

The genesis and emergence of Education 3.0 in higher education and its potential for Africa  
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## Abstract

This paper presents a scenario in which education is approaching a potential tipping point, where major changes are about to happen as a result of developments in technology, social networking, deeper understanding of educational process, as well as new legal and economic frames of reference. The set of changes constitute what we refer to as Education 3.0, and it impacts on the roles and behavior of key stakeholders. Education 1.0 is mainly a one-way process, Education 2.0 uses the technologies of Web 2.0 to create more interactive education but largely within the constraints of Education 1.0. Education 2.0 is laying the groundwork for Education 3.0, which we believe will see a breakdown of most of the boundaries, imposed or otherwise within education, to create a much more free and open system focused on learning. The scenario we describe suggests that Africa can shape these changes to benefit its own development, but that if it fails to do so, it will be left behind and will end up impacted negatively by the changes that are inevitable. We list the adjustments required at the level of institutions of higher education to become leaders of Education 3.0 and present some of the activities that the University of the Western Cape is undertaking in this area. Finally, we offer a fictional short story to provide an Education 3.0 narrative.

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## Introduction

A new landscape for education is emerging as a result of developments in information and communication technology (ICT) in the last 15 years; community-based innovation and production models based on concepts of sharing and legal mechanisms to support them that have blossomed in the past four-five years; and, educational pedagogies as well as institutional arrangements that are still forming. Widely known and vigorously discussed and debated among those 'in the know', this incipient educational landscape remains largely invisible to the majority of educational practitioners and participants in higher education on a global scale.

Over the past three-four years, a set of technologies and social phenomena have arisen on the Internet that are collectively referred to as Web 2.0 (Web two point oh) indicating that the World Wide Web has seen a set of important changes since its inception (version 1.0) which have turned it from an *access* technology into a *participation* technology. The term Web 2.0 was made popular by Tim O'Reilly and John Batelle in a series of conferences organized by O'Reilly Media [1].

The concept of Web 2.0 is still fluid, but it is characterized by a number of features including increasing levels of two-way communication, content creation by users, increased social interaction, naturally formed communities of practice and social networking. There is also an increasing blurring of the distinction between desktop computing and Web-based computing, and many software applications are increasingly provided as Web-based services. Specific technologies contributing to Web 2.0 include weblogs (blogs), wikis, syndication of content through RSS, podcasting and videocasting for audio and video content, screencasting, social bookmarking, the sharing of photos, videos and other artifacts.

Education 2.0 (Education two point oh) refers to the use of the technologies and social engagements of Web 2.0 in a relatively unchanched institutional framework that characterises Education 1.0. We believe it represents only the first step in the direction of a fundamental transformation of higher education, and when this transformation is complete, we will have arrived at an entirely new form of higher education that we refer to in this article as Education 3.0 (Education three point oh). We argue that the higher education environment is approaching a tipping point, enabling the radical step to Education 3.0, and that institutions need to take the necessary steps today, in order to remain relevant institutions and lead higher education tomorrow. Leaders in educational institutions need to be aware of what is happening, the speed of evolution, and understand how to shape their institutional participation in the future now.

This paper should be considered a scenario document; it is not based on a particular research study, but aims to integrate some of the changes we are witnessing today, based on our own grounding within higher education, drawing from discussions in the global community of researchers and practitioners working in this field, and from our solid involvement in the changing landscape of technology including collaborative and shared creation of software and content. We hope to contribute to a foundation that leads to comprehensive analysis and study of the changes that have started happening at the intersection of technology, education, economics and society and their impact on the role of universities.

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## Three generations of education

Education 1.0 is, like the first generation of the Web, a largely one-way process. Students go to universities to get education from professors, who supply them with information in the form of a stand up routine that may include the use of class notes, handouts, textbooks, videos, and in recent times the World Wide Web. Students are largely consumers of information resources that are delivered to them, and although they may engage in activities based around those resources, those activities are for the most part undertaken in isolation or in isolated local groups. Rarely do the results of those activities contribute back to the information resources that students consume in carrying them out.

Education 2.0 happens when the technologies of Web 2.0 are used to enhance traditional approaches to education. Education 2.0 involves the use of blogs, podcasts, social bookmarking and related participation technologies but the circumstances under which the technologies are used are still largely embedded within the framework of Education 1.0. The process of education itself is not transformed significantly although the groundwork for broader transformation is being laid down.

Education 3.0 is characterized by rich, cross-institutional, cross-cultural educational opportunities within which the learners themselves play a key role as creators of knowledge artifacts that are shared, and where social networking and social benefits outside the immediate scope of activity play a strong role. The distinction between artifacts, people and process becomes blurred, as do distinctions of space and time. Institutional arrangements, including policies and strategies, change to meet the challenges of opportunities presented. Education 3.0 as used here embraces many of the concepts referred to by Downes (2005) in his concept of e-learning 2.0, but complements them with an emphasis on learning and teaching processes with a focus on institutional changes that accompany the breakdown of boundaries (between teachers and students, higher education institutions, and disciplines).

Table 1: Educational generations in higher education			
Characteristics	Education 1.0	Education 2.0	Education 3.0
Primary role of professor	Source of knowledge	Guide and source of knowledge	Orchestrator of collaborative knowledge creation
Content arrangements	Traditional copyright materials	Copyright and free/open educational resources <i>for</i> students within discipline, sometimes across	Free/open educational resources created and reused <i>by</i> students across multiple institutions,

		institutions	disciplines, nations, supplemented by original materials created <i>for</i> them
Learning activities	Traditional, essays, assignments, tests, some groupwork within classroom	Traditional assignment approaches transferred to more open technologies; increasing collaboration in learning activities; still largely confined to institutional and classroom boundaries	Open, flexible learning activities that focus on creating room for student creativity; social networking outside traditional boundaries of discipline, institution, nation
Institutional arrangements	Campus-based with fixed boundaries between institutions; teaching, assessment, and accreditation provided by one institution	Increasing (also international) collaboration between universities; still one-to-one affiliation between students and universities	Loose institutional affiliations and relations; entry of new institutions that provide higher education services; regional and institutional boundaries breakdown
Student behaviour	Largely passive absorptive	Passive to active, emerging sense of ownership of the education process	Active, strong sense of ownership of own education, co-creation of resources and opportunities, active choice
Technology	E-learning enabled through an electronic learning management system and limited to participation within one institution	E-learning collaborations involving other universities, largely within the confines of learning management systems but integrating other applications	E-learning driven from the perspective of personal distributed learning environments; consisting of a portfolio of applications

Three aspects of Education 3.0 are of particular importance. Firstly, there is the role of students in making choices of a different kind than are available today. Secondly, the concept of students as producers of reusable learning content is vital which is available in abundance under licenses that permit the free sharing and creation of derivative works. Thirdly, institutional arrangements permit the accreditation of learning achieved, not just of courses taught.

However, while Education 3.0 holds much promise for higher education in general, it also poses serious challenges to existing universities. One of the key elements of what is happening with Web 2.0 is people-forming communities, making choices, and doing things for themselves without the need for institutional involvement. Only the vehicle is provided by sites such as

MySpace, Flickr, Blogspot, etc. Applying these developments to the field of higher education, it is likely that we will see emergence of new types of organizations and institutions, which might begin competing with today's universities in any combination of higher education services, including research, teaching, and accreditation.

The implications of these developments on the role that universities will play as part of Education 3.0 is not clear. We must ask, what will happen to education when the vehicles are provided, and students begin to make their own choices facilitated by an abundance of open content, and flexible opportunities for accreditation? What will happen to those institutions who are not able to survive on reputation alone, and who have not embraced Education 3.0?

We are still far from Education 3.0, even Education 2.0 is not as widespread it might seem to the already initiated, especially in the developing world and particularly in Africa. However, we may be close enough to a *tipping point* to engineer crossing it in a way that is advantageous to education and educational institutions.



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## **The potential of Education 3.0 for Africa**

Developments in e-learning technologies, and the emergence of global private higher education within the broader context of globalization represent both a significant challenge and a significant opportunity to the higher education systems of the “developing world”. As a result of competitive pressure universities are asked to become more efficient, and strive for “excellence” (Readings, 1996) an objective that was promptly defined by policy-makers and the private sector in terms of wealth creation. These developments are threatening the important social role the institution university has historically played. Education 3.0 provides an alternative scenario in which an open higher education environment can bring the mechanisms of open peer review and critical rationality (Popper, 1972) to teaching and learning, reduce cost through resource sharing, and increase collaboration across national and institutional borders.

Attempts to increase access to higher education in Africa face serious challenges, one of them being a scarcity of skills in most institutions, resulting in a general lack of on-site critical mass of researchers and students in most disciplines. However, such skills are not absent just widely dispersed and if the new collaborative Internet technologies are used wisely, they can help to create powerful and synergistic partnerships at local, regional and global scale (Keats, *et al.*, 2003). Such new and large-scale partnerships may have the potential to enable African institutions to benefit from the changes that constitute Education 3.0, provided students and lecturers can make the cultural shift to one where collaboration through technology features strongly, and where reuse is valued. More than technology, these culture shifts are likely to limit the spread of Education 3.0 in Africa in the near future.

A second challenge is the lack of funding. With some notable exceptions African higher education is characterized by severe under-funding, limited access to computing technologies

(Massingue, 2003), and high cost and scarcity of bandwidth (Keats, *et al.*, 2003; Keats and Beebe, 2004). Apart from a few urban dwellers, the typical African higher education student is exposed to information and communications technologies for the first time at university, and are not the digital natives (in the sense of Tapscott, 1998) of typical First World universities. In general there is probably a still-widening gap between the developed and developing worlds (“digital divide”) in this area (Wolff and MacKinnon, 2002), particularly in Africa.



## **The higher education environment tipping point**

The concept of a *tipping point* was coined by Grodzins (1958), and has since made its way into other literature, where it was popularized in the book by Malcolm Gladwell (2000). Gladwell cites epidemiology to explain how social phenomena resemble disease epidemics, and how a set of circumstances come together in such a way that some small change can push a system over a threshold so that it grows exponentially. Research on technical change and innovation has long used epidemic models to explain the diffusion of technology, which can be shown to follow an s-shaped curve. After an initial slow period, during which uncertainty often holds back uptake — since users are reluctant to take the risk of adopting a new technology with uncertain outcomes — a threshold value of adoption is reached, after which the diffusion speed increases significantly [2]. An important aspect of Gladwell’s argument is that it is possible through social engineering to create environments that enable the “tipping over” of adoption processes.

The education environment is currently in the first phase of the s-shaped curve and uptake of Education 3.0 ideas and technologies is still slow. However, a number of educational, social, technological, legal, and economic developments have laid the groundwork for a tipping point in higher education.

### **Education**

- Wide diffusion of e-learning
- Growing interest in alternatives to teacher-centred approaches such as constructivism (Dewey, 1998), resource based learning, etc.
- Local, regional, and international collaboration to create repositories of educational content
- Awareness for the need of recognition of prior learning
- Increasing use of the Internet to find information and just in time learning

### **Social**

- Increasing use of information technologies in daily life and for social purposes
- Increasing social use of online virtual spaces
- A new definition of self and society that includes computer mediated social structures, and people outside of one's immediate physical environment

## Technology

- The widespread adoption of personal computers and the Internet (especially e-mail and the World Wide Web)
- The emergence of Web 2.0, including blogs, podcasts, social interaction tools, etc.
- E-Learning platforms or learning management systems that incorporate features of Web 2.0
- Free and open source software

## Legal

- The development of alternative licensing mechanisms to traditional copyright, which promote the use and reuse of (educational) content without requiring further explicit permission by the author or copyright holder or payment of royalties

## Economic

- Internet mediated peer-production has emerged as an efficient organizational model for development of information goods and complements the traditional understanding of firm- and market-organized production processes

However, while the stage is set, the institutional elements of an Education 3.0 environment are still largely absent. The following section describes the actions that higher education institutions need to take in order to be Education 3.0 leaders.



## Engineering the tipping point into Education 3.0 at the institutional level

The emergence of Education 3.0 hinges on the continuing rapid development and diffusion of new technologies, and the increasing attempts to create a channel within which education reform can flow. Inspired by the recent developments in these fields, we believe that Education 3.0 is emerging fast. To ready our institutions to become leaders in the development of Education 3.0 (rather than trying to catch up as others lead) we need to begin making a number of changes. The table below lists some of these changes that characterize future Education 3.0 leaders. Any institution which wishes to be a leader in Education 3.0 will need to take active steps to create these changes now or will be left to play catch up later.

**Table 2: Changes that need to happen in higher education institutions in order for them to be leaders in Education 3.0**

Change	Reason	Notes
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<p>Embracing and contributing to free software [3] that is fit for purpose</p>	<p>Education 3.0 leadership will depend on the ability to experiment, and grow new and integrated technologies that foster social collaboration within institutions, across institutions, across disciplines, and across nations</p>	<p>Free software development shows efficient community-based innovation mechanism (Lee and Cole, 2003). The barriers to participation in these innovation processes are much lower with free software than with proprietary software. Institutions that fail to understand and embrace this will either be left behind or will incur disproportionate expenses.</p>
<p>Embracing and contributing to free and open standards for sharing and co-creation (not just information exchange)</p>	<p>Education 3.0 is fundamentally about multi-directional collaboration and multipurpose use and reuse of educational resources. The use of open standards ensures that resources remain compatible and accessible</p>	<p>Only if standards are open and implemented in free software can true collaboration happen with the level of innovation that will be required in Education 3.0 leaders</p>
<p>A good base of Free and Open Resources for Education (FORE) to which the institution contributes and from which it draws</p>	<p>Resources are the building blocks of collaborative educational processes. Without them, Education 3.0 is impossible</p>	<p>We need to move beyond publishing of static open courseware (OCW), which is still following a producer-consumer model</p>
<p>Learning processes and structures that take into account lessons from the collaborative development communities observed in free software development</p>	<p>Education has lots to learn from the loosely organised yet highly efficient production networks of free software communities. Learning from and adapting their practices can greatly benefit educational activities, formal (<i>e.g.</i> Keats, 2003) and informal</p>	<p>These kinds of collaboration can be both student-focused, lecturer-focused, or both. See the <a href="#">fictional story</a> at the end of this article for one particular example</p>
<p>A mindset change that says students have something to offer, and that fosters a “Rip-Mix-Burn” [4] approach to education. This includes a willingness to blur the line between student and teacher</p>	<p>Without a mindset change, the concept of students as creators of knowledge resources will not be realizable. There is no better way to learn than to teach. In general, students have much to teach one another, and reuse/remix is one of the ways in which this can be fostered</p>	<p>Along with the mindset change, we need tools (<i>e.g.</i> rubrics) to foster assessment of remix activities</p>

Institutional policies and strategies that foster progress towards collaboration and sharing, and students as producers rather than consumers	Institutional frameworks in higher education are needed to enable professors and students to engage in Education 3.0. Being a leader in the face of counter-policies and strategies is impossible	Institutions of higher education change slowly and few have embraced the opportunities of Education 3.0 or even Education 2.0
Good solid evidence-based research on the educational and economic implications of Education 2.0 and 3.0	Without evidence, decision making will be based on intuition, yet there is very little research in this area that goes beyond a high-level philosophical treatment. We need to understand the nuances of all the possibilities, not all of which will be equally appropriate	There is also scope for the creation of standards for describing and assessing informal and unstructured learning activities.
Agile information systems able to cope with the administrative challenges of Education 3.0	Education 3.0 will require institutions to assess and accredit a wide range of learning activities, not just formal, on-site or classic distance courses	One approach to this that is rapidly winning place in the business world is services oriented architecture, and approach that is designed for agility of business processes



### What UWC is doing towards Education 3.0

Like most institutions in Africa, we are deeply embedded in Education 1.0, and have as yet no formal strategy that will take us to Education 3.0. We are beginning to apply educational technologies but still largely within this paradigm, although uptake is happening at a more rapid pace than we expected. We are thus beginning to scratch the surface of Education 2.0, and lay the foundations for our participation in Education 3.0. Some of the specific initiatives are described in the table below.

**Table 3: Initiatives at UWC that could become the precursors of our work in Education 3.0**

Initiative	Description
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<p>Established the African Virtual Open Initiatives and Resources (AVOIR) project, and created the KEWL.NextGen (soon to become KEWL 3.0) e-learning platform as an AVOIR product</p>	<p>AVOIR is a network for capacity building in software engineering in Africa. It works exclusively with free software, including an application development framework originally known as KINKY and now called <i>Chisimba</i> in the latest version. <i>Chisimba</i> [5] is used to build the KEWL e-learning platform as well as a number of other applications all of which have Web 2.0 capability. URL — <a href="http://avoir.uwc.ac.za">http://avoir.uwc.ac.za</a></p>
<p>Creation of the Free Software Innovation Unit (FSIU)</p>	<p>The FSIU spearheads the AVOIR project and leads our Free Software development initiatives. All software produced at UWC is released as Free Software unless circumstances dictate otherwise. The FSIU gives us the capacity to experiment with Web 2.0 technologies within our own e-learning platform, and also makes it possible for us to innovate in areas from postgraduate studies to management information systems. URL — <a href="http://fsiu.uwc.ac.za">http://fsiu.uwc.ac.za</a></p>
<p>E-Learning strategy</p>	<p>The e-learning strategy is aimed at laying the foundation of using technology to improve the quality of teaching-and-learning. An E-Learning Division was created to drive its implementation within the University. URL — <a href="http://elearn.uwc.ac.za">http://elearn.uwc.ac.za</a></p>
<p>Free Content/Free and Open Courseware project</p>	<p>A free content/free and open courseware strategy was approved in late 2005 by Senate and Council, and is in the process of being operationalized. A manager has been appointed to carry this out, and is working with the FSIU internship programme to create the necessary software tools and services. The project will begin integrating with the academic programme at the start of the next Academic year in February 2007. URL — <a href="http://freecourseware.uwc.ac.za/">http://freecourseware.uwc.ac.za/</a> (this site is currently being developed and may not be fully setup by the time you read this)</p>
<p>The NetTel@Africa programme</p>	<p>NetTel@Africa is a network for capacity building in ICT Policy and Regulation. It consists of four components: eLearning Programme in ICT Policy and Regulation; Peer-to-Peer Network (P2P); Community-to-Community Programme for ICT applications (C2C); and, Research Programme. The e-learning Masters and Diploma programme is jointly developed and collaboratively taught by around 20 African universities. NetTel@Africa is offering a synergistic programme that could not be done without collaboration. URL — <a href="http://www.nettelafrika.org">http://www.nettelafrika.org</a>, <a href="http://kng.nettelafrika.org">http://kng.nettelafrika.org</a></p>

<p>HP Digital Publishing Grant: Creating a rip-mix and burn culture to enhance teaching and learning in a higher education institution serving primarily economically deprived students</p>	<p>Students and educators can create digital materials for learning, where they can explore the cutting edge of display and print materials, and where Multiple Media Publication can be explored. The project also uses a multimedia wiki that is fully integrated with the e-learning environment, and within which wiki pages can be combined in different ways to create wikibooks. This is just one example of use, others will emerge as the project develops.</p> <p>We are also working with a donor to put together a rip-mix-burn project aimed at creating a proof of concept for student remix in education. The project is not yet funded, but is expected to begin operation at the beginning of the next academic year pending the outcome of the funding proposal.</p> <p>URL — The project is not yet up and running as the facilities for it are under construction. Information will be available on the Free Courseware site at <a href="http://freecourseware.uwc.ac.za">http://freecourseware.uwc.ac.za</a></p>
<p>Services Oriented Architecture</p>	<p>UWC is currently in the process of implementing a services-oriented architecture (SOA). The SOA is being implemented with the <i>Chisimba</i> application framework that is also being used for e-learning and other systems. This aligns business process with IT systems in an agile way, and allows for the creation of flexible administrative arrangements that can cater for the more diffuse nature of Education 3.0</p>

The most important work that we are currently involved in with respect to Education 3.0 is probably what is happening in the Free Software Innovation Unit and the African Virtual Open Initiatives and Resources project. There we have a team of people who have created an e-learning application that is designed to enable Education 1.0, to include capabilities for Education 2.0, and to allow for experimentation in Education 3.0. Furthermore, the *Chisimba* framework on which this application is built is being used to build numerous other applications, all of which can interface and blend seamlessly into the e-learning domain.

We would be hard pressed to claim that anyone in the institution is even aware of the potential of Education 3.0, or that more than a few are even aware of Education 2.0. However, these strategies, projects and programmes can become the building blocks of a strong potential to lead in Education 3.0 in Africa. To do so, however, will require someone to endure the pain and pleasure of driving institutional change.

Some of these building blocks, or complementary ones, exist in other institutions around Africa. If we can create these change agents, the building blocks could be assembled in such a way that Africa leads in Education 3.0 for Africa's development. We can only achieve this by a massive, continent-wide commitment to collaboration in this space. We present a short story, in African

story-telling tradition, to illustrate what Education 3.0 might mean for Africa and other areas of the developing world.



## A short story from Education 3.0

*This story is a work of fiction. None of the characters or events have happened. Its purpose is to convey in story form how one example Education 3.0 might unfold. Where real institutional names are used it is to create a sense of reality, it does not imply any endorsement or otherwise of the ideas presented here by those institutions.*

As an assignment in his English class at UWC, Vusi has to create a visual poem. He finds a piece from Carol in California that contains the line “the mountain leers down, indifferent to the lives passed its shadow” and it is licensed with a Creative Commons Attribution-ShareAlike license. He bookmark’s Carol’s page on del.icio.us [6] and discovers that about 40 other del.icio.us users have also bookmarked it, including another English student at a neighboring university with the comment “reminds me of Cape Town”.

This gives Vusi the idea to combine photographs of poverty in Cape Town with a poem based on the idea expressed with an entirely different basis in Carole’s poem, and use Carole’s entire poem with pictures. But where to find the pictures in the time available to him? He searches on a few archives, and finds some images with a Creative Commons Attribution-ShareAlike license on Flickr [7].

Vusi is sure to give attribution to all sources of the materials that he has used as required by the license and common academic practice. His lecturer looks at the materials, assesses the creativity and evidence of understanding key elements of the work, and gives Vusi an “A” grade.

Vusi posts his work on the UWC Free Content site, and it is quickly syndicated on other Free Content sites around the world via open standards implemented mainly through Free Software systems in different institutions. Chippo is studying music in Zimbabwe, and picks up Vusi’s poem from the University of Zimbabwe Free Content site, and sets it to music as an assignment in one of her undergraduate courses. and posts her music sheets and a recording of her singing it on a Free Content site.

Fatima is doing film and media studies at UWC and Chanda is doing music in Zambia. They come to know about one another through the FOAF capabilities of the *Chisimba*-based version of the KEWL e-learning platform. After spending a bit of time in a video chat using KEWL’s realtime tools, they decided to collaborate to do a music video that also makes use of video footage depicting poverty in other parts of the world. Using only Creative Commons Attribution-ShareAlike licensed clips, they also release their work under the same license.

As a result of their work, they not only get good grades, they show their production in the student centre on Friday night and contribute half of the entry fee to a new project that is creating technology-based income generation opportunities in poor communities.

Thanks to Technorati links to a blog by John Hibbs, the *Good Old New Media Company* pick it up and broadcast it on their TV channel, donating a portion of the advertising proceeds to the media studies department.

Moses Torres is a student at Aklan State University (ASU) in the Philippines, and he decided that he would use some of the work of Vusi, Fatima and Chanda to create a multimedia tutorial on sustainable livelihoods. He is particularly interested in the potential role of science and technology research and how it has combined with rural entrepreneurship and government policy to enable the Pina industry in Kalibo to prosper and create livelihood opportunities. He believes this could be a model for tackling poverty in other areas where unidentified resources await the local communities.

Inspired by the tutorial work, upon graduation from ASU he proceeds to carry out an excellent piece of research, and through various online sources he gets connected to a community of practice studying similar sustainable livelihoods initiatives. One of those diffuse communities of practice has a node hosted by UWC's Programme on Land and Agrarian Studies (PLAAS), giving Moses a second taste of UWC. Upon learning about UWC's expanded ROLA (recognition of learning achieved) opportunities, he submits his work to UWC for accreditation. All processes happen via electronic means, including interviews and presentation of his lifelong portfolio via the KEWL e-portfolio system, and Moses graduates from UWC without ever leaving Kalibo. Moreover, his work is recognized by ASU, and he is offered a job in the Centre for Entrepreneurship Studies.

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This story fictionalizes some instances of international, cross cultural collaboration, but it is driven entirely by the students. However, institutional processes of teaching-and-learning and assessment allow for, or even promote this kind of collaboration. This is not the only way Education 3.0 could be manifest. Another is access to courses in one institution by students in another, obtaining credit from the home institution. Other permutations and combinations are possible. The point of this paper is that institutions can make choices now to shape how education 3.0 unfolds, and the impact that it has on the future of knowledge and learning. 

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## Notes

1. Further information about Web 2.0 can be found on Wikipedia ([http://en.wikipedia.org/wiki/Web\\_2.0](http://en.wikipedia.org/wiki/Web_2.0)), which includes a good image of its memes constructed by Markus Angermeier in November, 2005 from an article by O'Reilly (2005).
2. The tipping point and the s-shaped diffusion curve go back to Everett M. Rogers (1983) who describes the factors that determine the shape of diffusion, including communication channels, time, and the social system within which an innovation is diffused.
3. The term 'free software' is used here to refer to what is often called 'open source', a similar concept differing in some philosophical elements.
4. Lawrence Lessig first used this line from an Apple Computer commercial to explain how technology and the law offer tremendous opportunities for ordinary people (students in our case) to become creators. He argued that the ability to copy ("rip"), modify/improve ("mix") and pass it on to others ("burn" on CD) was essential for the development of human culture and society.
5. *Chisimba* is the pole framework used in the construction of a traditional African house.

6. e.g. <http://del.icio.us/dkeats>.

7. e.g. <http://www.flickr.com/photos/dkeats>.

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