Can Educational Technology be defined from South African university facilitators’ understanding…?

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Abstract
This article presents an interpretive case study of university facilitators who reflected on their understanding of Educational Technology at a South African university. Educational Technology is about teaching/learning resources which are divided into Technology in Education (hard-ware and soft-ware) and Technology of Education (ideological-ware resources) that are used in education to organise Teaching/Learning Signals. The aim of the study was to explore the facilitators’ understanding of Educational Technology and also give voice to their perceptions. The study used an email to involve all the sixty facilitators from the school of education in answering research question one. One-on-one semi-structured interviews and focus group discussion for data generation were conducted with six facilitators that were purposively selected for the in-depth data needed to answer research question two of this study. Purposive sampling together with convenience sampling was used in selecting the six facilitators from the School of Education, one facilitator from each of the school’s six departments. Guided analysis was used and generated four themes for data analysis framed by Teaching/Learning Signals, Technology of Education and Technology in Education. The main findings of this study indicate that the facilitators did not understand Educational Technology. This article consequently recommends the promotion of the proposed definition of Educational Technology in order to sustain Educational Technology as the discipline that generates theories that underpin the integration of different resources in education or curriculum.

Keywords: Awareness, Teaching/Learning resource, Teaching/Learning Signal, Technology of Education, Technology in Education.

Introduction
Educational Technology (ET) was initially perceived as the use of audio-visual aids in teaching and learning. At the time Audio-Visual Education was the most suitable name for this field until the introduction of Instructional Technology (United State of America with other countries that supported this name) and Educational Technology (United Kingdom with other countries that supported this name) (Amiel & Reeves, 2008). Today with the explosion of Web 2.0 technology, a massive increase in global population and the scarcity of teaching/learning/research resources, ET appears to need a definition that suggests a framework that positions all the new technologies on contextual educational goals (Bansilal, 2015). Such framework should open/create opportunities for the members of the population who are far from educational institutions and address the scarcity of the teaching/learning resources (Khoza, 2015b). In other words, resources should be framed in such a way that they help educational institutions to spread education to people in every corner of the world.

In 2009 some South African universities unsuccessfully tried to respond to this situation by advertising Educational Technology posts. The universities that tried and failed to recruit the qualified Educational Technologists were University of Zululand, University of KwaZulu-Natal and others. As a result, when these universities integrated any new technology in teaching/learning process they used technicians instead of Educational Technologists. Learning Management System (LMS) was one of the technologies that were being integrated by the technicians even though they had at least one Educational Technologist within the institutions who could help them to integrate education and technology into one effective unit that could promote a good teaching/learning environment (Amory, 2012; Khoza, 2015a).
After the universities failed to recruit they combined Educational Technology discipline with other disciplines. The theorising process of integration was then given to the technicians. These technicians find themselves in difficult situations because they were not trained in the integration process of technology and education (Khoza, 2015e). The process tended to promote computer technology at the expense of education, as if learning was about technology (Amory, 2010).

However, the University of Cape Town, University of Witwatersrand, Cape Peninsula University of Technology, Durban University of Technology (DUT), Tsana University of Technology and others managed to keep Educational Technology as the independent disciplines/centres of excellence, where they theorise and practise the effective integration of any new required technology with education to form one unit that may help them in achieving educational goals (Czerniewicz & Brown, 2014). The centres were led by experienced Educational Technologists that helped staff members to incorporate relevant technologies in their education (Ngubane-Mokiwa, 2013).

Therefore, this suggests that the integration of technology in education should be facilitated by Educational Technologists who will be able to bring relevant theories and practices. It is for these reasons that the next section defines ET and also discusses the three important issues that unpack Educational Technology (Berkvens, van den Akker, & Brugman, 2014; Khoza, 2015c; Ngubane-Mokiwa, 2014).

**Literature review**

This article defines Educational Technology (ET) as a discipline/field of study that deals with the application of both Technology in Education (TIE) and Technology of Education (TOE) (Percival & Ellington, 1988) as required by curricular spider web (Berkvens et al., 2014) or Teaching/Learning Signal (T/LS) (Khoza, 2015e) with an aim of improving teaching/learning situations (Mulay & Chaudhary, 2006). TIE and TOE are the main two components of ET which frame teaching/learning resources into two main categories (Percival & Ellington, 1988) which are required by curricular spider web or teaching/learning signals. A resource in this context is “any person or thing that communicates learning” (Khoza, 2015c). TIE is any teaching/learning resource that one can see and touch (Ngubane-Mokiwa, 2013). TOE is any teaching/learning resource that one cannot see and touch (Khoza & Manik, 2015). T/LS is any of the concepts of education that constitute teaching/learning (Khoza, 2015c).

Technology in Education (TIE) is further divided into hardware and software (Percival & Ellington, 1988). Hardware is any machine or tool used in teaching and learning (e.g. overhead projectors, video cassette players, radio cassette players, desktop computers, laptops, smart-boards, mobile phones, library, classroom and others). Software is any material that is produced in order for the hard-ware to display information or communicate learning (e.g. overhead Projector transparencies, computer application software, YouTube, blogs, Facebook, Learning Management System, Skype, library/online books/articles and others) (Khoza, 2015a).

Technology of Education (TOE) (Percival & Ellington, 1988) has only one component known as ideological-ware (IW) (Khoza, 2015c) or technologies of self (Foucault, 2007) (e.g. teaching/learning strategies, theories of teaching/learning, research findings, facilitators’ experiences, facilitator’s competencies, time, everyday/general knowledge, school/scientific knowledge and others). Educational processes appear to be demanding a third category of ET that was occupied by the systems approach (Hogan & Pressley, 1997) before it fell under the
wing of TOE as one of the TOE theories. This third category needs to be redefined as the Teaching/Learning Signal (T/LS) (Khoza, 2015e) which should consist of rationale, content, context (which brings space and time), goals, teaching/learning activities, assessment (evaluation), learners and teachers (Figure 1). Figure 1 shows the three main components of ET (TIE, TOE and T/LS) (Khoza, 2015e; Percival & Ellington, 1988).

Berkvens et al. (2014) and Khoza (2015e) indicated that the issues that constitute teaching/learning have to be grouped together to form a curricular spider web or T/LSs. This suggests that the teaching/learning environment has to start by defining or understanding each of the teaching/learning signals as shown in Figure 1. Once one defines or understands the teaching/learning course rationale, content, context, activities, assessment, type of learners, type of teachers for the course, teaching aims, teaching objectives and learning outcomes one stands a better chance to identify relevant TOE (IW) resources for the course (Czerniewicz & Brown, 2014). This then leads to the incorporation of relevant TIE (HW/SW). IW resources are closer to the T/LSs because they also cannot be seen and touched in a similar way as the T/LSs and sometimes they are not separable from the T/LSs (Khoza, 2015d). In Figure 1 TOE/IW resources are inside the area of the T/LSs because they are closer to each other and it becomes impossible to teach/learn successfully without applying any IW resources because they are the ones that organise the T/LSs and identify any relevant HW/SW resource. HW/SW resources are outside the area of education because they are only included in the teaching/learning environment if they are required by the T/LSs through the IW resource. Most of these HW/SW resources were not created by education sector but they are coming from other sectors whose initial goals were to serve those sectors. For example, the internet became the most popular tool used by every organisation/sector in the world but it was intended solely for the US Department of Defence research project (Mowery & Simcoe, 2002). Education takes advantage of these innovations from other sectors which then force the education sectors to have well trained Educational Technologists to adjust HW/SW resources to suite the changing educational processes. Another example is the popular overhead projector (OHP) which also came from the same Department of Defence and was adopted by the education sector. This indicates that teaching/learning is not about HW/SW resources but is, instead, about IW resources (Khoza, 2015c) because the IW resources
organise the T/LSs and identify any required HW/SW resource (Khoza, 2015e). In other words education processes start with IW resources that organise T/LSs in order to identify relevant TIE (HW/SW) resources.

The rationale for teaching a course is very important because it produces relevant teaching goals (aims/objectives and learning outcomes) of the course. Aims are general statements, which are generated according to the teachers’ intentions (e.g. to introduce students to... or to make students aware of...); while objectives are specific statements (e.g. to understand or know...); that are also generated according to the teachers’ intentions (Donnelly & Fitzmaurice, 2005). On the other hand, learning outcomes are also specific statements (e.g. to define, explain, criticise, draw, ask...) but they are addressed in terms of students’ performance when students perform according to the relevant learning outcomes’ keywords. Harden (2002, p. 153), further suggests that learning outcomes should cover a range of competences that challenge students to apply what they are learning in their professions (context based). These competences should be applicable in three categories of learning. Category one is what is expected of a student in his or her profession in terms of technical competences (HW/SW or “doing the right thing”). Category two is how their courses are being approached in their profession (IW or “doing the thing right”). Category three involves students’ on-going development in their professions (Facilitator’s duties or professional competences – “the right person doing it”). This means that learning outcomes should drive any course design in order to give students the right direction in learning. These issues should be explained to the students in advance so that students can work hard to achieve the outcomes, while the teachers work hard to achieve the aims and objectives.

Activities are divided into teachers’ activities and learners’ activities. In other words these are teachers’ role and students’ role that need to be carefully defined and understood before teaching/learning processes take place (Reeves, Herrington, & Oliver, 2004). These defining or understanding processes of the activities/roles should be based on the teachers’ qualities and students’ qualities (e.g. who is the ideal teacher to facilitate learning in this environment? Who are the ideal students to learn under this environment or context?). After understanding all the above issues the processes lead themselves to the identification of relevant assessment processes.

Assessment in education is the process which assesses students ‘for learning’ (formative assessment) curriculum/content; assesses students ‘of learning’ (summative assessment) curriculum/content; and assesses students to become assessors themselves (assessment as learning) (Bailey & Garner, 2010). Formative assessment is the process of learning when students are assessed for their collection and processing of relevant information (Khoza, 2015c). This indicates to teachers/facilitators where their support is required without necessarily grading students (it usually takes place during the learning processes) (Harden, 2002). When students use hardware/software resources, they seem to enjoy them and they easily become a habit once they get used to them (Czerniewicz & Brown, 2014). It then becomes easy to make mistakes and the grading can lead to the failure of students (Khoza & Manik, 2015). It is then important for the facilitators to always introduce new activities that force the students to be aware of what they are doing at all times and avoid habits in learning (Khoza, 2015c). Summative assessment is a summary of formative assessment of their students’ achievements of learning outcomes where facilitators are grading their students (it usually takes place at the end of learning processes) (Harden, 2002). Assessment as learning is the process where both the facilitators and students develop relevant knowledge/skills in assessment which usually come in the form of peer assessment for the students and course
evaluation for the facilitators (Kennedy, Judd, Dalgarno, & Waycott, 2010). This suggests that facilitators should start their facilitation process by teaching ‘awareness’ so that their students would be aware of what is happening around their learning processes and be able to exploit all learning opportunities that are presented by the process and avoid habit (noise) (Khoza, 2015c).

Today, the Educational Technology environments seem to have ‘noise’ (attractive things that have nothing to do with teaching/learning) that mostly comes from HW/SW resources (Kennedy et al., 2010; Khoza, 2015e). When students come to universities they become exposed to different new attractive digital technology (HW/SW) such as face-book, tablets, YouTube, Skype, twitter, blogs and others, where they end up losing the Teaching/Learning Signals (T/LSs) and join the social/entertainment groups which sometimes have nothing to do with their Learning Signals for their specific university courses (Singhal & Rogers, 1999). As a result, they become addicted to these hard-ware (HW) or soft-ware (SW) resources and use general (everyday) knowledge in learning instead of school (scientific) knowledge (Bernstein, 1999; Khoza, 2015d).

Hoadley and Jansen (2014), argue general knowledge is usually unplanned and is a learned anywhere. Bernstein (1999), argues that everyday knowledge usually comes either from overheard social conversations or different hard-ware/soft-ware resources. It is usually based on people’s opinions within a particular local context, which makes it impossible to be repeated because it usually comes in the form of oral information (Freire, 1993). On the other hand, school knowledge is specific to each field of study (Tyler, 2013). This suggests that it is formally learnt according to different fields of study.

**Research Objective and Research Questions**

Therefore, this article intended to explore facilitators’ understanding of Educational Technology in order to understand and define educational technology. This article may help higher education institutions to answer the question of ‘why do facilitators understand Educational Technology in a particular way?’ The data production was organised to respond to the following research questions:

- What is the facilitators’ understanding of Educational Technology at a South African university?
- What are the facilitators’ explanations of understanding Educational Technology in particular ways?

**Research Design and Methodology**

This study followed the interpretive qualitative case study of six South African university facilitators from one university with many departments/schools. However, the study started with sixty facilitators from the School of Education which is divided into six departments. Qualitative case study is important for this study because it is more descriptive, holistic, explorative and contextual in its design and aims to produce rich description of explored phenomena (Creswell, 2014). For this study, qualitative case study has helped to understand the deeper meaning of the facilitators’ understanding of Educational Technology because it is important at higher education level (Clare & Sivil, 2014).

**Sampling**

Purposive sampling was used in selecting all the sixty facilitators from the university’s School of Education to answer the first research question through an email which was sent to all of them with only one question (what is your understanding of Educational Technology or
what is Educational Technology?). The second research question, which looked for the in-depth description of the facilitators’ explanations of understanding Educational Technology in particular ways, was answered by only the six most accessible facilitators, one from each of the six School of Education’s departments through semi-structured interviews and focus group semi-structured discussion. The six facilitators all represented their departments in the university Technology Integration Committee (Convenience sampling). The six facilitator’s names were not revealed because of ethical considerations as suggested by Creswell (2014). Informed consent and ethical considerations were acquired in terms of confidentiality, voluntary participation, benefit and anonymity. In this study they will be referred to as Participant 1, 2, 3, 4, 5 and 6.

**Data generation/production and analysis**
Methods used in this study for data generation/production were: email for the sixty facilitators to answer the first research question; semi-structured interview and semi-structured focus group discussion for the six facilitators to answer the second research question. The email was administered once and both the interviews and discussions were each administered twice and were about thirty minutes long. The three sources of data were used for the purpose of enhancing trustworthiness validity of data (Clark, 2000) and achieving measures of trustworthiness (Krefting, 1991). Audio-tape was used to record the interviews for ease transcription. This was done to verify that the data gathered was consistent across the three sources of data, that triangulation, transferability, dependability, confirmability and credibility were supported and to ensure trustworthiness of the findings.

In terms of data analysis this study used guided analysis where researchers have categories that can be modified through interaction with data (Samuel, 2009). The findings are exploratory in nature; four themes with categories were generated from the data and ET components.

**Findings**
Table 1 of findings is presented to answer the first research question and narrative stories (mostly by means of direct quotations to answer the research questions to enhance trustworthiness) for each of the six participants followed by discussion of findings under the four themes and substantiated with discussions to re-contextualise them with relevant literature.

<table>
<thead>
<tr>
<th>Definitions from the facilitators</th>
<th>Number of Responses (N=60)</th>
</tr>
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<tbody>
<tr>
<td>Audio-visual aids</td>
<td>07</td>
</tr>
<tr>
<td>Technology Education</td>
<td>19</td>
</tr>
<tr>
<td>Computer technology</td>
<td>18</td>
</tr>
<tr>
<td>Internet</td>
<td>03</td>
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<tr>
<td>Internet in teaching/learning</td>
<td>02</td>
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<tr>
<td>Teaching/learning from technology</td>
<td>02</td>
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<tr>
<td>Technical resources for teaching/learning</td>
<td>01</td>
</tr>
<tr>
<td>Teaching aids or equipment/materials</td>
<td>03</td>
</tr>
<tr>
<td>ICT</td>
<td>05</td>
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</tbody>
</table>

**Findings generated by the semi-structured interview and focus group discussion**
**Participant 1**: ‘I responded to the email question by defining Educational Technology as Technology Education because it is only about applying technology in education... In my
modules I sometimes use MOODLE... I attended three workshops on MOODLE and they were all conducted by our university administrators. I do not think that Educational Technology is a field of study because anyone can use technology in teaching without any formal training... People should use and enjoy technology freely to communicate with friends whenever they feel the need in their activities... The moment you talk about theories you start to push people away... To access technology I use my university computer and my phone (BlackBerry) and I do not think I need more than this because I even access online library books using these two machines...

Participant 2: ‘I define it as audio-visual aids used in teaching because it is about what we use in teaching to help our students to understand the module content... it cannot be a field of study but it can only be a short course where people learn new technology for teaching... I do not use online teaching but to access my email, what’s up and Face-book I use my university office computer and my Tablet phone... but I do not use the online in my teaching because I enjoy the use of basic teaching aids of which others are easily accessible from the library for both facilitators and students... I did ET in my B.Ed honours where I could remember these concepts of Technology in Education, Technology of Education and systemic approach but I did not understand them because it was a short course in AV [audio-visual]... I think education deal with fundamental issues of life that include curriculum delivery, achievement of objectives or outcomes, asking students some questions, answering to students’ questions and assessment of students’

Participant 3: ‘Educational Technology is the use of internet and other computer applications in teaching or learning to interact with content and assessment strategies and other activities... I use my Tablet phone together with my office computer to access my email, Face book and online discussion forum with limited use of the library resources because I do not have much time for the library because my Tablet phone has enough space to download information from many sources. The only online tool I use in teaching is Discussion forum... I enjoy these online system without any formal training although I attended three presentations on MOODLE which I found them not useful for me because they were more on designing websites and not much on designing an effective teaching or learning platform...

Participant 4: ‘It is the use of computer technology or ICT in teaching and learning... I do not think it is different from computer studies... It should be using computer science theories to underpin technologies in teaching... Theories like connectivism, activity theory, constructivism, actor network theory... are useful in teaching using technology... but I use systems approach in teaching information system... I use Face book, twitter, YouTube, blogs, Skype and Whatsapp for entertainment or social... I only use online sources which I access them using my office computer, personal laptop, iPad...’

Participant 5: ‘It is defined as the teaching aids for presenting the content to students... it is not a field of study on its own because all teachers learn about teaching aids in their degrees... New technology in teaching does not need training because it is interesting everyone enjoys it... I have just change my iPad to Tablet because I want to continue to enjoy the latest technologies but I do not use these technologies for teaching because students do not afford...’

Participant 6: ‘...for me it is about technology of technical education or equipment and materials which can include the latest technology used in teaching... It should not be separated from technical or technology education or even computer studies...’
Discussion of findings

Theme one: Email responses in Table 1

The results in Table 1 indicate that the participants only understood Educational Technology under one category (TIE or HW/SW) of the three categories that are presented in Figure 1. Nineteen of the sixty participants which is the majority define Educational Technology (ET) as Technology Education. Technology Education (TE) is learning about technology (HW/SW) but not learning how to apply the technology in education with an aim of improving teaching/learning environment like ET. TE involves learning about technology in a general sense not specifically for education.

Eighteen of the sixty facilitators defined ET as Computer Technology (CT). CT is about learning how to build computers and use programming languages unlike ET which moves beyond computers. Seven of the sixty define ET as audio-visual aids which suggests that they define it as TIE (HW/SW) which considers only one component of ET.

Five of the sixty defined it as Information and Communication Technology (ICT) which is also a TIE (HW/SW) resource. Other definitions defined ET as Internet, Internet in teaching/learning, teaching/learning from technology, technical resources for teaching/learning and teaching aids or equipment/materials which suggest that they are all pointing at the TIE division of ET.

Theme two: Technology in Education (TIE)

The findings suggest that the participants define Educational Technology as Technology in Education in terms of the following hard-ware (HW) and soft-ware (SW):

**HW** – Audio-visual/ICT tools/machines, computer, laptop, iPad, Tablets, desktop, mobile (blackberry) and library.

**SW** – Face-book, discussion forum, Tablet software/application, iPad software/application, blogs, YouTube, twitter, Whatsapp, MOODLE and Skype.

Although these facilitators did not understand the main concepts of Educational Technology (ET) as a field of study, their definitions appear to describe only one concept of ET which is Technology in Education (TIE). TIE resources appear to be outside the compulsory issues of education (T/LSs) as shown in Figure 1 because they are not always compulsory in the teaching/learning environment. For example, if facilitators want to tell their students a story in their classrooms they may not need any TIE resource because their proximity allows them just to verbally convey the story by talking to students, but if they are at a distance it may be compulsory for them to use TIE resources like email, mobile phones or other relevant resources. It may be compulsory for Participant 4 to apply TIE resources because she had more than 200 students. According to Amory (2010, 2012), if education is determined or driven by technology it means that students learn from technology instead of learning with technology. This should be avoided because it indicates that learning is about technology and no longer about ideology. Ideology is what constitutes the Technology of Education resources that organise the Teaching/Learning Signals (T/LSs).

Theme three: Technology of Education

The findings suggest that the participants involve the following ideological-ware (IW) in their practical definition of Educational Technology:
**IW** – Constructivism, system/systemic approach, connectivism, Activity Theory, question-answer method, technology language and Actor Network Theory.

Even though the facilitators were not aware of Technology of Education in their definitions, they used it because of the above Technology of Education (TOE) (IW) resources. As a result, they defined ET as the HW/SW resources because they were not aware of IW resources. Teaching/learning is about applying IW resources by organising both relevant T/LSs and TIE (HW/SW) resources to produce effective teaching/learning environments. This suggests that teaching/learning may not take place in the absence of IW resources. For example, it facilitators have to teach their courses they apply certain theories from their experiences which may be teacher-centred or learner-centred or a combination of the two or any other approach. According to Hoadley and Jansen (2014), there are three approaches in which facilitators choose from in order to ground their teaching. The three approaches are Ralph Tyler’s objectives approach (Tyler, 2013), Lawrence Stenhouse’s process approach (Stenhouse, 1975) and Paulo Freire’s critical approach (Freire, 1993).

Tyler’s objectives approach is driven by objectives that need to be defined or identified before any teaching takes place (Tyler, 2013). The defined/identified objectives should be followed by content, teaching activities and then assessment strategies. This approach favours the teacher-centred approach and tends to promote passive students who do not question their teachers in most cases (Khoza, 2015d).

Stenhouse’s process approach favours the learner-centred approach as it starts the teaching process by identifying students’ learning activities in order to drive a lesson (Stenhouse, 1979). In this approach students learn through their activities that are facilitated by their facilitators.

Freire’s critical approach is guided by values and question of power content based on key themes from students’ lives (Freire, 1993). It aims at promoting active and critical students who are exposed in a political empowerment curriculum.

**Theme four: Teaching/Learning Signals (T/LSs)**
The findings suggest that other facilitators were aware of some of the T/LSs such as the content, objectives, outcomes and assessment. Although they were not aware of the difference between the teaching objectives and learning outcomes but in practice they seem to involve the identification of certain T/LSs. The choice to choose the Teaching/Learning Signals (T/LSs) depends on the facilitators’ experiences and competences (Khoza, 2015e). For example, if teachers expect passive students they may use Tyler’s approach where they may start their lesson planning with aims together with objectives, course content, teaching activities and assessment together with evaluation. If facilitators like active students they may use Stenhouse’s process approach by starting the planning with learning activities together with definition of learners’ qualities before any other signal. For questioning students, facilitators may choose Freire’s approach which deals with teaching for political empowerment and power.

**Conclusion**
In conclusion this article is starting a debate/discourse by challenging all Educational Technology definitions that exclude any of the three ET components/concepts (as shown in Figure 1). It may be observed from this study that the teaching/learning process should always start with TOE/IW followed by T/LSs (to be organised by TOE/IW) and then TIE
(HW & SW). This definition may help by bringing back all the parts of Educational Technology that seem to be missing because of the new attractive technology (TIE resources). The definition emphasizes the important of TOE (IW) resources and T/LSs more than TIE (HW/SW) resources in any teaching/learning environment. Therefore, defining Educational Technology from the participants’ understanding may not help education because it is dominated by Technology in Education (TIE) also known hard-ware (HW)/soft-ware (SW) resources and exclude Technology of Education (TOE)/ideological-ware (IW) resources.

**Recommendations**

Therefore, this article recommends that Educational Technology (ET) should be defined as a field of study that uses Technology of Education (TOE) (Ideological-ware – IW) resources to organise Teaching/Learning Signals (T/LSs) and identify relevant Technology in Education (TIE) (hard-ware – HW & soft-ware – SW) resources for teaching/learning environments in order to improve teaching/learning processes. This definition may help in producing a new understanding for the digital age that frames education together with technology to form one teaching/learning process.

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