be appropriated through learning.

In using ICTs such the Zing Team Learning System (ZTLS), the conventions that teachers exercise over relationship boundaries are overturned. Instead processes which engage students, regulate interactivity, support interpersonal collaboration and achieve mutually satisfying communication flows are mobilised. Transformations in learning management result, with teachers and students sharing understanding, co-creating meaning and eliciting knowledge. The findings reported here point to technical processes which can cultivate communities of learning as well as communities of practice. Teachers and students collectively exchange knowledge and validate learning as an outcome of authentic engagement and purposive interaction. Implications for face-to-face teaching and online teaching are also considered from the vantage point of professional pre-service and in-service teacher development.

This article has been peer-reviewed and accepted for publication in *Studies in LEID*, an international journal of scholarship and research that supports emerging scholars and the development of evidence-based practice in education. ISSN 1832–2050  
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## Introduction

A key premise governing mainstream classroom practice holds that it is teachers who manage the critical balance between teaching and learning and that this has a bearing on the extent and level of interactivity between learners and teachers. Indeed, teaching, like management, deploys a range of methodologies geared to secure particular forms of social exchange. These exchanges between teachers and learners are vital, as these not only establish the foundation for learning but also extend the possibilities for knowledge creation and knowledge acquisition. This motif (Hruby, 2001), born of social constructionism (Berger & Luckmann, 1996; Gergen, 1985; Shotter, 1993), provides an epistemology from which to assess the gains that information and communications technologies (ICTs), such as the Zing Team Learning System (ZTLS), bring to classroom practice, in a concerted attempt to deepen learning and to extend learning management (Findlay, 2000).

Stemming from a theoretical premise which advocates the use of cooperative learning (Berry, 2003; Hockaday, 1984; Johnson & Johnson, 1984), we argue that socially relevant activity in teaching and learning, a cornerstone of the ZTLS approach, enables teachers to scaffold the curriculum (Glassman, 2001; Wells, 2000), effect learning management (Graham, 2003; Lynch, 2003; Thompson, Smith & Mienczakowski, 2002) and derive key opportunities for knowledge management (Bruffee, 1986; Mercer, 1995). Early evidence suggests scope for extended investigation which complements prevailing research into cooperative learning and which sets the stage for establishing learning communities within schools – two areas of investigation more often found to be vehemently ‘at odds’ with each other in educational research (Hruby, 2001). Indeed, knowledge management presents itself as the most pressing challenge, and as one of the most complex issues, for contemporary organisations seeking to secure a competitive advantage by emphasising learning (Peterson, 1991; Wenger & Snyder, 2000).

By encouraging teachers to adopt the ZTLS at five Central Queensland schools, we confirm that shifts in teaching and learning are required in order to implement ICTs effectively and to extend mainstream curriculum delivery. This is an important finding, as one outcome of the research has been to consider introducing the ZTLS into teacher education.

The ZTLS comprises a technology which inculcates design principles geared to supporting collaboration through cooperative learning (Felder & Brent, 2001; Hockaday, 1984; Slavin, 1981). The ZTLS is a tool which demonstrates convincingly that knowledge is situated in activity (Cole & Engeström, 1993) – activity which enables individuals to appropriate knowledge through purposive exchange. One natural extension of this mode of organising is the emergence of communities of practice (Wenger, 1998; Wenger & Snyder, 2000) which extend individual learning beyond the social boundaries of classrooms.

To date, our research has sought to address a key question in deploying the ZTLS to enhance cooperation between teachers and learners in mainstream classrooms: “What transformations in teaching and learning are necessary when implementing a Group Support System (GSS), such as the ZTLS, to elicit knowledge creation and exchange?” Essentially, GSS technologies in and of themselves are inert, inasmuch as it is the social *milieu* of the facilitated group or team that provides the chief distinguishing characteristics of what such a system can achieve (Beer, 1999; Callan & Whymark, 2002; Dennis, George, Jessup, Nunamaker & Vogel, 1988; Whiteley, 2002; Wu, Farrell & Singley, 2002). The presence of such technologies

in classrooms raises particular challenges for teachers and learners. Among these are requirements for:

1. real time processing capabilities (feedback and flow to underscore learner engagement and participation)
2. social relevance of attendant processes and tasks (learners readily discriminate between genuine and pointless activities)
3. flexibility and transparency (allowances for individual differences, matters of personal equity, group compliance and individual accountability); and
4. teacher reflexivity (management prerogatives and associated classroom dynamics).

### **Knowledge creation tools and teacher education**

Teacher pre-service and in-service at Central Queensland University (CQU) is focused on developing learning managers. Learning management is the design of pedagogical strategies to achieve learning outcomes in students (Purnell, 2004). The curriculum is predicated upon learner engagement contingent upon learning management rather than the teacher-centred control assumed in conventional models (Graham, 2003). While teacher involvement is still at the heart of the learning process, there is recognition and active encouragement of heterogeneity and of acceptance of multiple perspectives amongst learners. The learning process is no longer viewed as the ‘one model fits all’ approach and the teacher does not seek to transfer knowledge passively to the learner. Instead, the diverse nature of learners is acknowledged and strategies involving individual learning plans are used to support the multiplicity of needs. The learning manager moves from being “a specialist instructor of collectives to a manager of individual learning” (Graham, 2003). The appropriation of learning outcomes by each learner using appropriate pedagogies takes precedence over past practices that focused more on one set of curriculum plans or outcomes being applied across many groups.

With the assistance of ICTs such as the ZTLS, we seek to establish that learning managers can not only go well beyond individualising the learning process in the interests of “diversity, inquiry and equity” (Graham, 2003) but also invoke standards of practice that are comparable to the notions of best practice promulgated by those educators concerned with adult learning. Ongoing research with respect to the deployment of the ZTLS continues to cast a favourable light on applying standards of practice to mainstream classroom teaching through:

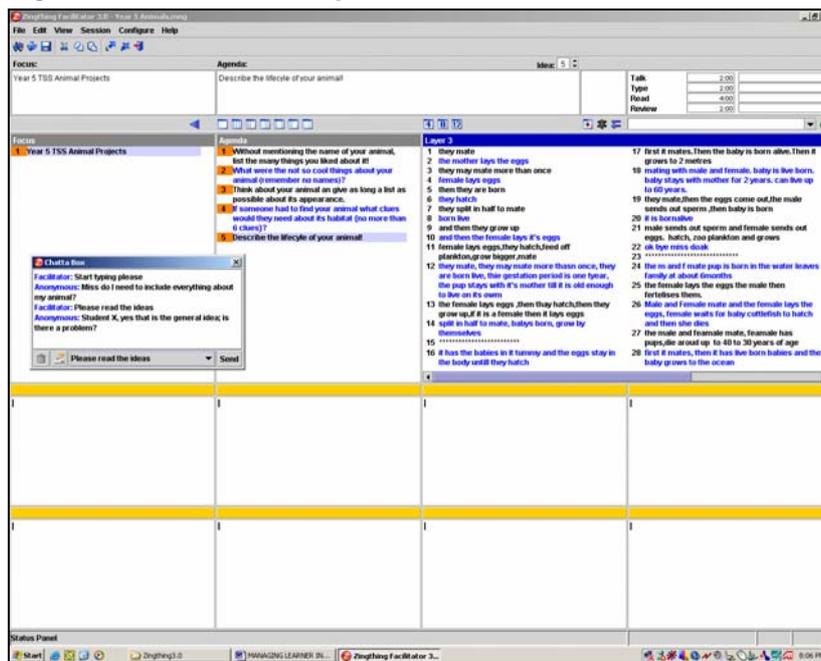
1. Joint productive activity: Teachers and students producing together
2. Developing language and literacy across the curriculum
3. Making meaning: Connecting school to student’s lives
4. Teaching Complex Thinking: Cognitive Challenge
5. Teaching through Instructional conversation. (Rivera, Galarza, Entz & Tharp, 2002).

### **The Zing Team Learning System**

The ZTLS provides co-located or remote participants with the opportunity to interact via keypads, laptops or desktop computers. Each participant contributes by keying in items to an allocated playspace. Typed entries are posted (published) to the teamspace, effectively forming a foundation for shared discussion or conversation. A chat feature is included with the web version of the software, and this enables cross flow conversation between individual participants and the facilitator (teacher). The facilitator’s role initially involves posing a series of open-

ended or socially relevant questions. The responses involve protocols such as “Talk”, “Type”, “Read” and “Review” and dialogue with the system is based on keystrokes in the form of responses in playspaces which are then transmitted to the teamspace. In this way, learners are able rapidly to process ideas (parallel processing), which can then be subjected to higher order structuring. In effect, learners are provided with modelled sets of processes which enable them to become “acquirers, users, and extenders of knowledge in the sustained, ongoing process of understanding” (Brown, Ash, Rutherford, Nakagawa, Gordon & Campione, 1993, p. 190) (see Figure 1).

Figure 1: The ZTLS workspace



Dialogue during a Zing session is supported in a number of ways, but intellectual processes occur as a consequence of teacher (facilitator) intervention. The progressive conversational flows or exchanges of ideas take place at a pace that ensures optimal flow. The ZTLS is in short a tool that ensures “mutual appropriation” whereby “learners of all ages [teachers and students] and levels of expertise and interests seed the environment with ideas and knowledge that are appropriated by different learners at different rates, according to their needs and to the current state of the zones of proximal development in which they are engaged” (Brown, Ash, Rutherford, Nakagawa, Gordon & Campione, 1993, p. 193).

## Research literature

Traditional teaching methods require particular protocols for how students and teachers interact and how knowledge dissemination and exchange occurs in classrooms. The long history of association with industrial age motifs, akin to assembly line control or operations management, supported by a social ethos which prevailed during the 19<sup>th</sup> century, endures in many classrooms despite developments in teaching methods and classroom management techniques. The industrial motifs emphasise productivity and efficiency by extending the machine metaphor to social systems. Teacher-centred control over learner behaviour, individual choice, information delivery and task completion are hallmarks of such an approach (Thompson, Smith & Mienczakowski, 2002). As a response to the persistence of the teacher-centred model, successive developments in educational

theory and practice and in educational technology, and transformations in social and community expectations, have contributed to increased advocacy for student-centred approaches to learning (Thompson, Smith & Mienczakowski, 2002).

At the outset of the 21<sup>st</sup> century, mainstream teaching comprises a broad collection of approaches to classroom practice. Notably, however, discretion is needed when deploying ICTs such as a GSS, since technologies designed to foster socially constructed knowledge assume that social interaction among participants in the classroom will be predictable and catered to by the learning system (Bonner & Basaravaj, 1995; Liou & Nunamaker, 1993; Nunamaker, Briggs & Mittleman, 1995; Nunamaker, Dennis, Valacich, Vogel & George, 1991; Whiteley & Wood, 2000). As GSS technologies stem from the substantive development and extension of nominal group techniques (Thomas, McDaniel & Dooris, 1989), it is hypothesised that teaching approaches such as cooperative learning (Biehler & Snowman, 1997; Hockaday, 1984; Johnson & Johnson, 1984) provide a suitable foundation for integrating tools such as ZTLS to augment learning outcomes. Indeed, cooperative learning is most suitable not least because it is widely recognised for its capacity to support group heterogeneity, group goals and positive interdependence, individual accountability, interpersonal skills, equal opportunities for individual success, team competitiveness and learning at a distance (Berry, 2003; Biehler & Snowman, 1997; Felder & Brent, 2001; Johnson & Johnson, 1984; Slavin, 1981).

Given that the cooperative learning literature expounds techniques and activities suited to teaching systems that proffer collaboration between teachers and learners, the integration of the ZTLS with existing systems as a student-centred tool mandates the application of a suitable framework or methodology. Arguably, collaboration between teachers and learners must not be an end in itself. Teaching and learning, like opposite sides of the same coin, coexist to ensure greater individual participation, engagement and commitment to learning, heightened individual critical awareness and increased scope for learning management.

### ***Situated learning and knowledge management in classrooms***

In most classrooms, teachers and learners deal with abstractions and shape understanding through learning. Our research seeks to establish a basis from which knowledge creation and exchange are recognised not only as integral parts of learning, but also as outputs of the learning process that are verifiable. By introducing a tool such as the ZTLS, learning becomes truly situated (Brown, Collins & Duguid, 1989). The learning process, harnessed by the efficacious use of a GSS, enables teachers and learners to access, acquire and develop useful intellectual processes within a framework of experience that is both collaborative and discursive (Brown, Collins & Duguid, 1989; Whiteley, 2002). Engagement in authentic learning tasks leads to purposive social interaction, so that knowledge among individuals, within a team/group and across a class occurs in a socially constructed way. Learners co-create knowledge and meaning (Whiteley, 2002; Whiteley & Wood, 2000). Such grounded social experience cultivates ownership as an outcome of learning activity, appropriate learning contexts and discourses based on a commitment to deep learning (Lave & Wenger, 1991; Lyotard, 1984; McLellan, 1995; Wertsch, 1985). It is from this vantage point that ‘communities of practice’ can be established (Callan & Whymark, 2002; Wenger, 1998; Wenger & Snyder, 2000) as a basis for knowledge creation and exchange.

The social construction of knowledge in this way signals possibilities for an epistemology of learning underscored by a general theory of knowledge acquisition and knowledge management. Notwithstanding the possible emergence of communities of practice (Lave & Wenger, 1991; Wenger, 1998; Wenger & Snyder, 2000) in this way, it is clear that classroom learning must be guided by an appropriate methodology. The shortcomings of conventional teacher-centred modes of learner engagement and interactivity cannot be overthrown by a change in educational philosophy alone. Indeed, in securing any transition to a knowledge-based approach to teaching and learning that is based on the suitability of learner-centred approaches that achieve the requirements stipulated earlier, teacher pre-service and in-service experiences must be suitably grounded in methodologies that sustain practices in line with the shift towards the learning management systems suggested here. To secure the transition from conventional teaching and learning to knowledge-based and learner-based approaches, pre-service and in-service teacher education must teach the methodology of collaboration that supports the shift to learning management.

### ***Social constructionism as a basis for learning management***

Student-centred learning which embraces cooperative learning between teachers and learners suggests that ongoing learning development is appropriated as a 'dialogic process' (Berger & Luckmann, 1996; Brown, Collins & Duguid, 1989; Gergen, 1998; Shotter, 1993). Knowledge is essentially derived as an artefact of such a process, whereas knowledge creation and exchange are derived as a consequence of situated learning. In this way, knowledge building is enabled by way of tools, techniques and intellectual processes (Lave & Wenger, 1991; Lipman, 1991; Lyotard, 1984; McLellan, 1995; Mercer, 1995, 2000; Slavin, 1981; Stables, 2003). With such an approach, it is possible to conceive of mainstream classroom practice as a form of purposive social engagement between teachers and learners within a workspace. The ZTLS workspace itself is perceived as a co-created 'action space' where teachers and learners create and exchange knowledge through modes of discourse: mental (individual cognition); organisational (informal and formal social structures); and interactional (levels or types of social exchange) (Såmmé, 1997). Commensurably, this action space in our research is articulated involving the ZTLS as a knowledge creation tool to encapsulate learning, whereby learning and knowledge creation are enacted in socially meaningful ways (Rogoff & Lave, 1984; Stables, 2003).

Effectively, the ZTLS secures the foundation for the social construction of knowledge where implicit dimensions of thinking are made explicit. Learning is derived from discourse, whereby shared understanding and co-created meaning provide a socially supported, formative, experiential order where teams/groups of learners co-create and take ownership of knowledge. According to Lave and Wenger (1991, p. 51):

Learning, thinking, and knowing are relations among people in activity in, with, and arising from the socially and culturally structured world. This world is socially constituted; objective forms and systems of activity, on the one hand, and agents' subjective and intersubjective understanding of them, on the other, mutually constitute both the world and its experienced forms.

## Methodology

Action research (Kemmis & McTaggart, 1988), with its cyclical and repetitive phases of planning, implementation, evaluation, was used. The justification for using action research is that the nature of the methodology must fit the research itself. The cyclical and overlapping nature of the three phases, involving at times concurrent activity in all three, meant that we could more readily address the outcomes sought by participants: namely, to maximise learning outcomes for learners; change professional practice for teachers; and increase professional expertise and knowledge in using ICTs relevant to planned learning experiences. As Robottom (1987) observed, action research is a spiral of successive cycles, rather than a linear cycle of three phases. This flexibility in approach ensured that we could more aptly respond to emerging needs. As Reason and Bradbury note: “Action research is a participatory, democratic process concerned with developing practical knowing in the pursuit of worthwhile human purposes, grounded in a participatory worldview” (2001, p. 1). Participant observation was used, along with focused interviews with the participating teachers. A key participant was a Year 7 teacher who had used ZTLS previously and who assisted one of our team members (an expert GSS trainer) in the provision of professional learning experiences for colleagues involved in the project. A management group was formed that consisted of the research team and relevant school staff (teachers and school principals).

The program of research involving pre-service and practising teachers across five separate locations in Central Queensland to date has utilised a combination of face-to-face and distributed versions of the ZTLS (Callan & Whymark, 2002; Callan, Whymark, & Waters, 2000; Purnell, Callan, & Munnerley, 2003; Waters & Callan, 2003). Of consequence to the research has been a requirement to confirm the suitability of a framework to appropriate the action space of mainstream classrooms. The application of the Transformative Dialogue Framework (Gergen, McNamee & Barrett, 2001) involved the inclusion of six congenial practices which enable classroom teachers to explore modes of interactivity based on norms and expectations to effect relational responsibility among team/group participants while deploying ZTLS techniques. This crucial addition to the social *milieu* of mainstream classroom practice initiated interdependencies between teachers and learners, secured the primary requirements to effect flow (Csikszentmihalyi & Csikszentmihalyi, 1988) and ensured sufficient scope for learning management. This included taking cognisance of the eight learning management questions expressed by Lynch (2003):

1. What does the learner already know?
2. Where does the learner need/want to be? (The outcomes to be achieved)
3. How does my learner best learn?
4. What resources do I have at my disposal?
5. What will constitute the Learning Journey and therefore what is the best context for the learning?
6. Who will do what?
7. How will I check to see the learner has arrived?
8. How will I inform the learner and others about the learner’s progress?

In particular, cooperative learning was the strategy used by the teachers with their classes in addressing several of the learning management questions. Insights from cooperative learning offers to our research appropriate levels of understanding about how efficaciously the ZTLS enables learners to interact effectively among

one another and with teachers. This is demonstrated in Figure 1, where student-to-student and student-to-teacher exchanges take place during team/group brainstorming and the development of ideas. These complementary yet distinctive forums of communication not only improve student-to-student and teacher-to-student interaction but also establish crucial opportunities for cross-flow communication, personalisation, prompting, reflection and feedback.

The ZTLS as a tool, along with the congenial practices framework, enhance cooperative learning by underscoring group/team interaction, but not at the expense of individualisation. In summary, the congenial practices framework (Gergen, McNamee & Barrett, 2001) emphasises: (a) relational responsibility; (b) self-expression; (c) affirming the other; (d) coordinating action; (e) self-reflexivity; and (f) co-creation. Feedback between teacher (facilitator) and learners (participants) or even among participants is available at appropriate intervals. Teachers claim sufficient scope to scaffold the learning tasks and are able to ask key questions to challenge learners further in order to enact deep learning strategies.

Leadership during task completion is shared, and shared understanding occurs inimitably (Whiteley, 2002) as group/team synergy deepens the social relations among participants. ZTLS enabled learning experiences are demonstrably rich learning experiences which draw on the social *milieu* of the learning context. This is important as many students come to school mainly to experience social interactions grounded in the culture of formative experiences between themselves and their learning managers (teachers). Learners acquire an appreciation of their responsibility to take an active part in creating and shaping knowledge in the interest of advancing the qualitative nature of learning experiences. Knowledge acquisition does not suggest the mere gathering of an intangible yet perceptible mass of facts and figures transferred from teacher to learner(s). Instead, it is summarily co-created, co-constructed and co-enacted as the group/team comprising teacher and learner(s) engage and interact with the tenable sense of the gap between what is known and what is yet to be known. This is how learning in the knowledge age has come to be situated through student-centred, technically enabled interaction in mainstream classrooms. Essentially the integration of systems such as the ZTLS to furnish real time interactivity provides the basis for knowledge building and learning for life inculcated through socially active and personally engaging processes.

## **Findings and discussion**

Classroom practices must be based on efforts to manage learning and knowledge creation effectively. ICTs collectively provide the wherewithal to enhance learning gains. However, this cannot be done in isolation. It must be socially contextualised, with teachers being prepared to question and critique their methods – the hallmark of effective yet critical management practice. The learning management process using ZTLS causes changes in pedagogy to manage and facilitate learning better but the teacher's role is not to 'teach' in traditional ways. The tools and intellectual processes of participants set the stage for communities of practice to emerge where knowledge is not only shared but also co-created and exchanged for mutual advantage. Tools like the ZTLS provide teachers and learners with the wherewithal to engage individually and collectively in meaningful interactions. As participants in knowledge creation processes, regardless of location, teachers realise that learning management takes on the goal of teams working together to address the entire group's learning needs.

The accompanying sample (Figure 2) features quotations from the participating teachers who have used the ZTLS with their students:

**Figure 2: Extracts from teacher feedback after Zing sessions**

“All the students were contributing, whereas in the same situation in a normal classroom routine not all students contribute”  
“You’ve got a lot more of their attention”  
“There was a lot of group participation and a lot of dialogue happening between the groups”  
“They could see the other students’ responses and it also assisted them with improving the next response”  
Teachers can “bounce [ideas] off each other”  
“The kids really enjoy being able to put up an answer on the screen as opposed to being left out (in traditional ‘one student responds at one time’ approaches)”  
“The cross-fertilisation that occurs with simultaneous projection [of student responses] is very powerful”  
“The system’s appeal definitely gets the kids in – even the shy ones have a go and seem to be delighted by the opportunity to have their say”  
“The speed through which data can be gathered (on individual student performances) is much greater than through traditional classroom methods”  
“The system helps teachers to profile the set of responses and track individual contributions”  
“Students’ ideas – although sometimes based on those of others – will be further refined and understood (internalised by them), as their knowledge bases are optimised”

The cooperative learning experienced by students in this study is an effective paradigm for 21st century classes (Biehler & Snowman, 1997; Felder & Brent, 2001; Johnson & Johnson, 1984; Slavin, 1981). However, cooperative learning needs to dovetail with learning management and knowledge management in today’s classrooms. This research provides preliminary evidence that technologies (tools) such as the ZTLS – or other GSS (Bonner & Basaravaj, 1995) – enables teachers and learners to be linked to broader learning opportunities through communities of practice.

The theoretical foundation of cooperative learning activity is extended by the integration of ZTLS to situated learning experiences either within the classroom or across classrooms (Brown, Collins & Duguid, 1989; Gergen, McNamee & Barrett, 2001; Lave & Wenger, 1991; Wenger & Snyder, 2000). New identities are forged as groups/teams perceptibly link together and engage one another as part of a wider base of knowledge enabled learners who are willing to explore the uniqueness and diversity that exist in the wider social *milieu* of a community of knowledge users. Clearly, the research findings have implications for what we do at CQU in pre-service teacher education programs such as the Bachelor of Learning Management. Schools have incumbent upon them the need to use ICTs in meaningful ways in learning environments and therefore our pre-service teacher education students need to know how and why they would use ICTs in learning experiences for their students. They not only have to acquire the requisite skills and knowledge but also must demonstrate successful use of the technologies in the management of student learning. The methodologies uncovered here are deemed to be purposive in pre-service teacher education. With the likelihood of the web-based version of the ZTLS being made available across CQU campuses, lecturers and students will have opportunities to develop competencies in the use of such an ICT to advance the higher education teaching and learning agenda.

## Conclusion

The conventional classroom motif is transformed from that of a separate or discretely bounded space where knowledge is abstracted and passed onto learners. Instead, classrooms become contexts comprising socially interconnected, enabling workspaces where the tacit and explicit realms of understanding between teacher and learner form the basis for discourse. In this way cognition, knowledge and learning are situated and made functionally relevant by virtue of how tools like the ZTLS and other intellectual processes are appropriated by teachers and learners. From such a standpoint, teachers are able to exercise professional prerogatives over learning and knowledge management. As a result of informed learning management and stewardship of ICTs, every learner's grasp of knowledge can be underscored by the highest levels of engagement and social probity that mainstream classroom learning can offer in the 21<sup>st</sup> century. In such cases, the time that it takes to interact and engage with others in the interest of knowledge creation and exchange holds far greater premium than having to rely on where learners and teachers may be physically located.

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