

The Teaching-Research-Technology Nexus: Implications for Engaging the Net Generation

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Introduction

The teaching-research nexus has received much attention in the higher education research over the past decade as universities contend with challenging questions about the purposes and functions of higher education in a massified sector. At the same time, a growing body of literature has grown up around the use of information and communication technologies (ICTs) in higher education and the possibilities of these technologies for transforming the core activities of learning, teaching, research and administration in universities. To date, however, little has been done to draw together these two key strands of enquiry with a view to determining policy and practical implications of the teaching-research-technology (TRT) nexus across the higher education sector.

This paper outlines eight key dimensions of the TRT nexus by proposing a conceptual framework (see Figure 1) that draws together a number of critically important – though currently discrete and atomised – areas of activity across the sector. These developments, both nationally and internationally, have a significant bearing on the success with which we will draw together teaching, research and technology in higher education.

Brief, illustrative commentary on each dimension of activity is provided. The goal is to raise questions about strategies for adopting a more coordinated, integrative approach to higher education policy and practice that will lead to positive sectoral outcomes, including enhanced student engagement.

Radiating from the central goal of enhancing the student experience and outcomes are two key areas of activity that have a significant impact on the success with which teaching, research and technology are integrated. These are the national and international policy context and the institutional context. Each will be discussed in turn.

Dimension 1. National and international policy context in higher education

Policy developments such as the establishment of the national Learning and Teaching Performance Fund and the introduction of the Research Quality Framework have played a key role in shaping the Australian higher education landscape over the past five years. These important, yet distinctly separate policy developments have the potential to reinforce the notion of research and

teaching as mutually exclusive endeavours, addressed by separate policies and funding arrangements. Such segregation at the national level necessarily filters through to institution level policies, practices and organizational structures.

The integration of teaching, research and technology is also influenced by the national priority areas and research priorities of funding bodies such as the Carrick Institute for Learning and Teaching and the Australian Research Council (ARC). Department of Education, Science and Training (DEST) priorities in relation to funding for systemic infrastructure and initiatives related to interoperability and standards represent yet another set of factors that influence higher education and its capacity to draw connections between teaching, research and technology. Parallel international activities in this regard, such as those initiated by the IMS Global Learning Consortium and Joint Information Systems Committee (JISC, UK), for example, also play a key role. The role of national bodies such as the Council of Australian Librarians (CAUL), the Council of University Directors of Information Technology (CAUDIT), and Australasian Council on Open, Distance and E-learning (ACODE) is not to be underestimated. However, in the spirit of integrative thinking and decision-making in relation to teaching, research and ICTs, important questions need to be raised about whether or not there is sufficient collaboration and cross-fertilisation of ideas at national and institutional levels.

Dimension 2. Institutional context

In response to the various policy agendas and activities described above, Australian universities are grappling with the challenge of establishing distinctive institutional goals and priorities, meeting legislative requirements, and trying to draw together the various strands of activity to achieve effective learning environments for students and staff. All but two of Australia's 37 universities publicly aspire to connect teaching and research, according to their websites (Krause, 2007c), yet organisationally, most of the initiatives to support enhanced teaching and research activity in universities have few, if any, points of connection. Institutional teaching and research agendas are typically separately funded and organisationally discrete endeavours. When one adds the further dimension of technology to this picture, there is likely to be even more disjuncture between these three areas of activity. Universities find themselves attempting to respond to government policies with often disjointed initiatives which, while individually effective, do not necessarily achieve the seamlessness of activity so fundamental to a joined-up approach to teaching, research and technology use in higher education.

Having argued for such a joined-up approach, however, the challenges of decision-making in relation to investment choices and directions for IT infrastructure remain formidable. Nevertheless, they must be addressed, for failure to achieve clarity and connectedness within and among these various agendas and priority areas often leads to what academic staff perceive as 'agenda-swapping' (Fanghanel & Trowler, 2007). As the focus shifts from one priority area to another, many academic staff in particular experience frustration and a sense of insecurity at what they perceive to be changing

agendas and priorities that, in turn, affect their work in myriad ways. Further adding to staff frustration is the fact that in activities relating to teaching and ICT use there are few clear measures of success that might be used, for example, as the basis for promotion. These staff frustrations and concerns highlight the need to draw together teaching, research and technology agendas that enable whole-of-institution approaches and that communicate a coherent message about the interconnectedness and reciprocity of these dimensions.

Dimension 3. Purposes and functions of higher education

Questions about the purpose and role of higher education in society have been posed for as long as such education has existed. However, more recently, as higher education has shifted markedly from elite to universal access (Trow, 2001), these questions have once again gained prominence. In April 2007, an invited group of scholars gathered in the UK for an international colloquium entitled *International Policies and Practices for Academic Enquiry*. A primary reason for this meeting was to foster debate about the role and nature of academic enquiry and the relative roles of teaching and research in a rapidly changing higher education environment.

Recent interviews with academics and policy-makers across the sector revealed that the majority assume that the teaching-research nexus is foundational to the culture of universities and provides benefits for students and staff (Krause et al., 2007). However, there is relatively little empirical evidence of a close relationship between the teaching-research nexus and student learning outcomes, not to mention staff benefits. More empirical work is required that acknowledges the complexity of the teaching-research nexus and that re-conceptualises the nexus in terms of significant contextual factors, including the significant role of emerging technologies that have the potential to reshape and transform the activities of learning, teaching and research in higher education.

A rigorous analysis of these issues is lacking from the current debate. However, Fanghanel's (2007) study of how academic staff conceptualise and approach teaching and learning makes a significant contribution in this regard. Fanghanel proposes the teaching-research nexus as one of seven filters through which academic staff view learning and teaching. Other filters operating at the macro level are perceptions of academic labour and roles, and external influences (such as those outlined above). Meso (department) level filters identified in the study are: discipline, department and institutional contexts. Finally, at the micro individual level, pedagogical beliefs function as a key filter. For our purposes, one might add an eighth filter that addresses staff perceptions of the role and possibilities of emerging technologies in learning and teaching. Fanghanel does not address this issue directly, but the notion of multiple lenses or filters influencing views about purposes and functions of higher education is a particularly powerful one that supports the importance of adopting a joined-up approach to further analysis of the potentially powerful interrelationships between teaching, research and technology.

Dimension 4. Learning, teaching and ICTs

Questions about the purposes and functions of higher education naturally lead to questions about the nature of the learning and teaching that are so fundamental to the higher education enterprise. For the purposes of this conceptual framework, the contribution of ICTs to achieving core learning and teaching goals is of particular significance.

ICTs, in the form of learning management systems, have become integral to the student experience in higher education. In a 2004/5 national study of the first year experience (Krause et al., 2005), three out of four students used course-related web-based resources on a daily or weekly basis.

The use of ICTs in learning and teaching encompasses three basic modes of operation.

Mode 1: baseline course administration and learner support, sometimes referred to as 'supplementary mode'. Most universities are anchored in this mode of operation.

Mode 2: blended learning, leading to significant enhancements of curricula and pedagogy.

Mode 3: online course modules that represent fully online courses and incorporate all the best features of Modes 1 and 2.

Despite the almost ubiquitous use of enterprise systems across the sector, however, we are yet to see evidence of the transformative impact of ICTs on curriculum and pedagogy in higher education. The vast majority of undergraduate students continue to value ICTs for the sake of convenience, rather than for the value they might add to the learning experience (ECAR, 2005). Initiatives such as e-Portfolios, Personal Learning Environments and a range of social computing tools provide ample evidence of the potential of ICTs to enhance the higher education learning environment. However, there is much to be done across the range of dimensions shown in Figure 1 to bring about curriculum transformation and to demonstrate evidence of the impact on learning of embedding ICTs into the curriculum.

Dimension 5. E-research

One cannot pose questions about the teaching-research-technology nexus, without acknowledging the e-research agenda and its possibilities for learning, teaching and research. There has been much activity in e-research in Australian higher education and it could be said that we have now reached the high-end of the 'cottage industry phase' where e-research infrastructure and processes might be described as being 'highly crafted', yet still operating within limited spheres of activity across the sector.

E-research developments to this point have tended to be divorced from most academic enterprises at the level of the individual academic and we are yet to see robust analysis of the policy and practical implications of drawing e-research into the learning and teaching domain. We know the power of e-research and grid computing for enhancing staff access to largescale data repositories and networked resources. However, the vast majority of

Australian academics are yet to harness and benefit from these resources. Many remain sceptical about such issues as intellectual property in such an environment, and typically, those working in the social sciences and humanities disciplines are yet to be convinced that e-research has a wider purview than the sciences. In a recent discussion of the benefits of e-research, one academic said 'I'm a researcher, not an e-researcher. It's just a tool – nothing to get too excited about'. This may well be so, but as we face the challenge of integrating e-research capabilities into the daily work of academic staff and institutions, it will be important to address staff perceptions of the possibilities of e-research in order to ensure that the promise of e-research is realised.

Apart from providing rich veins of research data for academic research, e-research offers particular promise for forging effective links between learners and the research of their discipline. For a generation of learners who are increasingly wired and wireless, the capacity to connect with their disciplinary community of scholars through advanced ICT capabilities is an exciting prospect. For instance, harnessing the power of e-research capabilities, undergraduate students may engage with large datasets as novice researchers. They may learn how to use disciplinary and multi-disciplinary research and interactivity tools that bring them into close contact with communities of researchers across the globe and provide them with a working knowledge of research conventions, tools and methodologies. E-research also enables students to disseminate and publish their findings creatively, collaboratively and accessibly (see, for example *Academic Intersections*: <http://edcommunity.apple.com/ali/story.php?itemID=9574&prev=true&version=0>). Thus, e-research offers the promise of motivating students and connecting them with disciplinary research in new ways that advance and augment traditional approaches to integrating research, learning and teaching. However, this has significant implications for academic staff who will be responsible for reshaping curricula, and for institutions who will need to consider the requisite infrastructure and support mechanisms to enable e-research to take hold in the classroom.

Some emerging applications for teaching in higher education have been developed in key DEST-funded projects, such as the DART Project at Monash University (<http://dart.edu.au/about/>) and the ARCHER Project (<http://archer.edu.au/>) at Monash, UQ and James Cook University. Like many other initiatives of their kind nationally and internationally, these projects face formidable challenges in addressing infrastructural issues of scale, sustainability and interoperability between repositories. Scalability and accessibility remain key issues if we are to ensure that e-research has meaning for students and staff across the sector.

Dimension 6. Academic labour

The dramatic changes to research processes enabled by technologies represents just one of the many significant developments taking place in the work of academic staff in the 21st century. We are experiencing notable generational shifts in the higher education labour force in Australia as

significant proportions of academic staff across the sector draw close to retirement age.

As one cohort of the academic population ages, so another one is taking its place. Typically, this new generation of academics falls into the early career category, is technology-savvy and may well be working on a fixed-term contract basis. In a current Carrick-funded project on the teaching-research nexus, I interviewed several such academics who see research as an integral part of the learning and teaching process, and technology as an exciting enabling vehicle. Their comments below illustrate the beginnings of a generational shift in academic staff approaches to the use of technologies in their work:

“Technology is a great tool that aids you ... to create the artwork ... display that artwork ... through the Net ... you have a direct connection to the audience. ... In Australia ... students feel somewhat isolated ... you can show them how their work ... can have an impact internationally, almost instantly. ... engage with ... people from all across the world through their artworks as opposed to struggling to get their painting up in a local ... university gallery” [Associate lecturer #1, University #1]

“I’m constantly dealing with new technologies ... you have to teach your students how to teach themselves ... my field is filled with people who work in it for about five years and then quit because they can’t keep up with the technology ... I teach my students to teach themselves”
[Associate lecturer #1, University #1]

“I use MySpace in my teaching ... [the material I put on MySpace] is the textbook that I can’t find ... my own personal blogs ... the students ... love it ... they’re encouraged to interact with me ... they put up ... comments ... they like it better than [Blackboard] ...I think it’s amazing”
[Associate lecturer #2, University #2, fixed term contract]

“This ... is not the style for everyone ... [there is a] generational change in this ... next cohort of academics [aged under 40] who have grown up in that neo-liberal environment who have had to survive ... casual contracts ... as opposed to older academics ...[there is a] big cohort of ... academics who don’t experience tenure ... don’t have a job”
[Associate lecturer #2, University #2, fixed term contract]

Similar to Australian higher education, Fanghanel and Trowler (2007) have noted that the UK higher education academic labour force is characterised by: casualisation of teaching staff; concerns about understaffing; lack of facilities and infrastructure; lack of training and staff development; a sense of being over-burdened; a sense of unease with technology; a battle to balance research and teaching interests; and a concern that the locus of teaching is changing with technology. There is uncertainty among many academic staff about where emerging technologies will lead and who therefore assumes control for learning and outcomes.

As we consider the possibilities offered by forging greater connections between teaching, research and technologies, we cannot underestimate the

critical role of the academic labour force, and their perceptions and concerns amidst significant changes taking place in the nature of their work.

Dimension 7. The Net generation and emerging technologies

There is a growing industry around the study of the so-called 'net generation', their expectations, preferences, behaviours, values and attitudes. Higher education is not immune from this focus of inquiry, neither should it be. However, there is growing consensus among scholars in this area that any attempt to depict the 'net generation' as a homogenous group, defined solely by age and technological aptitude, is limited to the extreme. It certainly is not the case that all first year students, for example, engage with technologies in the same ways and with the same level of ease. Demographic variables such as age, gender and level of access to and experience with a range of ICTs all play a key role in determining the extent to which an individual might be defined as digitally literate or fluent (see for example Krause, 2007a).

Livingstone and colleagues (2005) identified the need for a more 'nuanced' picture of the ways in which young people engage with technologies, highlighting that for many, internet literacy develops 'unevenly and unequally' (p.9). JISC's UK-based Ipsos MORI (2007) study of student expectations of ICTs in higher education highlighted that, above all, students expect 24/7 access with a focus on the convenience of being able to download and print learning materials or manage online learning spaces when needed. This study concluded that: 'students do not fully understand how ICT and learning can work together' (p. 31). They 'find it hard to imagine the kinds of learning and teaching that they might meet at university' (p.29) and therefore, universities should 'not overestimate the understanding that students have of the day to day experience of being at university when explaining how their ICT provision fits with student life' (p.22). These conclusions resonate with the findings of Kennedy, Krause and colleagues (2006) that being a member of the net generation in terms of age is far from synonymous with knowing how to use technology-based tools for the purposes of learning and engaging with the discipline in higher education.

Despite these cautions, however, it is nonetheless a fact that there has been a dramatic increase in the extent to which undergraduate students are engaging in social networking as a personal activity. This has significant implications for the ways in which Web2.0 tools are integrated into student learning environments and legitimised as part of an authentic and collaborative learning experience. Dede (2005) refers to neomillennial learning styles that are characterised by fluency in multiple media and the valuing of collective 'seeking, sieving and synthesizing' of experience and information over individual information absorption. To enable collective and distributed learning of this kind, considerable attention is now being given to the design of learning spaces that place a premium on 'mashed up' learning: a combination of online and face-to-face interactions that allow students to make optimal and seamless use of both.

Dimension 8. Learning theories

Underpinning all we know to be important about the successful interactions of people, policy and contexts is the need for a fundamental working knowledge of how students, staff and organizations learn best. To reiterate, none of the eight dimensions of the conceptual framework (Figure 1) can operate optimally in isolation. The teaching-research-technology nexus is best fostered by an appreciation of the fact that we learn best when we have the opportunity to construct meaning for ourselves (constructivism, Piaget and Vygotsky) and to learn from and with others (social learning theory, Bandura).

More recently, Siemens (2004) has proposed what he calls a learning theory for the digital age: connectivism. This theory has much to recommend it, including the view that:

- learning and knowledge rests in diversity of opinions;
- learning is a process of connecting specialized nodes or information sources;
- learning may reside in non-human appliances; and
- decision-making is itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision.

Siemens argues, for example, that knowledge that lies in a database or repository must be connected with the appropriate people in the appropriate context for the appropriate purpose if learning is to be maximised.

This focus on making connections between and among people, knowledge, ICTs, policies and practices is a powerful conceptual enabler for taking the arguments of this paper forward and for making the links that will enhance the learning of a new generation of students and staff in universities.

Ways forward

The conceptual framework (Figure 1) depicts eight dimensions of the TRT nexus. Importantly, without the connecting loop that links and encloses the wide range of activities and contexts that contribute to the TRT, these dimensions simply represent a series of parallel but unconnected activities. The encircling loop highlights the priority that now should be given to considering this broad range of current activities and developments in a coherent and integrated way.

Many implications arise from adopting a joined-up approach to examining the various dimensions of the teaching-research-technology nexus, as outlined in this paper. Implications apply to policy makers and practitioners alike. In the first instance, the challenge lies in reconsidering the mechanisms and incentives to help reconceptualize the nature of the problems of bringing together teaching, research and technology in a higher education setting, at national, institutional and curriculum levels. Closer study must be given to the conditions that will bring about systemic, transformational change in order to:

- optimise the return on investment from government initiatives;

- enable institutions to take a more holistic view of institutional planning;
- enable academic staff to feel confident that they will receive adequate and ongoing support as they forge new paths in connecting research, teaching and technology activities; and
- provide clear direction for the further development of ICT infrastructure within and across institutions.

If we are to embrace systemic change and acknowledge its multidimensional character, as outlined in Figure 1, we must look at student and staff enquiry from a broader perspective and re-examine current theorising on learning. ICTs challenge us to consider the learning that may reside in non-human appliances, for example. Such challenges demand transformed approaches to curriculum design, staff development and policies relating to staff reward and recognition.

The proposed conceptual framework provides a particular challenge to universities to reconsider institutional approaches to the teaching-research divide and the need to engage in more integrative policy-making that brings together the people and the structures that will effectively connect learning, teaching and research with enabling technologies for the benefit of staff and students.

Those responsible for designing, developing and advocating further developments of ICT infrastructure to support institutional initiatives connecting teaching and research need to find ways of engaging in this broader debate in ways that will resonate with policy-makers and with academic staff as part of the quest for systemic and transformational change.

Each of the eight dimensions identified here represents specialised activity and demands expert analysis, yet at the same time, if we are to succeed in capitalising on the benefits to be gained from integrating learning and teaching with research and technology in higher education, visionary leadership is required to see the future possibilities and make them happen.

References

- Campbell, J. P., Oblinger, D. G. and Colleagues. (2007). Top-ten teaching and learning issues, 2007. *Educause Quarterly*, 3, 15-22.
- Dede, C. (2005). Planning for neomillennial learning styles: Implications for investments in technology and faculty. In D. Oblinger, *Educating the Net Generation*. Available online: www.educause.edu/ir/library/pdf/pub7101o.pdf.
- Educause Center for Applied Research (ECAR): *ECAR Study of Students and Information Technology, 2005: Convenience, Connection, Control and Learning*. Available online: www.educause.edu/ecar/.
- Fanghanel, J. (2007). *Investigating university lecturers' pedagogical constructs in the working context*. Higher Education Academy. Available online: www.heacademy.ac.uk/assets/York/documents/ourwork/research/fanghanel.pdf.

- Fanghanel, J., & Trowler, P. (2007). *New academic identities for a new profession?: Situating the teaching dimension of the academic role in a competitive enhancement context*. Paper presented at la première conférence Internationale du RESUP: Les universités et leurs marches, Paris, 1-3 February 2007. Available online: www.resup.u-bordeaux2.fr/.../conferenceinternationaleparis2007/Actes/FANGHANEL%20et%20TROWLER_RESUP2007.pdf.
- Ipsos MORI. (2007). *Student expectations study*. Available online: www.jisc.ac.uk/media/documents/publications/studentexpectations.pdf.
- Kennedy, G., Krause, K., Gray, G., & Judd, T. (2006). *First Year Students' Experiences with Technology: Are they really Digital Natives?* The University of Melbourne. Available online: www.bmu.unimelb.edu.au/research/munatives/index.html.
- Krause, K-L. (2007a). E-learning and the e-generation: The changing face of higher education in the 21st century. In J. Lockard & M. Pegrum (Eds.), *Brave new classrooms: Educational democracy and the internet* (pp.125-140). New York: Peter Lang Publishing.
- Krause, K-L. (2007b). *Juggling undergrads with new quests*. University Teaching, The Australian, 3 October 2007, pp.1-2.
- Krause, K-L. (2007c). *Knowledge Transfer, Engagement and Public Scholarship: Emerging Possibilities for an Integrated Approach to Academic Enquiry*. Paper presented at International Policies and Practices for Academic Enquiry: An International Colloquium, Marwell Conference Centre, Winchester, 19-21 April 2007. Available online: www.griffith.edu.au/centre/gihe/
- Krause, K-L., Arkoudis, S., & Green, A. (2007). *Teaching-research linkages: Opportunities and challenges for practice and policy*. Paper presented at Carrick Teaching-Research Nexus Forum, Adelaide, August 2007. Available online: www.griffith.edu.au/centre/gihe/
- Krause, K-L, Hartley, R., James, R., & McInnis, C. (2005). *The first year experience in Australian universities: Findings from a decade of national studies*. Canberra: Australian Department of Education, Science and Training.
- Livingstone, S., Bober, M., Helsper, E. (2005). *Internet literacy among children and young people*. London: Department of Media and Communications, LSE. Available online: www.children-go-online.net.
- OECD. (2005). *Policy Brief: E-learning in tertiary education*. Available online: www.oecd.org/dataoecd/55/25/35961132.pdf
- Siemens, G. (2004). *Connectivism: A learning theory for the digital age*. Available online: www.elearnspace.org/Articles/connectivism.htm.
- Trow, M. (2001). From mass higher education to universal access. In P. Altbach, P. Gumpert, & D. Johnstone (Eds.), *In defense of American higher education* (pp. 110-143). Baltimore: The Johns Hopkins University Press.

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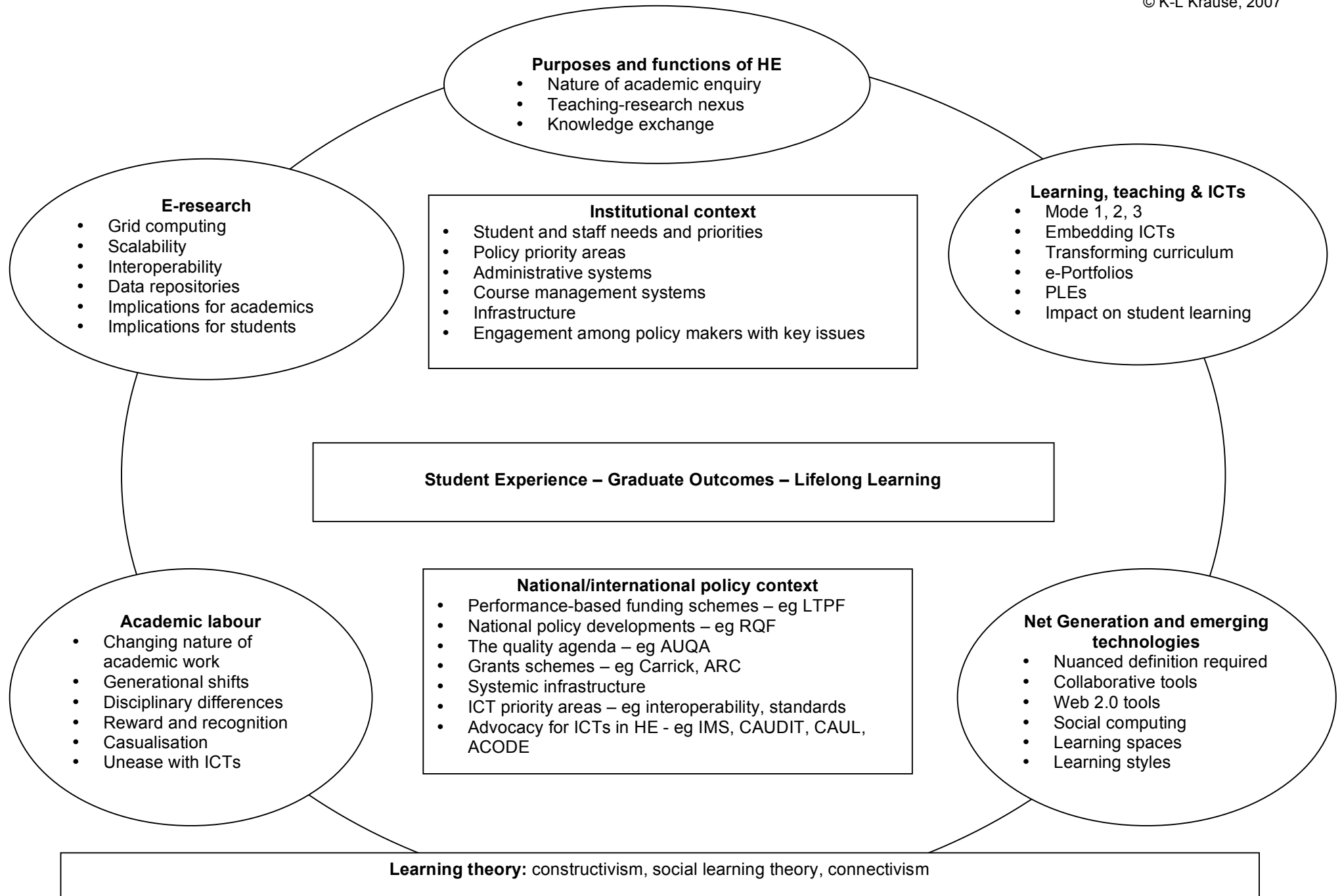


FIGURE 1. Key Dimensions of the Teaching-Research-Technology Nexus: A Conceptual Framework