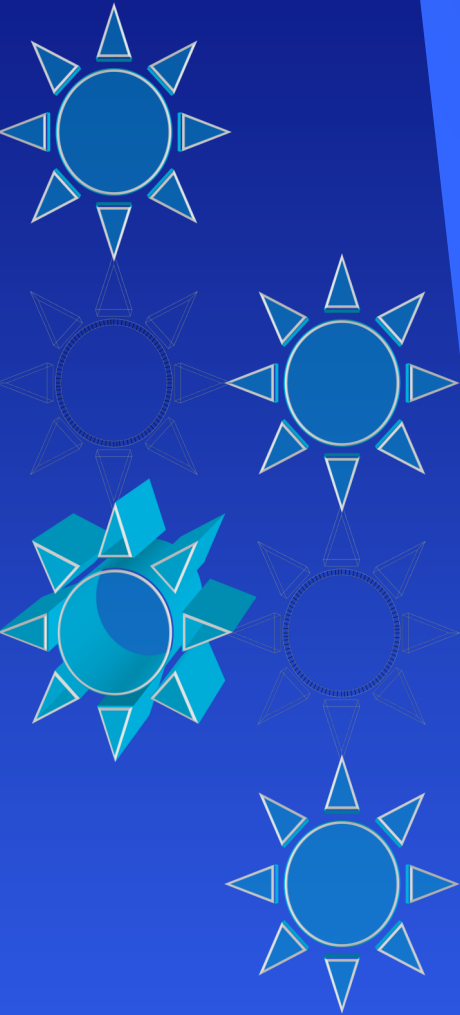


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Challenges for Online Learning and Teaching: A Subjective Academic Narrative

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Abstract: The subject of this paper concerns my reflections upon postgraduate and undergraduate online teaching from 1995 to 2014. At the heart of this paper lies a mystory (Ulmer, 1985) about the pleasure of teaching and the transference of that pleasure from face to face to e-teaching. In this paper, I consider scholarship in online learning and teaching and the early adoption of e-learning and e-teaching. I go on to present a snapshot of asynchronous e-learning and teaching, to look at e-models and e-methods. In critiquing intransigent templates, I refer critically to the work of Gilly Salmon, and propose that the quality of the academic input is the most important element in any e-curricula. Methodologically, I describe this as a subjective academic narrative, and theoretically I place it within narrative qualitative discourses. The brave new world of online teaching has become somewhat tattered as the time has progressed from the heady days of the 1990's when anything seemed possible and a pedagogical revolution seemed certain. Today, those dynamic possibilities are in danger of being replaced by the realities of budgets, of a determination to remain on the campus, and by a distinct feeling that online teaching and learning may be being evaluated and even actually developing as a second rate pedagogy. Unfortunately, some of it is. One way to challenge any second rate online offerings is to submit them to traditional academic guidelines for best practice. Certainly, they should at least meet the bottom line and at best extend it. This paper contributes to this scholarship.

Keywords: online teaching; asynchronous; narrative methodology

Introduction: Scholarship in online learning and teaching

There is no simple formula for online pedagogy; but much of the expertise that we bring to it from our off line teaching remains strategically relevant. It is important that the academy and academics themselves recognise this. Just as it's insufficient to simply put text online with perhaps some talking heads, so it is insufficient to remove tried and true pedagogical practices from our curricula developments. Significantly, much more research is needed to 'find out how

students acquire knowledge outside the formal learning environment in order to tailor online learning at universities to their needs and learning styles' (Christie and Jurado, 2009:276). Just as significantly, I believe that much more critical and insightful research is necessary to develop the best online curriculum materials. The move to technological educational opportunities involving a-synchronous chat, discussion forums, peer interactions, twitter, and the use of the rich WWW materials, for example, should not overwhelm the academic scholarship that the University courses should offer for credentialing. This academic scholarship comes from the 2 complementary research activities academics bring to their students. The first is enabling students to understand the germinal, ongoing and latest materials in the subject area, the second is to add to that area by scholarly research activities.

Critics of online learning note too often that it lacks pedagogical soundness:

'Sound pedagogy supported by strong theoretical foundations is of key importance in online learning...critics of online elearning have argued that student interaction and over-all quality of education suffer in this medium...just as in classroom-based courses, online applications need to be informed by strong theoretical foundations in order to ensure educational excellence' (Herie, 2005:29-30). Others suggest it supports communities of practice (Jones et al 2015) and problem-based learning (Herrell 2015; Forret et al 2015). There is much useful discussion about this (Hrastinski 2008; Wang 2003; Welsh et al 2003).

There is a purpose in rejecting template online curriculum deliveries that do not address the above. For example, Pam Moule identifies Salmon's five stage model as becoming a dominant discourse and warns that 'there is a broad concern that the reification of models of learning and teaching, while meeting organisation needs for transferable, multi-use products, will dominate and stifle professional practice development' (2007:39). This concern deepens when academic scholarship is etiolated in the production of knowledge within this environment.

In bringing together the opportunities of internet information and communication to staff and students, we are in a sense acting as library cataloguers of relevant scholarly information in WWW sites, as well as academics bringing our own knowledge and insights about the academic learning materials. We continue, then, to have responsibilities and duties in developing e-curricula to lead students to the construction of their own learning under our aegis.

Further, in bringing online information and communications systems to the students via such curricula development, academics enact pedagogical research based on making their specialist scholarly material accessible and useful to their students. Such pedagogical research relies upon their own scholarship as well as their interpretive and scholarly teaching skills. I call this enabling the students to learn through co-constructing knowledge with them.

It can be seen, then, that academics bring to e-teaching at least the following insights and abilities as academics:

- Read refereed journal articles to update their knowledge areas
- Suggest areas of knowledge
- Bring together disparate materials so as to form a new whole
- Challenge students to extend their knowledge base
- Enable students to question
- Co-construct with students research capacities and abilities
- Select relevant WWW sites
- Develop quizzes, questions, discussion and debate points so as to build students' knowledge further
- Introduce peer interactions without relying on them as replacements for scholarly excellence
- Tease neural pathways from the given to the possible
- Introduce academic /givens' within subject areas and scholarship generally
- Bring together theory and practice
- Initiate into scholarly and professional standards as appropriate and relevant
- Enter into dialogic communications
- Problematize and critique
- Their own original contributions to the privileged academic discourse

These abilities should be valued in all curriculum developments, but most specially in making e-curriculum as it is far too easy to look at online information as replacing individual academics. The abilities of such scholarly specialist teachers means that we are not taking education to the internet, but are bringing it to the students in much the same way as we would not put our students into a library with a booklist and set of questions to talk about with one another.

Developing e-curricula-indeed all curricula-is not for the fainthearted. There are no viable short cuts or templates that replace scholarship from academics. Although templates may be a useful starting point, they are not the endpoint. My knowledge of this comes from over 50 years of teaching, producing and publishing curricula and from being an early adopter, teaching online since 1997. I offer this as a subjective academic narrative building upon narrativity and autoethnography in scholarship (Arnold 2005; 2012;2008; Gallop; Midgely; Ulmer 1985).

Early Adoption of e-learning & teaching

Early adopters became change agents to produce some fascinating insights and capacities. This occurred for me in teaching Media and then Writing at Swinburne Institute of Technology. It also occurred as we offered more and more undergraduate courses through Open Universities Australia's (OUA) online programs. Today my university has many thousand subject enrollees across our online programs delivered through our partners OUA and Swinburne Online (SOL). In 2000 there were 13 online undergraduate students from OUA, by 2010 there were 18,178 OUA students and another cohort from Swinburne direct. In 2006 there were 91 writing students in the MA (Writing), by 2010-12 there were 532 from OUA and another cohort from

Swinburne direct making over 700 subject enrolments per annum. SOL since 2009 has now many thousand students.

As early adoption is not yet hamstrung by 'expert' overviews and/or institutional paradigmatic thinking, our institution gave us a great deal of leeway. This was certainly my experience in undergraduate Media Studies and then the MA (Writing). In developing online Media Studies Units, we were supported by major grants from the then Committee for the Advancement of University Teaching (CAUT) an Australian Federal Government agency. We developed both interactive multimedia game-based lectures and online teaching materials. When the MA (Writing) was called for by our then Deputy Vice Chancellor, I utilised what we had learnt from these projects, and from teaching online subjects in Media Studies, as the basis for the new postgraduate course. This pedagogical innovation stood alone within the university for some time. It involved a number of complementary elements that students could resource a-synchronously:

- the provision of an interactive multi-media game 'G21: Australia's Cultural Dreaming' (Arnold et al 1997-2003)
- dedicated web pages for each subject
- virtual lectures delivered in print enlivened with visual interviews
- weekly questions for discussion with links to relevant expert WWW sites and contacts
- discussion threads as virtual tutorials
- a coffeeshop for students to interact across all subjects
- virtual spaces for students to peer interact with and workshop one another's writing
- An online journal Bukker Tillibul for refereed students and staff publications.

Our basic aim throughout was to provide a high quality e-learning experience through curriculum that utilised the possibilities provided by the e itself. That is, we agreed that the student was always at the centre of the learning process. Taking this as a given, we developed the curriculum in a way that enabled teachers to act as co-constructors of student learning towards a particular goal in a particular subject.

In preparing and delivering this material, we acted in ways that foreshadowed much of what became standard in later e-teaching methodologies, and is recommended by Gilly Salmon in her 'Carpe Diem' and 'Duet' processes (2013). For example:

- We formed a team that included expert online designers and evaluators as well as expert staff who developed curriculum with a view to producing it online in electronic lectures and tutorials.
- We paid particular reference (even reverence) to what facilitated online learning in ways that were different from face to face presentations.
- As a result, we saw that whilst much (too much) of what is on the web is print based, we could bring virtual people in to videos, we could design the screen so that it had its own aesthetics rather than being a tired (exhausted) simulacra for talking heads and receptive (inert) students.
- We were particularly engaged by what we could do with a CDROM for multimedia interactivity that was games-based, and how we could combine this with online delivery spaces where students could practice interactions with the

materials, with one another, and with relevant expert information/opinions/deliveries from selected sites.

- Our designers made programs that facilitated this, as commercial ones were not yet available
- The excitement of a-synchronous deliveries meant that we exploited fully what was different to time and space regulated face to face delivery: an early recognition of the timeless and non-geographic factors of cyberspace
- We recognised the facility for peer interactions within and across subjects particularly in the Master of Arts (Writing)

Inevitably, the broader community of teachers caught up with our early change as electronic learning became quite every day. There was, then, nothing of what Salmon identifies as a reluctance on the part of some university teachers to embrace pedagogical practices and change to online learning and teaching (2002; 2003). Instead, our early adaptation is now being viewed through the prism of social constructivism and Salmon's work is based upon identifying resources and capabilities and developing these further 'through collaborative effort' (Salmon et al, 2008:96). Both of these are compatible as they were considered in the foundation and implementation of this course. Today the MA (Writing) courses have been rewritten but the basic elements of presentation remain somewhat static.

Electronic asynchronous learning and teaching spaces with access to the WWW and its various social media places interest me both practically and theoretically. This intersection of theory and practice is an important one when we are considering the academic discourse and scholarly conversations about the implementation of e-learning and teaching. It is essential that no one method of developing e-curricula dominates, even those methods such as Salmon's that have the best of intentions can far too easily become one size fits all with a concomitant lack of scrutiny to givens. In her challenge to Salmon's domination of e-curriculum models, Pam Moule et al (2010) note that e-learning and teaching was introduced into many UK institutions by:

'local staff champions...these 'champions' were self-motivated individuals with a passion for technology and a range of skills and expertise, generally self-developed, to draw on. The influences wider institutional adoption of new technologies through working to support local staff development and organisational adoption of technology' (13).

They also note that there was a 'recognition of a student demand for technology'. Hence, 'in these institutions a combination of student expectation and 'champion' leadership was driving the development'. Unlike their observations of the UK experience even as late as 2012, the Australian experience has been of a large and quite enthusiastic take up of online teaching and learning since the late 1990's.

The shift to online teaching occurs because it can: but it is also more than this. The zeitgeist is one of technological multi-level experiences almost universally as we live on our iphones, itablets and computer screens. Many of us experience talking to people, or even dining out with them, as they are also multi-tasking on their technological cyberspaces. Charlene Dykman and Charles Davis describe this as a 'huge transition' noting that 'the same networking and computing technology that has revolutionized global commerce and many other

facets of modern life, is now being targeted at education' (1:2008). Yet such a target comes from within accepted everyday practices rather than being imposed from outside, so the universities are responding to the cultural lifestyle demands of their students and staff.

For me, the virtual tutorials and lectures offer an e-version that enhances and extends what can be found on campus for best student learning and life experiences. Marilyn Herie notes that 'the internet has been conceptualised as a medium that shares many of the properties of a physical place', and notes that inserting such 'real world' interpretations into cyberspace builds an understanding of it as having 'characteristics of transportation, communication and storage by combining the learning activities of independent research with collaborative discussions and problem-solving' (2008:33). This has resulted in most material being text based and delivered as it might be in geographic learning classrooms. Thus the term 'learning community' has become common descriptor of online groups to describe a space that is not shared physically, but is shared relationally. The enhancement of on campus geographically defined learning and teaching that is offered online includes immediate access to websites that bring the most diverse expert updated information about the subject. This immediacy is valuable to time poor students. It has revolutionised libraries and the book as so much is now electronically available at a screen touch. It has transcended time and space as I now discuss.

A snapshot of asynchronous eLearning

The capacity for e-teaching and learning to be asynchronous is one of the most valuable components of e-tutorials and for the delivery of e-lecture materials and interactions. In the MA(Writing), we have been delivering an online tutorial/lecture and extended WWW site references course since 2002. This section looks at asynchronous e-tutorials. By recording and analysing the posting times of students, tutors and of student-responses over the first, fifth and tenth week of a 12 week course, I identify the versatility of asynchronous deliveries of e-tutorials. I go on to practise making a narrative from raw data.

There is much debate about how to best utilise the e-delivery of online courses. Some University programs opt for synchronous deliveries which of course demand that students and tutors be available at a specific time and date. Others have a melded delivery that has both synchronous, asynchronous and real-time on-campus elements. This 'blended' learning has, I believe, many real disadvantages for global deliveries. These include the obvious time difference factor as well as the ability of students to learn in their own chosen times. One of the singular features of digital learning opportunities is that students can choose the best times for themselves to enter into virtual lectures, virtual tutorials and online learning programs with digital information links (Zhang et al 2003). They also provide spaces for peer interactions.

Having (as earlier noted) entered this field early by making online curriculum and games-based CDROM materials 'Oz 21: Australian Cultural Dreaming' and "G21 Global Cultural Dreaming', from 1995 to 2009, we identified early that e-deliveries should enhance what we can already do: not replicate the known. We

asked ourselves: ‘what **more** can computers do that face-to-face can’t?’ Today you might think this old-fashioned and even naïve: however, sadly, much e-curriculum delivery has shied away from the possibilities of interactivity, 3-dimensionality, multi-media productions and a-synchronicity to deliver online a replication of written text and talking heads by not asking and addressing this.

My experience agrees with Gurmak Singh et al (2005) that the ‘degree of interaction between lecturers and students is still predominant in eLearning environments’; it adds to this that the formation of learning communities based upon ‘critical friendship’ has been and remains a significant element in our MA(Writing) online course.

This section reports my looking at 3 years (2009-2011) of asynchronous delivery to establish how real time can be successfully replaced by e-time in virtual tutorials delivered via Blackboard discussion threads. It does so by making a narrative from the data provided by student and staff posting times.

To begin this narrative and to collect data, I went to our Blackboard courses and selected 3 different subjects and 3 different tutors to see what times were recorded for their entries into the e-tutorial. Significantly, these responses are not subjective but arise from reading and analysing both lecture materials in print text of between 3-5 thousand words and extended WWW links that are regularly updated. These responses of about 500 words per week are part of student assessment along with responses to at least 2 other students’ postings each week to maintain a learning community that could otherwise be fragmented.

This model of e-tutorial was initially advanced so as to simulate face-to-face tutorials by making a weekly website available that included summary of the cogent discussion point, links to relevant information sites and lecture materials in print. This brought together the elements of people, print and electronic deliveries. For the first eight years (2002-2010) of MA(Writing) it was also extended by a games based interactive CDRom that acted as a model for electronic textuality and discourse. By this I mean that electronic games offer far more ways to develop online discourse than traditional textuality. This includes:

- Multimedia. The possibilities of film, art, design, alone and together are able to be implemented and also explored
- Interactivity: the user is also in charge of the journey in a very direct way so that choices are made and the text is rearranged to choice albeit within a games structure
- Fun: Students are able to play
- Challenge; There are many possibilities and many choices
- Failure as well as success: Often the player is lost and must rearrange their preconceptions
- Choice: the player has a number of possibilities to evaluate

- New visual and verbal possibilities: The lively nature of the screen provides a text unlike any traditional text
- Jumping off points to WWW links: Elements of the full potential of the WWW are made available
- Reference to other e-experiences: games permeate students' lifestyles

Gamesplaying online is a central element of students' lives: in our contemporary e-based society, interactive simulations are a dominant form of leisure. Sara de Freitas and Martin Oliver discuss how this pervasive leisure-based home-based games playing provides a pathway for games based learning to become more wide-spread in e-curricula (2006). 'Games based learning is seen as a highly motivating, engaging form of media and is a rapidly expanding field...applied in a wide variety of different fields' (Hainey et al 2011: 21).

The narrative and the raw data: raw data presents researchers with numerous opportunities. In this case, I have used it to develop and illustrate a narrative about the use of asynchronous online learning spaces. These tables, each of a few weeks of raw data are representative of what I found about the times students and staff chose to enter their electronic communities/classrooms:

Table 1. Subject 1: Week 1

Students' post times	Tutor response times	Students' responses times
1/06/09. 11.54.a.m.	13/06/09 12.13a.m.	06/09 1.17a.m.; 8.15.p.m.; 6.15.p.m.
6/06/09. 1.46.a.m.	13/06/09. 12.13.a.m.	6/06/09. 7.15.p.m.; 8.50.p.m.; 10.30.p.m.
6/06/09. 2.21.p.m.	14/06/09. 10.27.a.m.	9/06/09. 3.29.p.m.
6/06/09. 7.12.p.m.	14/06/09. 10.38..a.m.	6/06/09. 7.42.p.m.; 10.24.p.m.; 10.42.p.m.

Table 2. Subject 1: Week 5.

Students' Post Times	Tutor response times	Students' responses times
3/07/09. 11.15.a.m.	13/09/09. 11.42.p.m.	5/07/09. 10.15.p.m. 6/07/09. 9.39.p.m. 7/07/09. 12.13.p.m.
5/07/09. 10.08.a.m.	13/09/09. 2.41.p.m.	6/07/09 9.57.p.m. 7/07/09. 12.36.p.m.; 2.23.p.m.
5/07/09. 10.46.a.m.	13/09/09. 3.18.p.m.	6/07/09.2.32.p.m. 7/07/09.12.51.p.m.; 4.38.p.m.
6/07/09. 9.17.p.m.	13/09/09. 7.04.p.m.	7/07/09. 1.48.p.m.; 8.25.p.m. 19/07/09. 9.03.p.m.
7/07/09. 9.30.p.m.	13/09/09. 7.17.p.m.	7/07/09.12.22.p.m.; 1.39.p.m.; 2.09.p.m.

Table 3. Subject 1: Week 10.

Students' Post Times	Tutor response times	Students' responses times
9/08/09. 11.25.a.m.	17/08/09. 4.17.p.m.	11/08/09. 3.27.p.m.; 6.59.p.m.9.35.p.m.
10/08/09.12.09.a.m.	17/08/09. 4.26.p.m.	11/08/09. 3.11.p.m; 10.02.p.m.
10/08/09. 8.15.p.m.	17/08/09. 4.39.p.m.	11/08/09. 12.48.p.m.; 3.02.p.m. 12/08/09. 8.18.p.m.
11/08/09. 12.02.p.m.	17/08/09. 7.55.p.m.	11/08/09. 2.44.p.m.; 5.47.p.m.; 7.41.p.m.; 9.49.p.m.; 12.29.p.m. 12/08/09. 8.48.p.m.; 8.50.p.m.
11/08/09. 2.37.p.m.	17/08/09. 8.23.p.m.	12/08/09. 2.25.p.m.; 3.28.p.m.; 8.05.p.m.

The narrative arising from the raw data.

This data tells me that students and staff both fully utilise the time stretch of asynchronous deliveries. The story that data tells is one that can be expressed in many ways within the academy. Increasingly, there is acceptance and use of qualitative methodologies that concentrate upon narrativity as an academic methodology. Storytelling is the most ancient of human discourses. Throughout time all human knowledge, ideas and information have been told as a story. Many such stories have been designated as fictional by Eurowestern knowledge brokers, and this is particularly evidenced in the academy. As such, they have been discredited or even ignored within knowledge structures except as an object of study by credentialed academics. For example, Indigenous Australian beliefs, mores, rules, regulations and societal practices have long been published by white claimants as 'myths and legends'. However, storytelling has now become an acceptable if autoethnographic academic methodology (Ellis 2004) that challenges such scholarly colonisations.

Today much academic writing, particularly in the social sciences, utilises qualitative methodologies and theoretical perspectives replacing more traditional science-based approaches. In stating my own methodological perspectives, I call this methodological approach 'the subjective academic narrative' (Arnold 2010-2012). By this I am signalling that the scholarly conversation about the research topic arises from an individual's experience and hence is involved in that individual's present narrative and arises from their cultural experienced backstory. Hence it is subjective. It also arises from each academic's scholarly training and research, hence it's academic. Finally, it can be seen as the story that the particular academic is telling about her or his observations and experiences, hence it's a narrative.

There are many scholarly reasons for this approach, mostly arising from broadly postmodernist positions that entail a dispersal of certainties. For me, one of the most compelling is a reference to the work of Jacques Derrida who refused to undertake further PhD candidacy as he asked why we should do what has already been done before. He sees Necessity (he gives the noun a capital letter deliberately, of course) as driving us towards 'the risk of never arriving' (1983:37). The personal narrative precludes this stale Enlightenment- driven methodology that may reveal and rearrange the data but also run the risk of never arriving at the dynamic nature of the narrative it reveals. I also see the influence of Roland Barthes, the 'mystory' of Gregory Ulmer, and of Mary Midgley and Jane Gallop, about whom I have regularly written when putting forward my idea of the 'subjective academic narrative' as a scholarly methodology and help us to arrive at rather than to miss out on the narrative (Arnold 2010-2013).

e-Models and e-methods.

The dominance of a single pedagogical model in e-learning and e-teaching curriculum development and presentation is not healthy. Although Salmon's (2003) early adopter's model of a 5 stage approach to e-moderating has successful elements and remains influential, it should be seen as one of many ways to approach e-learning and teaching rather than what Moule describes as becoming a dominant discourse that is overwhelming alternative and perhaps more dynamic possibilities. Other scholars have also critiqued this model showing concern about its apparent intransigence; and its lack of academic input and encouragement for reflective knowledge processes to occur (See Lisewski & Joyce 2003; Turner 2004). Laudrillard also challenges the peer interactions upon which Salmon's model relies, stating that the claims made about them 'rest on the assumption that students learn effectively through discussion and collaboration...However, this is not a well-tested assumption as far as the research literature is concerned' (2002:147). She avers that university curricula, learning and teaching is defined by the quality of its 'academic conversations'. The evidence is that this quality is not adequately addressed by Salmon.

This is a most significant criticism. Peer interactions are a valuable learning tool within a well-directed e-tutorial, but they are not scholarly in themselves. After all, students undertake tertiary education to develop scholarly knowledge. Of course, this is not held by academics alone. The many sources that are available on the WWW vary from the scholarly to the personal: all have values. In credentialing learning, however, the university is offering something other than and more than what can be found in peer interactions. The rich blend that e-curriculum can resource is one that starts with scholarly curriculum development and continues with such oversight, teaching and assessments so as to co-construct student actions and reactions and peer interactions that lead to new scholarly knowledge acquisition.

Conclusion: Quality Academic Curricula

As the popularity of e-courses indicates, students are increasingly time poor, and e-education addresses that problem in new and dynamic ways. Indeed the cover story for the University of Melbourne's magazine in August 2013 tackles 'the brave new world of online universities, and the article 'Coursing Ahead' (9-11) describes how the University has developed its first massive open online course or MOOC. 'With a single keystroke, the University of Melbourne, in its 160th year, launched into a world where all that's needed to access one of its prestigious courses is a computer and a curious mind'. The result was a 'tsunami...over the next few days the number of students downloading the videos and participating in the course swelled to more than 26,000'. The courses, of course, were developed by top academics who had shown themselves as early adopters.

The quality of the academic input should be the basis of all models that are proposed for curriculum development and delivery at any University, for without this there is a stale and non-scholarly dominance of models and methods over content and ideas (Laurillard 2002).

Out online students have repeatedly told us of the importance of being able to access material that is interesting, up to date and that involves regular threads of discussion between peers and tutors. They express the importance of meeting people online just as they do in their everyday interactions with online 'friends'. They come from diverse backgrounds and geographical spaces and find that illuminating too (Clowse & Evans 2003). Today, as Germak Sing, John O'Donohue and Harvey Worton stated in 2005: 'The Internet is a technological development that has the potential to change not only the way society retains and accesses knowledge but also to transform and restructure traditional models of higher education, particularly the delivery and interaction in and with course materials and associated resources'.

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Mapping Preservice Teachers' Metaphors of Teaching and Learning

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Abstract. This study explores preservice teachers' metaphors of teaching and learning. Specifically, it uses social cartography and critical discourse analysis to map the beliefs of 20 preservice teachers at a large urban university. The results suggest a split between those who share positivist metaphors, which depict teaching and learning as a unidirectional process, and those who share constructivist metaphors, which depict teaching and learning as a more dynamic social process. Considering the increasingly diverse population of students in the United States, learner-centered metaphors are framed as the most pedagogically appropriate, and the implications of replacing positivist ways of thinking with more constructivist views are discussed.

Keywords: teacher education; metaphor; social cartography; critical discourse analysis; constructivist pedagogy

Introduction

Metaphor is generally understood as a comparative figure of speech. When Shakespeare's Ophelia compared Hamlet to a rose, for example, she was not only emphasizing his gentleness, she was also alluding to his capacity for violence. For Lakoff and Johnson (1980), however, metaphor is more than just a poetic device. They contend that "metaphor is pervasive in everyday life, not just in language but in thought and action" (p. 3). Because metaphor structures our most basic understanding of experience, allowing us to use what we know to make assumptions about what we do not, it follows that our actions are then mediated by how metaphor allows us to see phenomena from a particular point of view, by how our subconscious assimilates and makes sense of our environment.

Metaphor in Teacher Education Discourse

One of the ways that researchers examine preservice teachers' beliefs is by studying the cognitive devices they use to situate themselves in the profession (Akinoglu, Tatik, & Baykin, 2015; Cameron, 2010; Ersozlu, 2013; Gatti & Catalano, 2015; Olthouse, 2014; Ozdemir & Akkaya, 2013). According to Tobin (1990), who

was among the first to study the link between preservice teachers' metaphors and their beliefs, "teaching can be defined in terms of roles undertaken by teachers. And just as metaphors are at the basis of all (or most) concepts, the metaphors used to make sense of the main teaching roles can be the focus for reflection and change" (p. 125). Similarly, Martínez, Sauleda, and Huber (2001) assert that "metaphors exert powerful influences on processes of analyzing and planning in education" (p. 966). In particular, they find that metaphors can have a profound effect on teachers' thinking, and further suggest that they can be used as a catalyst for a deeper understanding of the profession as a whole.

For Fry and Fleeners (1997), "metaphor offers new perceptions of reality, ultimately the means to communicate beyond the literalness of experience" (p. 27). As a tool for examining the ways in which knowledge is constructed, metaphor can help researchers unpack preservice teachers' latent assumptions and help them reflect on their identities in relation to their students. After all, "a large part of self-understanding is the search for appropriate personal metaphors that make sense of our lives. Self-understanding requires unending negotiation and renegotiation of the meaning of your experiences to yourself," and, in education, this process involves the conscious recognition of and reflection on the metaphors we teach by (Lakoff & Johnson, 1980, p. 233).

Sfard (1998) suggests that because "metaphors bring with them certain well-defined expectations as to the possible features of target concepts, the choice of a metaphor is a highly consequential decision. Different metaphors may lead to different ways of thinking and to different activities" (p. 5). From this perspective, the metaphors that guide preservice teachers' thinking can provide a glimpse of how they intend to situate themselves in the profession, including the approaches they will take to content and the kinds of student-teacher relationships they will attempt to create (Bullough & Gitlin, 1995; Tortop, 2013). More recent research includes Gök and Erdoğan's (2010) metaphor analysis of preservice teachers' perceptions about technology, as well as Pinnegar, Mangelson, Reed, and Groves' (2011) exploration of metaphor plotlines to determine how preservice teachers position themselves in relation not only to their responsibilities in the classroom, but also to the expectations they have for their students.

In general, researchers agree that metaphors are powerful tools for helping preservice teachers reflect on their beliefs, and the consensus is that this lead can to a more nuanced understanding of any conflicts that may exist in their understanding of what it means to teach (Bullough, 1991; Bullough, Knowles, & Crow, 1991; Capan, 2010; Yalcin & Erginer, 2012). For Tobin (1990), "using metaphors of teaching and learning provides a focus from which to begin looking at teacher change processes. By conceptualizing teachers' beliefs and roles through the metaphors they use, and then introducing...more appropriate metaphors, teacher change can be implemented" (p. 127). For example: replacing positivist metaphors that view teaching as the passive transmission of knowledge from teachers to students with constructivist metaphors that view teaching as a more dynamic social process might better prepare preservice teachers to work with diverse populations of students.

Constructivist Pedagogy

Constructivist pedagogy supports the kind of activity-based teaching and learning that encourages students to develop their own frames of thought. Based on the work of Dewey (1938), constructivism encourages reflection and empowers students to become responsible for their own learning. According to O'Loughlin (1992), "emancipatory constructivism is best viewed as a reaction against the positivist doctrine that objective truth exists and that by using certain rational methods of thinking we can arrive at authoritative knowledge that can be imparted to others" (p. 336). By supporting the construction rather than the transmission of knowledge, this approach is open to the multiple perspectives and alternate worldviews that teachers are encountering in our public schools.

In the present study, which aligns with Pinnegar, et al.'s (2011) contention that we can learn more about how teacher candidates might situate themselves in the profession by examining their beliefs, metaphor is used to provide preservice teachers with an opportunity to reflect on any discrepancies that may exist within their understanding of what it means to teach. Instead of simply identifying the metaphors that the participants brought with them into a teacher education program, however, this study also employs social cartography to map these metaphors in an intertextual field (Weidman, Jacob, & Casebeer, 2014). According to Paulston (1997), social mapping "seeks to open up meanings, to uncover limits within cultural fields, and to highlight reactionary attempts to seal borders and prohibit translations" (p. 454). Rather than offering a static portrait of preservice teachers' metaphors, in other words, the map functions as a heuristic device, encouraging the participants to reflect on their beliefs.

Methods of Inquiry

This study maps the teaching metaphors of 20 preservice teachers in a one-semester course on the social foundations of education. All of the participants were enrolled at various levels in the Bachelor of Applied Psychology degree program at a large urban university; however, excluding classroom observations and informal daycare work, none of them reported any previous teaching experience. Eighteen of the participants identified as female, two identified as male. With the exception of one Black participant and one Hispanic participant, all of the preservice teachers identified as White.

Data Collection

After reading Lakoff and Johnson's (1980) work, specifically their thoughts on the experientialist alternative for giving new meaning to old myths, and discussing how metaphor might help teachers construct meaning and reflect on their experiences, the participants responded to a three-part questionnaire. Part 1 solicited demographic information (see Table 1), while Part 2 asked the participants to provide their own metaphors for teaching and learning in the form of "Teaching is like..." and "Learning is like..." Finally, in Part 3, the participants justified their responses to Part 2 by writing brief personal narratives.

Table 1: Participant Demographics

Gender	N	%
Female	18	90
Male	2	10
Ethnicity	N	%
Black	1	5
Hispanic	1	5
White	18	90

Critical Discourse Analysis

Critical discourse analysis, which views language as a form of social practice, was used to construct knowledge communities from the preservice teachers' metaphors and personal narratives (Fairclough & Wodak, 1997; Foucault, 1986). Then, using social cartography, these communities were mapped in an intertextual field whereby the participants were encouraged to reflect on the results (Paulston & Liebman, 1994). In order to construct the knowledge communities, the participants' metaphors were examined in the context of cultural transmission. According to Sfard (1998), "one glance at the current discourse on learning should be enough to realize that nowadays educational research is caught between two metaphors...the *acquisition metaphor* and the *participation metaphor*" (p. 5). The acquisition metaphor, on the one hand, suggests that knowledge is acquired through individual experience and gradually refined into more complex cognitive structures. Participant responses that were categorized as acquisition metaphors include: "Teaching is like tuning a violin" and "Learning is like building a bridge." The participation metaphor, on the other hand, suggests that knowledge is the consequence of participating in authentic learning communities. Participant responses that were categorized as participation metaphors include: "Teaching is like being a guide" and "Learning is like being on a team."

Next, the participants' personal narratives were examined in the context of positivist and constructivist epistemologies. For Guba (1990), "the constructivist chooses to take a *subjectivist* position. Subjectivity is not only forced on us by the human condition...but because it is the only means of unlocking the constructions held by individuals" (p. 26). Excerpts from participant narratives that were categorized as constructivist include: "It is important for teachers to construct democratic learning environments" and "Teachers should be open to diverse perspectives." Alternately, "the positivist is constrained to practice an *objectivist* position...that permits the inquirer to wrest nature's secrets without altering them in any way" (p. 19). Excerpts from participant narratives that were categorized as positivist include: "It is the teacher's responsibility to make sure that their students are prepared to take standardized tests" and "Students learn by soaking up information from their teachers."

Social Cartography

Social cartography was introduced to comparative researchers as a method for enhancing the presentation of their findings (Paulston & Liebman, 1994). The argument, initially proposed by Paulston (1993) in response to Rust's (1991) call for the application of postmodern theories to emerging representations of reality, was that the construction of a visual discourse in education would provide a better understanding of the diverse and often marginalized players in the social milieu. Mapping, in other words, was packaged as an effective method for counter hegemonic boundary work.

According to Paulston (2000), "in the process of mapping meaning, the subject is seen to be mobile and constituted in the shifting space where multiple and competing discourses intersect...Social mapping, in this view, makes possible a way of understanding how sliding identities are created" (p. xxi). Rather than being pinned to a fixed position, as in the case of the Cartesian subject, the perspectivist subject is articulated around a core self, which is differentiated across local and historical contexts. Recent examples of how social cartography has been used in education research include O'Dowd's (2001) mapping of texts from the Malmö Longitudinal Study and Nicholson-Goodman's (2012) mapping of the doctoral journey via autobiographical consciousness.

While mapmaking is a personal practice, akin to writing poetry or painting a picture, there are certain steps that all social cartographers must take: border-making, populating, and interpreting. Border-making involves drawing the map's boundaries, usually along invisible axes that represent conceptual dualisms; in the present study, the map's borders are drawn along the vertical axis of Acquisition/Participation and the horizontal axis of Positivist/Constructivist. Populating requires determining the locations of knowledge communities on the map, not only in relation to the axes but also in relation to each other. Finally, interpreting encourages a return to critical discourse analysis to justify all of the decisions that went into border-making and populating, thus producing a phenomenological rather than an arbitrary construct (Nicholson-Goodman, 2009).

Results

Critical discourse analysis revealed the five knowledge communities that appear on the map (see Table 2). They are labeled according to size, from largest to smallest, and represent the overarching metaphors that emerged from the participants' responses to Parts 2 and 3 of the questionnaire. The largest knowledge community includes metaphors pertaining to growth, such as "Teaching is like tending a garden" and "Learning is like mapping new worlds." These metaphors position teachers as partners in learning who encourage their students to improve by building on their own experiences. The second largest knowledge community includes metaphors pertaining to production, such as "Teaching is like working in a factory" and "Learning is like fitting into place." These metaphors view teachers as content experts who are solely responsible for the transmission of information.

Table 2: Participants' Dominant Metaphors of Teaching and Learning

Knowledge Community	Dominant Metaphor	N	%
Growth		6	30
	Teaching is like gardening.	2	10
	Teaching is like mentoring.	1	5
	Teaching is like beekeeping.	1	5
	Learning is like painting.	1	5
	Learning is like pollenating.	1	5
Production		5	25
	Teaching is like building.	2	10
	Teaching is like carving.	2	10
	Learning is like absorbing.	1	5
Travel		4	20
	Teaching is like traveling.	2	10
	Learning is like traveling.	2	10
Maintenance		3	15
	Teaching is like watchmaking.	2	10
	Learning is like working out.	1	5
Guidance		2	10
	Teaching is like guiding.	1	5
	Learning is like hiking.	1	5

The third largest knowledge community includes metaphors pertaining to travel, such as "Teaching is like going on a journey" and "Learning is like collecting postcards." In much the same way as the growth metaphors in the largest knowledge community are closely aligned with constructivist epistemologies, the metaphors in this group also envision teachers in partnership with their students, working together instead of in opposition. The fourth largest knowledge community includes metaphors pertaining to maintenance, such as "Teaching is like pruning a hedge" and "Learning is like working out." These metaphors lean more toward positivist epistemologies, offering a more objective view of knowledge acquisition. Finally, the fifth largest knowledge community, albeit the smallest, includes metaphors pertaining to guidance, such as "Teaching is like being a tour guide" and "Learning is like going on a hike." These metaphors, while still essentially positivist, begin to move toward an acceptance of more constructivist worldviews.

Discussion

The map suggests that the preservice teachers involved with the present study were almost evenly split between positivist and constructivist epistemologies, between objectivist and constructivist worldviews (see Figure 1). While this does not imply that the beliefs of all preservice teachers can be so neatly categorized, it does provide a starting point for discussing how teachers' unconscious beliefs about teaching and learning can manifest in their practices. If the atmosphere in a particular classroom, as Martínez, Sauleda, and Huber (2001) suggest, can be traced to the teacher's preferred educational metaphor, then it can be assumed that the atmosphere in the participants' future classrooms would be significantly different. A preservice teacher who favors the growth metaphor, for example, might be more open to collaborative teaching strategies, encouraging students to make sense of learning in the context of their own experiences, whereas a preservice teacher who favors the production metaphor would be more likely to exercise control in the classroom, preferring didactic rather than dialogic methods of instruction.

The map also suggests that the preservice teachers who favored an objectivist approach to teaching were more likely to accept the acquisition metaphor of student learning. Similarly, the preservice teachers who favored a subjectivist approach were more likely to accept the participation metaphor. There was very little overlap, although some of the preservice teachers, especially those who viewed teaching as guiding, seemed to be accepting, or at least aware of, alternate perspectives prior to viewing the map. According to Sfard (1998), the acquisition metaphor's emphasis on viewing knowledge as intellectual property, as something that can be accumulated, has the capacity to promote rivalry rather than collaboration. The participation metaphor, however, can bring people together through its shifting conceptualization of permanence, through the promise of a more democratic process of teaching and learning.

In addition to exploring the knowledge communities, the overlaps and disconnects, the participants also considered the *negative space*, the gray area in which none of their metaphors were mapped. The most obvious gaps, or *silences*, occurred at the intersection of participation metaphors and positivist epistemologies, and at the intersection of acquisition metaphors and constructivist epistemologies. While this is not surprising, given the position of the knowledge communities at the opposite poles, it does provide an opportunity to think about the metaphors that preservice teachers possess in a different way. According to Star (1991), "finding the silent blueprint to a life means looking in areas of darkness" (p. 266). Extended to teacher education, this suggests that we can learn just as much from the metaphors that preservice teachers do not possess as we can from those that they do. After the participants spent some time with the map, questioning its borders and challenging the placement of their own ideological positions, they began to think about which metaphors might help them in our current climate. This added a reflexive element to the study that encouraged the preservice teachers to think about making their own maps, which may or may not have resembled the researcher's.

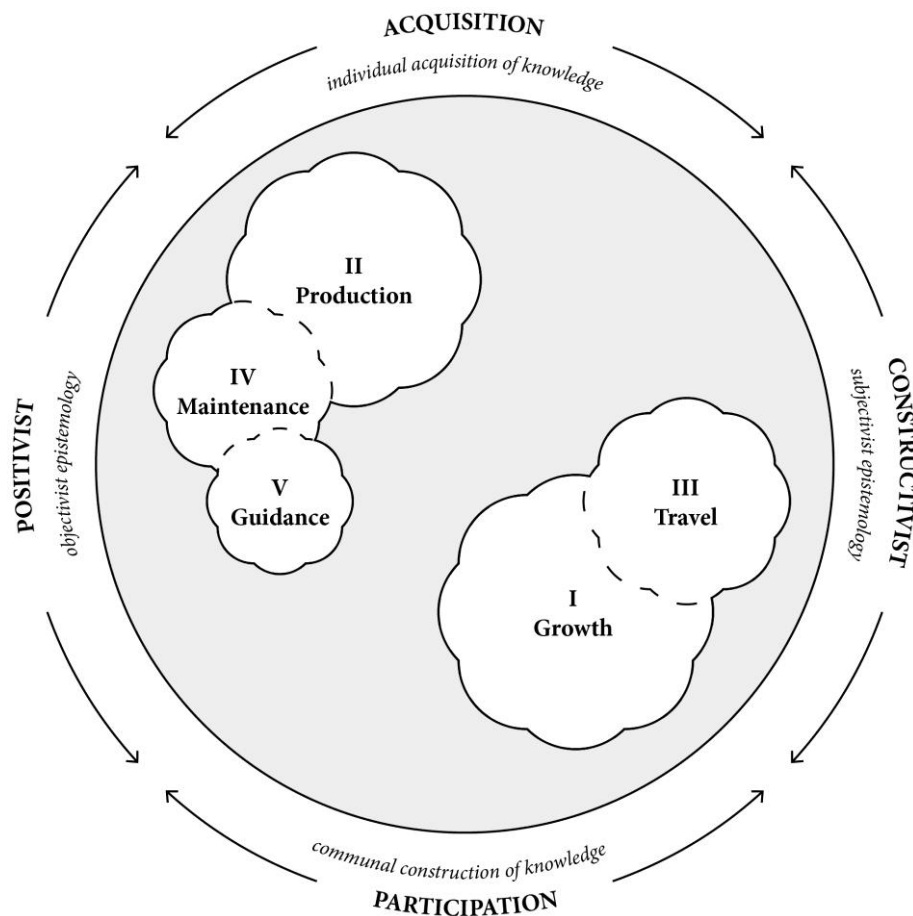


Figure 1: Heuristic map of the participants' metaphors of teaching and learning.

According to the United States Department of Education (2014), non-White minority students collectively outnumbered their White counterparts for the first time last year in America's public schools. Even though White students will remain the largest social group for some time, currently accounting for over 49% of the total enrollment, their numbers are expected to decline. Teacher demographics, however, are shifting at a much slower pace, with White teachers accounting for over 85% of the teaching force (Hill-Jackson & Lewis, 2010). For Dee (2004), this disparity is problematic because racial interactions between teachers and students can affect student performance. For example: "pupils may trust and respect someone with whom they share a salient characteristic, making learning come more easily. Likewise, a teacher of the same race may serve as a more effective role model, boosting students' confidence and enthusiasm for learning" (pp. 53-54).

Even though it might be easier for teachers to work with students from similar cultural or economic backgrounds, it is possible for all teachers to engage all of their students if they are willing acknowledge that people are capable of constructing knowledge in different ways. According to McAllister and Irvine

(2000), teachers who accept and display multifocal worldviews are more likely to create productive learning environments that motivate their students, and, one of the ways that preservice teachers can work toward an acceptance of multiple perspectives is by examining and reflecting on their beliefs. By replacing acquisition metaphors of teaching and learning, which view students as containers to be filled, with participation metaphors, which view students as active participants in their own education, preservice teachers can start to address their own latent assumptions about teaching and learning before ever stepping foot in a classroom.

Limitations and Recommendations for Future Research

Even though the use of metaphor in teacher education discourse can help preservice teachers uncover some of their latent beliefs about teaching and learning, it is not without its drawbacks. Thompson and Campbell (2003), for example, identify three problems with metaphor analysis: the narrow focus on self, the potential for superficial responses, and the inherent limitation of using metaphor to express complex ideas. The narrow focus on self is problematic because it diminishes the importance of context, suggesting that a single metaphor is somehow capable of expressing all of a preservice teacher's beliefs. The potential for superficial responses is also of concern because preservice teachers who do not take metaphor analysis seriously might compromise the complexity of the study. Finally, the inherent limitation of using metaphor to express complex ideas is potentially troublesome because, once again, it supports the compression of large ideas into smaller ones.

Social cartography, as a method for helping preservice teachers acknowledge and visualize difference, also has its share of limitations. For critics, the absence of objectivity and generalizability make social maps too context dependent (Torres, 1996). Another complaint is that a lack of "hard data" reduces social cartography to little more than an exercise in "intellectual gymnastics" (Watson, 1998, p. 108). For social cartographers, however, it is this very lack of objectivity and generalizability that make social maps so important: "A map...is a construct, a unique object. Initially, each map, as is true of any written discourse, is the property of its creator—it contains some part of that person's knowledge and understanding of the social system" (Paulston & Liebman, 1994, p. 223). Regardless of how social maps are perceived, as metaphorical curiosities or literal representations, they nevertheless provide researchers with an opportunity to open and extend social dialogue.

Future research on preservice teachers' metaphors of teaching and learning should focus on exploring the actual extent to which metaphor is capable of helping them reflect on their beliefs. According to Mahlios and Maxson (1998), "there are observed instances in which root metaphors change [or hold] as students become teachers...What is not known at this point is how teachers actually enact the practices of teaching that grow out of their initial metaphor/cognitive systems" (p. 239). One of the ways that researchers can begin to address this gap in the literature is by conducting more longitudinal studies that explore teachers'

metaphors from the moment they enter a teacher education program through their first several years of practice, perhaps even longer. By examining how these structures may develop and change over time, teacher educators would be in a better position to provide preservice teachers with a metaphorical profile, which, in turn, could be used to help them reflect on any disconnects that may exist between their future practices and current beliefs.

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The Comparison of Mediating Models for Stimulating Imagination with Psychological and Environmental Factors

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Abstract. The present study aimed to compare different mediating models of stimulating imagination for university students (novice creators) who were under demanded to demonstrate highly imaginative and creative capabilities. We invited 876 university students to participate in this study. Using the reliability and validity of research tools to explore the competing models obtained according to literature review, we then suggested the two factors mediating model that was appropriate for novice creators (through *inspiration through action* and *intrinsic motivation* as mediators between internal/external factors and two types of imagination). The results displayed: (a) the inherently psychological factors and two types of imagination were closely related. (b) *Intrinsic motivation* and *inspiration through action* can play the mediating roles between external/internal influence factors and two types of imagination. (c) The impact of environmental factors on imagination is relatively limited, but two mediators would raise the predictive power. (d) Using this model to stimulate the creators' imaginations, we should pay attention to how the *social climate* and *negative emotion* may carry out a direct negative influence, and guide learners through two mediators to stimulate imagination that would be the more effective inspirational path.

Keywords: environmental factors; imagination capability; model comparison; psychological factors.

Introduction

Innovators in a variety of fields need high quality internal and external resources to develop their imaginations and create works of influence (Ribot, 1906). During the process of innovation, from coming up with an original idea, implementing the idea, arranging the content, making the characteristics stand out, and simulating audience's viewpoints, a huge amount of imagination and creativity was required. How individuals release imagination is often influenced by internal and external factors. Internal factors refer to how an individual operates his or her cognition, motivation, emotion, and self-efficacy (e.g., Finke, 1996; Hsu, Liang, & Chang, 2014; Vygotsky, 1967/2004); external factors refer to

how individuals cooperate with environmental resources, such as physical components, social climate, organizational measure, and aggregate culture (e.g., Chang & Lin, 2013; Liang, Hsu, & Chang, 2013; Zhao, Seibert, & Hills, 2005). However, there have been few empirical studies systematically exploring how internal and external situations can coordinate to stimulate the creator's imagination. Therefore, this study concentrated on both psychological and environmental factors by examining how these two sets of factors coordinate to inspire imagination. The results of this study expect to establish a foundation for constructing innovators' imagination capabilities.

Previous studies (Eckhoff & Urbach, 2008; Lindqvist, 2003) summarized Vygotsky's key points regarding imagination and pointed out that for individuals, imagination is the bridge of thinking between reality and the unknown. Broad theoretical expositions have clearly shown that imagination is profound for innovators. For example, to achieve outstanding performances in the field of creativity, high-quality imaginative energy is essential (Chiu, 2013; Perdue, 2003; Stokes, 2006). Given these internal operations of imagination, creators focus their imagination on certain targets of creation by mentally planning all details in their minds; then, through a series of processes, it is possible that the tacit imagination can be turned into real existence. In other words, imagination, which plays the role of the bridge between reality and the unknown, is an inherent important mental ability of humans (Beaney, 2005; Perdue, 2003); it is characterized as flexibility of mind, and allows us to call up mental images, think about things that are not present, or consider things that do not exist (Egan, 1992, p. 36; Egan, 2007).

Specifically, factors that drive creators' flexible applications of this strong mental ability also include internal psychological influences, external environments, and guidance, as well as creators' perception and interpretative capability (Bailin, 2007, p. 113). These factors all play important roles and need to be further clarified. For example, Speller (2006) pointed out that environment can facilitate, change, or constrain individuals' behaviors and emotions, further influencing their thoughts. Browne (2008) and Henderson (1999) both mentioned the interactions between individuals and his or her environments can be used to analyze human behaviors and can be used as a way to influence the development of imagination. However, while philosophical or narrative studies abound on the relationships between imagination capabilities and internal/external influence factors, use of empirical methods to validate these variables and to conduct model comparisons was relatively rare. Due to the background described above, this study focused on the subjects in whose studies cultivation of innovation capabilities was emphasized. These participants were the college students majoring in design, film/video, or information communication as the target subjects. The concepts of imagination in this study refer to the individuals' capabilities of transforming their inner imagery while facing their productive themes.

Creative Works and Imagination

Susanne K. Langer (1895–1985) pointed out in her representative book “Feeling and Form” (1953), regarding modern esthetics, that imagination plays an important role in both the process of creation and that of appreciation. Especially in the phase of creative work forming, the creator must continuously respond to many unsolved internal issues. In this phase, the creator needs to fill himself with rich thoughts, emotions, and imagination in order to start a series of exercises of his mind. Creators need a huge amount of imagination to master and control emerging creative ideas. Through continuous refinements of imagination and ideas, eventually creators would find core spirits and main subjects in their minds. Then, they can further use creation media (possibly images, music, or colors), along with rhythms, strengths, and forms, to concretize their rich creative ideas and show their creativeness.

Next, through a detailed insight into the process of a production, it can be seen that its literary composition requires the writer’s and the director’s knowledge of existing events. Through imagination, the events can be described. Well applications of the combination of illusion and reality can help audiences get into the plot. Therefore, Das (2007) indicated that the ability of imagination is an important ability for a writer to use his or her talents and present his or her creativity. In other words, the answers to how many plot details should be included in a film and which details create what kinds of feelings for the audience are all related to the tasks and skills of the writer and the director. That is, creative professionals need not only have rich imagination but also must include the audience’s feelings and responses into their own imagination, combining them so that the completed works can be connected to the audience’s thoughts and feelings.

We investigated the concepts on imagination literatures thought out databases of EBOSCO, ERIC, PsycINFO, and SSCI between the period of 1900 and 2012. The research team observed that most of studies define imagination as a trait, however, the present study would argue that “imagination” is “abilities” (different from fantasy and containing multiple capability dimensions), which can be further developed (Weick, 2006). The research angle taken was different from seeing “imagination” as the degree of vividness of a human impression (Marks, 1995) or spatial mental representations (Thurstone & Thurstone, 1989). One’s imagination is based on his rich life experiences, and it can further connect, expand, or transform various elements to create a new manifestation (e.g., Bailin, 2007; Chiu, 2015; Egan, 1992, pp. 45–65). Imagination can help people using others’ experiences as a foundation to develop competency and empathize with others. Moreover, because almost all emotions are linked to certain images, with languages or related cognition as the media, imagination can be linked to these images more thoroughly.

Imagination in this study was defined as the ability shown during the evolution of internal awareness or a mind map in the process of thinking while a creator handles the production task or faces a problem (Gaunt, 2003; Stokes, 2006). This was consistent with the later viewpoints from the studies, which considered

imagination as “a power of the mind” or “a creative faculty of the mind” (Passmore, 1985; Perdue, 2003). Furthermore, this study organized the viewpoints from a lot of studies, categorizing imagination into creative imagination and reproductive imagination (Betts, 1916; Liang, Hsu, Chang, & Lin, 2013). Creative imagination is often perceived as a facilitator for great discoveries and achievements of humankind, it emphasizes the thinking attributes of initiation and originality. In Liang and his colleagues’ (2013) work, *Creative Imagination* (CI) has six indicators: *exploration* refers to the ability of the individual to continuously explore unknown or novel things (Finke, 1996; Finke, Ward, & Smith, 1992); *novelty* refers to the ability of the individual to come up with an unconventional idea or an idea that differs from traditional ones (Pelaprat & Cole, 2011); *productivity* refers to the ability of individuals to continuously produce rich content of imagination (Karwowski & Soszynski, 2008); *sensibility* refers to the sensitive emotions that the individual has for content of imagination (Bailin, 2007); *intuition* refers to the individual’s ability to associate different information in an instant and come up with content of imagination (Reichling, 1990); and *concentration* refers to the ability of the individual to continuously concentrate so that imagination can be formed (Liang et al., 2013).

Next, *Reproductive Imagination* (RI) is characterized by the capability to reproduce mental images described by others or images from less accurate recollection of reality. RI contains four indicators: *effectiveness* refers to the ability of the individual to come up with content of imagination for the target subject matter; *dialectics* refers to the ability of the individual to repeatedly investigate and make improvements (Thomas, 1999); *crystallization* refers to the ability of the individual to present an abstract concept using a concrete image (Reiner & Gilbert, 2000); and *transformation* refers to the individual’s ability to adapt to different situations and transform his/her thoughts for applications (Liang et al., 2013).

The Psychological and Environmental Factors to Stimulate Imagination

From practical teaching experiences, creators’ internal psychological influences and learning environments may affect development of their imagination to a certain degree. If the structural relationships among these factors can be clarified, it would be a great help to building a more efficient prediction model for effectively guiding creators to release their imagination capability. During the years, numerous scholars put in a lot of effort to drive imagination, directly or indirectly. For example, regarding the cognition aspect, there were studies by Finke (1990, 1996), Pylyshyn (2002), and Pelaprat and Cole (2011). Regarding the motivation aspect, there was a study by Eisenberger and Shanock (2003). Regarding the behavior aspect, there was the “seeing-moving-seeing” theoretical structure proposed by Schön and Wiggins (1992). As for the self-efficacy aspect, which is closely related to creators’ ability to make self-adjustments, there have been some studies in the field of creativity research (Choi, 2004; Prabhu, Sutton, & Sauser, 2008) and the initial exploration of imagination was covered.

This study adopted the results from related studies (e.g., Hsu et al., 2014) and summarized psychological influential factors into the following factors: *generative cognition* refers to the ability of the individual to explore diversified methods to generate ideas (such as one's own life experiences, extension of sensual perception, associations, assumptions, simulations, and other methods); *intrinsic motivation* refers to the individual's interest in the task or assignment, hold curiosity, or belief that engaging in the task was beneficial for oneself; *positive emotion* refers to individuals' emotions, such as merriment and excitement; *negative emotion* refers to the individual's feelings of frustration, anxiety, and worry; *inspiration through action* refers to the individual thinking while doing and intuition, inspiration, and review and evaluation of meta-thinking (Hsu et al., 2014); and *self-efficacy* refers to individuals' professionalism, familiarity with software/hardware tools, operating standards, goal assessments, and will to achieve a goal (Bandura, 2012; Choi, 2004).

Similarly, several environmental factors may influence learners' imagination. For example, some scholars found the influences of external physical models on facilitating students' imagination from various aspects, including designing tasks, life field and school constructions (e.g., Büscher, Eriksen, Kristensen, & Mogensen, 2004; Claxton, Edwards, & Scale-Constantinou, 2006; Uptis, 2007). This study referenced the literature related to influences of learning environments on imagination and referenced the research results from Hsu et al. (2014), then defined that the aspects of learning environments included: *physical component* as the physical conditions of an environment, including lighting, sound volume, ventilation, materials, decoration, tools, equipment, or public space for performances, that may influence imagination; *learning resource* refers to static (e.g., posters and models) and dynamic stimulations (e.g., short films and dynamic simulations) in an environment, including books, data, and learning activities, that may influence imagination; *organizational measure* refers to teaching, guidance, and measures of learning from organizations or teachers that may influence creators' imagination; *social climate* refers to peer atmosphere formed by creators' perception of peer groups' discussions, communications, and competitions that may influence creators' imagination (Strange & Banning, 2001); and *human aggregate* refers to organizational cultures or campus traditions formed in departments or schools that may influence creators' imagination (Kember, Ho, & Hong, 2010). This study explored the influences of environments on imagination based on these five variables.

The Present Study: Comparison of Models for Stimulating Imagination

The current study on imaginative capabilities adopted the research tool developed by Liang et al. (2013) of stable factor structure with good validity and reliability estimates. Then, we further analyzed the influences of internal and external situational factors on the students' imagination. This study expected to make comparisons among two models, which were based on prior related researches (i.e., Choi, 2004, 2012; Hsu et al., 2014; Zhao et al., 2005), and further built a structural model of consistency to efficiently trigger imagination. Specifically, the purposes of this study included: (a) Verify the validity and reliability of the imagination capability scale, with the sample of college students

of innovation majors, including design, film/video productions, and information communication, (b) Examine the theoretical model of the internal psychological and external environment influence on creators' presentation imagination, (c) Compare two models to reveal an integrated model with psychological state and environmental condition as predictive factors simulating the reproductive and creative imagination.

Psychological influences and environmental influences play the internal and external roles that influence individuals' imagination. This study assumed that the prediction power of the influences of these environmental and psychological factors on imagination might differ due to the cognitive characteristics of the learners. Furthermore, in the prediction model of learners' imagination, "intrinsic motivation" often played the key mediating roles between the psychological/environmental factors and imagination (e.g., Choi, 2004; 2012). Numerous contemporary studies have revealed that the framework of intrinsic motivation as a mediating role can stimulate creative process engagement (e.g., Zhang & Bartol, 2010). Therefore, this study, based on the existing literature, proposed a hypothetical model:

Model 1. Single-factor mediating model. Through the mediating effect of *intrinsic motivation*, psychological and environmental influences can be used to predict imagination.

There were, however, few studies to investigate the novice innovators' stimulating model, and the creators are usually in situations requiring a huge amount of teamwork, requiring them to get feedback through phased works in order to complete the final work; this study included "inspiration through action" to play the mediating role. Hsu referenced this factor in the study, Liang et al. (2013), which applied exploratory factor analysis and confirmatory factor analysis and found that this factor was convergent with personnel from various fields, such as curriculum design, interactive design, and visual design. To be more specific, this factor covered actions and operations, review and modification, thinking while doing, intuition, and inspiration. Egan (2007) and Shin (1994) also suggested that actions and operations could driver creators' imagination, and operations could trigger tacit knowledge and meta-cognition, and further drive imagination. Based on this, the study inferred that this factor might play a key mediating role regarding the creation field, where learning and thinking are performed through operation of tools and objects.

Then the present study proposed the second hypothetical model:

Model 2: Two-factor mediating model. Through the mediating effects of *intrinsic motivation* and *inspiration through action*, psychological and environmental influences can be used to predict imagination.

Method

Participants. Two independent samples of college students were from Taiwan. Sample 1 served as the sample for confirming the structure of the imagination scale. This sample consisted of 212 college students (156 female, 56 male) ranging from freshman to senior students. Sample 2 served as the validation

model sample and consisted of 664 college students. Of them, 467 were female and 197 were male. Table 1 is the demographic information of the participants.

Table 1

The demographic information of participants in the current study

	Confirmatory factor analyses		Model verification	
	Number	Percentage (%)	Number	Percentage (%)
Gender				
Male	56	26.4	197	29.7
Female	156	73.6	467	70.3
Grade				
Freshman	70	33.0	194	29.2
Sophomore	90	42.5	279	42.0
Junior	42	19.8	151	22.7
Senior	10	4.7	40	6.0
Total	212	100.0	664	100.0

Instruments

Imagination scale. This study adopted the research tool developed by Liang et al. (2013) to assess the construct of imagination. This scale consists of both creative and reproductive imagination, the 10-item scale that was composed of both creative (6-item) and reproductive (4-item) imagination. The Cronbach's α of each subscale was .763, .844, and the composite reliabilities of creative and reproductive imagination was .876 and .8215, respectively, both higher than .60. The average variances extracted were .546 and .539, respectively, both higher than .50, meaning good convergent validities (Bagozzi & Yi, 1988; Fornell & Larcker, 1981). The confidence interval of the relationship between reproductive and creative imagination was (0.682, 0.878), not including 1, meaning good discriminant validity between the two latent variables.

Psychological influence scale. This scale, developed by Hsu et al. (2014), was used to evaluate psychological influences in this study. This dimension contained six psychological subscales (variables); the 28-item scale included *generative cognition* (6-item), *intrinsic motivation* (7-item), *positive emotion* (3-item), *negative emotion* (3-item), *inspiration through action* (4-item), and *self-efficacy* (5-item). The Cronbach's α of each subscale was .874, .757, .839, .782, and .844, respectively. The average variances extracted (AVEs) of the original psychological variables were .626, .597, .742, .899, .571, and .617, respectively. The composite reliabilities were .908, .880, .894, .963, .839, and .888, respectively. Based on the values above, the convergent validity of this scale with this sample in this study was very good. The discriminate validities between the psychological variables were satisfactory.

Learning environment scale. The scale developed by Hsu et al. (2014) was used to measure environmental influences. This dimension contained six environmental subscales (variables), the 23-item scale including *physical components* (4-item), *learning resource* (4-item), *organizational measure* (6-item), *social climate* (5-item), and *human aggregate* (4-item). The Cronbach's α of each subscale was .660, .722, .899, .849, and .862, respectively. The AVEs of the five

variables were .413, .469, .705, .708, and .697, respectively. The composite reliabilities were .674, .778, .922, .922, and .900, respectively. The discriminate validities between the environment variables were satisfactory.

Data analyses. The LISREL 8.80 computer program, using the covariance matrix of all items, was applied for conducting confirmatory factor analysis for the imagination model. The following indexes were indicators for evaluating model in the current study: (a) comparative fit index (CFI; Bentler, 1990), (b) standardized root-mean-square residual (SRMR; Jöreskog & Sörbom, 2002), and (c) root-mean-square error of approximation (RMSEA; Steiger, 1990) to test model fitness.

Results

Descriptive statistics. The mean and standard deviation of all constructs were presented in Table 2. It can be seen that creativity and reproductive imagination were positively correlated. The correlations of the five learning environment variables and six psychological influence variables with imagination showed moderate-to-low correlation. In addition, the correlations of several psychological influence variables (e.g., generative cognition, intrinsic motivation, and self-efficacy, with imagination) were slightly significant than those of the learning environment variables.

Table 2

The descriptive statistics, reliabilities, and correlation coefficients of the scales ($N = 664$)

Variables	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Reproductive imagination	4.47	.629	(.767)												
2. Creative imagination	4.35	.645	.676	(.844)											
3. Physical component	4.54	.825	.102	.138	(.631)										
4. Learning resource	4.68	.782	.241	.276	.373	(.722)									
5. Organizational measure	5.13	.790	.194	.250	.396	.582	(.901)								
6. Social climate	5.47	.658	.197	.179	.302	.411	.621	(.887)							
7. Human aggregate	4.73	1.003	.195	.232	.229	.464	.551	.438	(.865)						
8. Generative cognition	5.05	.719	.320	.348	.287	.426	.489	.405	.411	(.874)					
9. Intrinsic motivation	5.20	.698	.322	.308	.215	.401	.553	.455	.510	.560	(.830)				
10. Positive emotion	4.98	.907	.225	.256	.250	.417	.449	.366	.292	.379	.527	(.840)			
11. Negative emotion	4.95	1.175	.072	.018	.117	.239	.384	.331	.231	.197	.318	.342	(.943)		
12. Inspiration through action	5.00	.701	.194	.232	.399	.400	.509	.431	.340	.528	.505	.385	.351	(.781)	
13. Self-efficacy	5.00	.790	.266	.256	.214	.453	.536	.432	.342	.361	.533	.386	.341	.488	(.847)

Note: (); reliability coefficient.

Model Examination

Based on the suggestion of the testing mediation model procedure by Baron and Kenny (1986), and Frazier, Tix, and Barron (2004), the first step was to confirm whether the individual variables (including organizational measure, social climate, generative cognition, positive emotion, and negative emotion) can predict the outcome variable (including creative imagination and productive imagination), and if it indicates the model fit the data well: $\chi^2(1120) = 4521.65$, $p < 0.05$, $df = 1120$, $CFI = 0.99$, $RMSEA = 0.035$, $SRMR = 0.058$, $NFI = 0.97$, $NNFI = 0.99$. The second step was to explore whether the predictor variables can predict the mediators (including intrinsic motivation and inspiration through action), the results support the hypotheses, which is that the factors of organizational measure, social climate, generative cognition, positive emotion, and negative emotion can predict the productive and creative imagination by different degrees and be significant, $\chi^2(707) = 3310.35$, $p < 0.05$, $df = 707$, $CFI = 0.99$, $RMSEA = 0.038$, $SRMR = 0.062$, $NFI = 0.98$, $NNFI = 0.99$.

Then we examined the different mediating models comparison. These models included the following: Model 1: Single-mediating factors model (e.g., intrinsic motivation); Model 2: Two mediating factors model (e.g., intrinsic motivation and inspiration through action). Model 1 was established based on related prior studies (e.g., Choi, 2004; 2012; Liang, et al., 2013; Zhao, Seibert, & Hills, 2005). Model 2 was the baseline model, which was derived from the present study and in which the supposed factor of "inspiration through action" may also play as the mediator, due to creators as team members performing work through actual operation as part of a back-and-forth interplay to modify the production, having bursts of inspirations influenced by other members' ideas; teamwork can drive the creative and reproductive imagination. The test results showed that both models were appropriate to explain the data. However, under the same sample size condition, the largest degree of freedom indicated the least number of parameters; the number of parameters of Model 1 was more than Model 2, but Model 1 did not have significant adaption. Referring to the simple principle, we adopted Model 2.

Table 3

Testing results of the fitness of the two models ($N=664$)

Model	Chi-square	S-B Chi-square	df	Δ S-B Chi-square	p-value	RMSEA	SRMR	CFI	NFI	NNFI
Model 1: Single factor mediating model	4855.49	2158.02	1132	3.55	0.17	0.04	0.08	0.99	0.98	0.98
Model 2: Two factors mediating model	4860.51	2161.67	1134	-	-	0.04	0.07	0.99	0.97	0.98

Note: The Δ S-B Chi-square might be negative, because the estimations went through the adjustment of the Sattora–Bentler scaled chi-square (Satorra & Bentler, 2010).

The results of the structural equation modeling analysis are summarized in Figure 1 and Table 4. The model test results showed that the two mediating factors model (i.e., Model 2) was the appropriate model, which explained 25% of the variance in the creative imagination and 33% of the variance in the reproductive imagination. It displayed that when the mediating factors of intrinsic motivation and inspiration through action were added to the model, the predictive effects to imagination from psychological and environmental factors would be significantly reduced (Frazier et al., 2004). Within these mediating factors, the intrinsic motivation displayed the highest effect, followed in turn as inspiration through action. The environmental factor of social climate and the psychological factors of generative cognition, positive emotion, and negative emotion, can predict two types of imagination through two mediators. In addition, organizational measures influenced intrinsic motivation, and social climate can predict imagination both directly and indirectly.

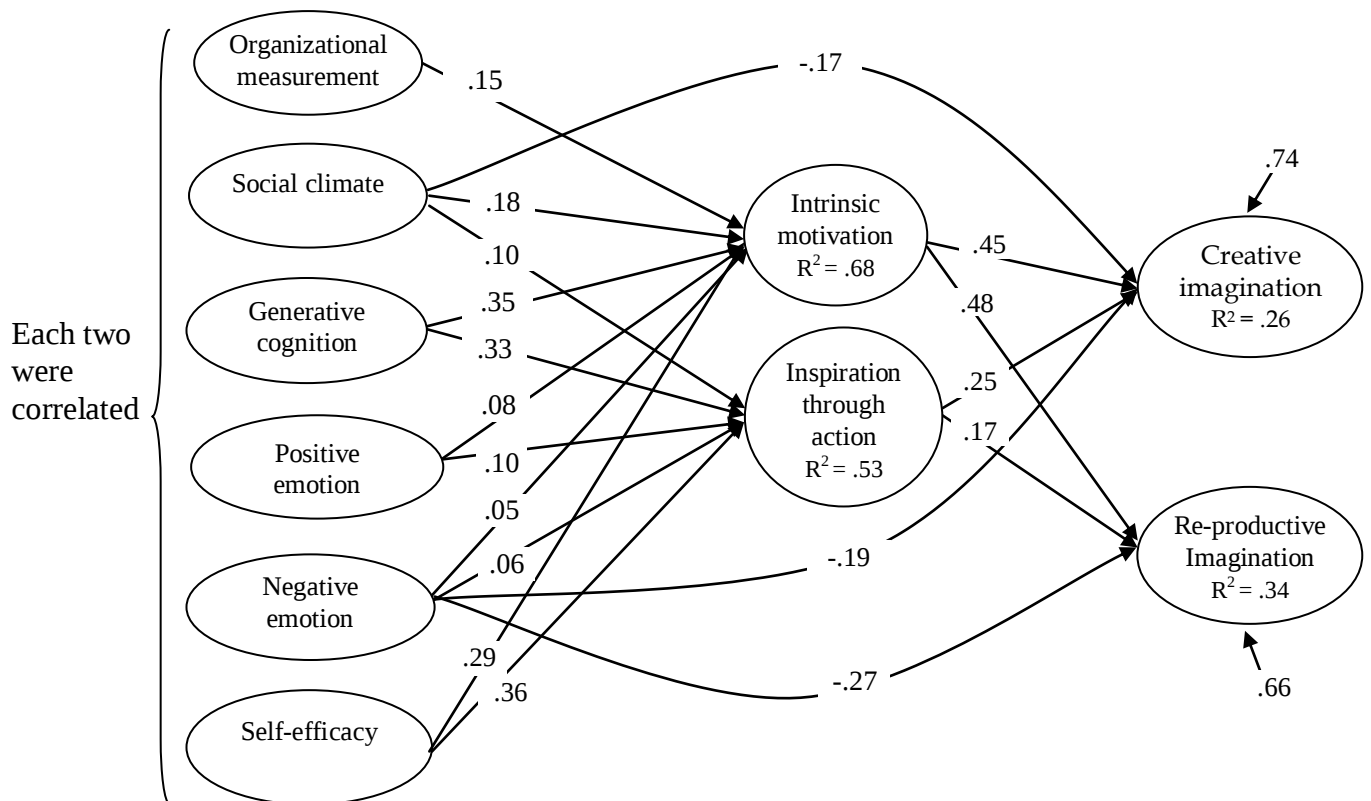


Figure 1. The structural model of the psychological and environmental influences on creators' imagination

Table 4

The correlation of latent independent variables and their direct and indirect effects for imagination

Independent variables	1	2	3	4	5	Direct effect		Indirect effect	
						RI	CI	RI	CI
1. Organizational measurement	—	—	—	—	—	—	—	.07	.07
2. Social climate	.65	—	—	—	—	—	-.17	.10	.10
3. Generative cognition	.42	.40	—	—	—	—	—	.22	.23
4. Positive emotion	.39	.39	.37	—	—	—	—	.06	.06
5. Negative emotion	.22	.26	.20	.30	—	-.19	-.27	.04	.04
6. Self-efficacy	.43	.52	.48	.44	.33	.11	.07	.20	.22

Note: RI, reproductive imagination; CI, creative imagination.

Discussion

Overall, the present study was displayed to drive creators escaping the imagination, who need the psychological factors, including cognition, motivation, and emotion, to cooperate with different paths and strengths. Consideration of the existing mediating model, such as Liang and his colleagues' (2013) intrinsic motivation as the single mediator model, our research team further explored the two mediators model, and the model fit well, based on the general characteristic of student innovators. The model was expanded to explain the major areas of novice creators while emphasizing innovation and imagination.

The present findings suggested that the features of imagination capabilities were distinguished appropriately as creative imagination and reproductive imagination. In other words, the present empirical studies supported the framework of reproductive and creative imagination as appropriately describing the innovators' different types of imagination. The sequence exertions made more concrete the ambiguous features of imagination (Egan, 2007; Fettes, 2010; Liang et al., 2013). Subsequently, we suggest these imaginative thinking characteristics can further conjunct with the curriculum design, which leads innovators to release their reproductive and creative imaginations.

It is noteworthy that even though the present predictive model integrated the external environmental and internal psychological factors to predict imagination, the explained power of two types of imagination was still low (less than 50%); this perhaps indicated that there are remaining factors (such as personal traits, learning materials, or other individualized factors) which were needed to be examined further. In addition, environmental factors such as *social climate* influence on imagination are less obvious than psychological factors; however, the two mediators of the model can influence imagination more effectively. These results could suggest that integration of the external environmental and internal psychological factors to influence imagination are important for the development of effective teaching strategies.

The study also pointed out that *intrinsic motivation* and *inspiration through action* can mediate the relation between the predictive variables of *generative cognition* as well as *positive* and *negative emotion* and the outcome variables of two types of imagination. The results demonstrated that the mediating roles of *intrinsic motivation* for imagination are consistent with the studies of Prabhu, Sutton, and Sauser (2008). Furthermore, we found

that *inspiration through action* also could be the mediating role to emphasize innovation majors. It is possible that for novice innovators, in addition to *intrinsic motivation* can be displayed the mediators, the factors relating the operation or action (i.e., inspiration through action) displaying the critical mediating roles.

Additionally, *organizational measure*, through intrinsic motivation as a mediator, displayed an indirect predictive effect on imagination. In the *social climate*, positive and negative emotion displayed not only a positive, direct effect on two mediators; it also had a direct effect on two types of imagination. Specifically, *social climate* had a negative, direct effect on creative imagination; demonstrating that it emphasizes directly the role of *social climate* and would not be a valuable strategy for stimulating imagination; however, through two mediating factors, social climate would have a positive influence on imagination. The results indicated that the climate of peer groups would positively influence creators' motivation and action. Both negative and positive emotions had negative direct effects on reproductive imagination; only negative emotion had negative direct effects on creative imagination. That indicated the positive, effective way to stimulate both types of imagination and that the emotional factors would be better stimulants through the two mediators.

Conclusion and further study

According to the research results, this study proposed several suggestions for follow-up studies and practical applications. First, there are indeed relationships among imagination, the psychology of learning, and the learning environment. In the future, this model can be referenced in teaching activity design or self-learning for planning teaching measures or creators' self-guidance. Second, the research subjects of this study were creative talents majoring in innovation fields. In these fields, dealing with problematic situations or tasks, teamwork and the tools and objects they work with are highly valued. In other fields emphasizing independent creation or having different professional levels of development, there may be differing preferences and values. Therefore, the model built by this study can be compared and modified for more appropriate applications to other creation-related fields. Third, although the results of fitness from the tests of the measuring model and the structural model were good, the residuals of the overall model corresponding to the predictions of creative and reproductive imagination were .75 and .67, respectively, showing that there were still influential factors not included in the overall model (such as individual difference or material difference). Follow-up studies may consider them to improve predictions of imagination. Lastly, to explore efficient models for cross-professionals will be important for talent cultivation. Therefore, follow-up studies can continue using these research tools with stable variable structures to compare models in different fields and combine academic cooperation between/among various fields.

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Using Mobile Devices to Improve Educational Outcomes: An Analysis in Primary Education

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Abstract. Significant challenges to the delivery of quality education remain as Taiwan has carried on its educational reform. In the attempt to find solutions to these challenges, desires associating new information and communication technologies (ICTs) should be put into consideration. Mobile-assisted-language-learning (MALL) is one of the examples. Nowadays, even though having wireless learning environment in Taiwan, schools have difficulties in implementing mobile learning if they do not possess the appropriate courseware. This article examines the extent to which mobile devices facilitate M-learning in terms of educational outcomes of Taiwan. The purposes of this study are: 1) developing the appropriate mobile learning application (App) for language learners, (2) designing the mobile learning curriculum model, and (3) evaluating the effectiveness of mobile learning. Analysis of the study indicates that there is important evidence of mobile application facilitating EFL (English as a Foreign Language) learning. The results also indicate that students are motivated to use the application in their spare time and that this benefits their learning. Mobile technologies should be embedded in a natural learning environment. As for the future investigation, more technical breakthroughs in curriculum and instruction need to be put into consideration, in order to gain an overall picture of the optimal outcomes of English teaching.

Keywords: Mobile devices, mobile learning, application (App), EFL (English as a Foreign Language), information and communication technologies (ICTs)

Introduction

As prosperity of the tools with the Internet, the international contact is frequent, from the exchange of information, science and technology, industry and commerce, even the educational use. Ministry of Education (MOE) of

Taiwan has announced “information technology should blend into subject teaching” which emphasizes learning should take place with the assistance of multimedia material to promote subject learning. Language requires a lot of input and practice. In addition, information technology blends into teaching increasing the variability of the course. From the perspective of English language teaching, the integration of information technology provides rich database resources as well as enhances a fully interactive learning during class.

MOE (Ministry of Education) of Taiwan aims to achieve universal primary education. However, significant challenges remain, particularly the huge gap between urban and suburb areas. It is believed that information and communication technologies (ICTs) can provide new modes of delivering and transforming teaching and learning process, in which interaction and communication is facilitated.

Current research intends to explore the potential of integrating mobile devices, such as smartphones, tablet computers and other mobile devices as educational tools inside and outside the classroom with alternative educational outlets (Collis & Wende, 2002; Prensky, 2007). In addition, increasing attention to mobiles outside the classroom should be recognized not just as social and entertainment devices, but as learning tools. How mobile devices are changing the way students learn and think about learning will be the significance of the research. The study might also bring about influence of the traditional student-teacher dynamic.

In light of the internationalization of English, Education should change progressively along with the science and technology in order to innovate some traditional teaching methods in children's English teaching and learning. With respect to English teaching, integration of information technology not only provides a rich database resources, more is to help teachers to create the best media interactive learning (Lai, 1998). Establishing an appropriate learning environment and developing effective teaching strategies are characteristics of children English teaching (McGlothlin, 1997). The multimedia materials concentrate words, videos, and variety of multimedia characteristics to make computer materials adapt individual demand to reinforce elasticity and interaction (Lippert, 1989). Therefore, educators must rethink current pedagogical strategies in order to increase educational achievement and learning outcomes.

With the promotion of technology, the ways of teaching have become more and more diversified. The unique aspect of a MALL (Mobile-Assisted-Language-Learning) system is that is not confined to a classroom, or the part of the day when the learner happens to be at a computer. In addition, the multimedia auxiliary not only allows children to have diversified learning environment and promotes their learning motivation, but it also provides the English learning whenever and wherever possible.

This study aims to create a different mode of teaching and learning that is speech-synthesis. Speech technology in computer-based systems can be used to

teach foreign language skills via creating robust interactive environments. Technology connected to the Automatic Speech Recognition (ASR) provides elementary school students a touchable learning companion. Text-to-speech (TTS) is one kind of speech technology, which transforms texts into voice files. TTS is like a learning robot, which has human's pronunciation and interaction to bring up learners' motivation. With fore-mentioned functions transformed into video clips shown in multimedia materials makes students to be clear at a glance, and clearly realize their problems should be improved.

In Taiwan, most teachers use traditional teaching methods, such as imitation, recollection and oral repetition practice. The TTS synthesis by rule has now reached human-like quality (Dutoit, 1997). The TTS technology is now reaching the stage where it can be applied to MALL. If teachers use TTS to facilitate teaching, it might result in high motivation, high learning self-confidence and low learning anxiety. TTS not only helps normal students to learn, but also assist blind people to recognize words through audio signals.

With the advancement of technology, the impact of English learning combining mobile devices has dramatically increased. Given the strong interest in the potentials of computer technology in language learning, mobile-assisted-language-learning (MALL) enhanced EFL learning. In addition, MALL not only boosts the self-learning and the motivation of children, but it also brings the welcome air of novelty to break the boredom of the language classroom. As a consequence, this study seeks to explore the process of designing an appropriate courseware. Furthermore, it examines the level of the acceptance of a mobile language learning application on elementary students featuring children English literature.

Research Questions

1. The level of acceptance of the Text-to-Speech and English children literature App on elementary students.
2. Whether the synthesis of Text-to-Speech (TTS) and English children literature improves the interest of learning English of elementary students.

Literature Review

M-Learning (Mobile Learning)

In the light of the development of mobile devices, a new form of learning environment was set up in which students can become totally immersed in the learning process, namely the mobile learning (M-Learning) (Kong, 2013). M-learning is beneficial for several reasons (McTeer, 2014). M-learning is a flexible educational technology that learners can learn anywhere at any time. M-learning can also be cost-effective, because most people possess mobile devices and learn without going out.

M-Learning is trans-regional limitation and a kind of learning way. Not only can learning take place in the classroom, but it also can happen in any

places. The application must perform the content of learning in effect, and provide educators and learners bidirectional exchanges. It is a wireless service so that learners will not be limited to time and location in learning (Harris, 2001).

There are varieties of aspects toward M-Learning. According to Living Technology Education Journal (2009), there are two parts in terms of education, 1) Innovative materials: exploring learning, cooperation learning and application software and 2) Assist traditional learning: promoting learning effect, instead of old tools (Chang, 2006). In addition, the popularity of smartphones and PDAs results in overall digital learning stage of the teaching activity and these devices have become the mainstream in the future. Mobile technology provides various resources and tools for language learning that encourages learners to be more motivated, autonomous, and socially interactive (Kim & Kwon, 2012). Traditional learning methods have transformed to M-learning in which people can learn anytime and anywhere (Chen & Hsieh, 2006).

M-learning can be implemented in many forms, such as face-to-face, distant, or online modes. Although using mobile phones to learn may take more time than computers, learners feel more freedom of time and space, so that they can spend their spare time to learn a second language when and where they are (Miangah & Nezarat, 2012). English learning will not be confined to written textbooks anymore. The advantage of mobile learning brings convenience to our daily life. Instead of physically participating in the traditional classrooms, M-Learning can be developed anywhere.

TTS (Text-To-Speech)

Nowadays, the technique of TTS has developed gradually. TTS is an artificial voice, which may be exempted from the trouble of pre-recorded, and save time and money at the same time. In addition, the sound engine of TTS system has increased a lot of rhythm tones to make synthetic speech lively. According to Dutoit (1999), his points out two modules of Text-To-Speech (Figure 3).

1. Natural Language Processing (NLP). It is a kind of language technology, used for everyday communication by humans. This module supplies in a wide sense to cover any kind of computer manipulation of natural language, combining the tone and the sound.
2. Digital Signal Processing (DSP). This module converts the received symbol information into speech.

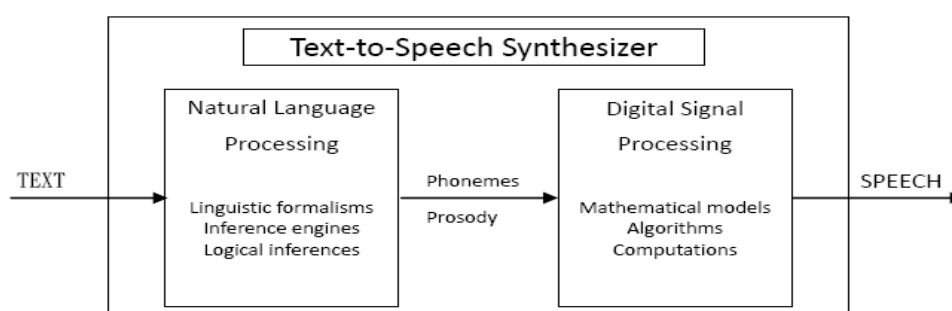


Figure 1. The Basic Operation of TTS

Text-To-Speech (TTS) plays an important role between learners and the computer, because speech as a communication interface is the most convenient and humanized. Compared with the traditional interface text, Text-To-Speech brings a cordial feeling and convenience. Furthermore, this system can break through the limitation of time and space. It can be employed anytime and anywhere. The most important, it provides a non-compulsory and no episodes of learning environment. In addition, if learners continue to practice the system, it will promote their oral and the confidence of speaking English spontaneously and simultaneously.

The application of TTS in language learning

Text-to-Speech (TTS) and Speech Recognition are commonly applied on language learning. The key point is the technology makes computers understand the significance of human speech (Ehsani et al., 1998; Neumyer et al., 1998). TTS can turn text information into voice reading, using the technique of artificial intelligence and natural semantic analysis. This technique can clearly read out the simulated human sound, with natural pronunciation, and the learner can adjust the speed and frequency on their own. The most important, it can facilitate the blind to learn new things.

Application Software (App)

Applications software on education can be used as a complement to the course, for home-schooling purposes, or for parent-guided literacy activities. They range from tools for storytelling, development of writing skills, and multi-sensory phonics-based instruction. There are also a large variety of apps that can be used to enhance organizational skills for students with learning disabilities.

Methodology

An exploratory design was conducted for data collection and analysis in this study. According to the statistic analysis, discussion, suggestions and pedagogical implications were provided. The App was designed mainly for elementary students. For the utmost achievement, multimedia animation technology as well as TTS technology was adopted to create a mobile application with diversification.

The researcher hopes to set up a new learning mode which can inspire children to learn English and stimulate students' interest in English learning and gain more knowledge in an amusing way. Consequently, the researcher designed an App combining TTS and animation for elementary students especially with the integration of children English literature. The App adopted a lively, romantic and interesting story as the main subject so as to inspire children to learn English and acquire English knowledge in an interesting way.

This study is divided into five stages. The first stage is Learning Mode Initialization. This stage is mainly to define the motivation, purpose and research questions. Afterwards, documents and references are collected at this stage in order to initialize the design of the learning mode. The second stage is

Actual Operation stage. In order to correspond to the level of elementary students, a well-known English children literatures with basic 1200 English vocabularies embedded is adopted as a topic to establish this application featuring TTS. The third stage is Data collection. Elementary students are the subjects of this experiment to explore the effectiveness of the mobile learning application. During the experiment, the conductor carries out an experiment by means of distributing a bilingual questionnaire. This part provides information for further analysis. The fourth stage is Data analysis. According to the statistic analysis, discussion, suggestions and pedagogical implications are provided at the fifth stage.

Instrument

A survey questionnaire invented by the researcher with both English and Chinese versions was employed, including 5-scale questionnaire for investigating participants' acceptance toward the app. The questionnaire was divided into two parts. The first part is basic information. The second part is to evaluate the overall design and effect of the App integrating TTS and children English literature. All subjects were asked to fill out the questionnaire and the participants were told that the purpose of the tests was to evaluate the level of the acceptance toward the app in terms of three aspects, including preference, involvement, and activeness.

The mobile application, which combines with TTS, and English children literature, was adopted in this study in order to determine the effectiveness as well as the satisfaction. There are verbal and visual effects in the application created for children to easily understand words or sentences.

Subjects

The target subjects were an unselected convenience sample. One hundred 5th and 6th grade students voluntarily participated in this study. Participants experienced the App for one lesson (fifty minutes) and filled out the questionnaire in order to receive the analysis with validity and reliability.

Materials

In order to create a joyful teaching and learning environment, "The Little Mermaid" was chosen to be the materials of this research. The App integrating TTS and children English literature was designed into three parts composed of main story, reading, and listening comprehension games.

Data analysis

The backgrounds of the subjects were first analyzed based on the collected information, including participants' English learning experiences and years of using computers and Internet. Secondly, the level of acceptance and the willingness of participants were analyzed according to the results of the survey questionnaires in order to examine whether the App affected students' learning

efficiency.

Results of Data Analysis

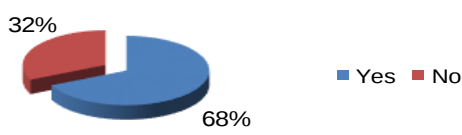
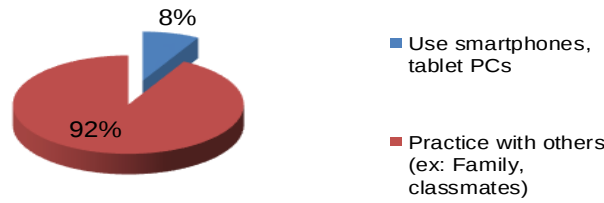
Demographics

The subjects were one-hundred 5th and 6th grade students. Among these participants, 43 % were males and 57 % were females. Most participants (60 %) reported they have learned English for 5~6 years; 32 % of the participants have learned English for 3~4 years and 8 % of the participants have learned English for 1~2 years.

Among the participants, 33 % of the participants have started learning English since 1st grade; 3rd grade is next and 27%. Kindergarten is 23% and the remaining 17 % of the participants have started since 2nd grade. The data collected from the questionnaire also revealed that the majority of the participants (88%) learned English from cram school; none with tutors or through self study and the remaining 12 % learned English from bilingual school.

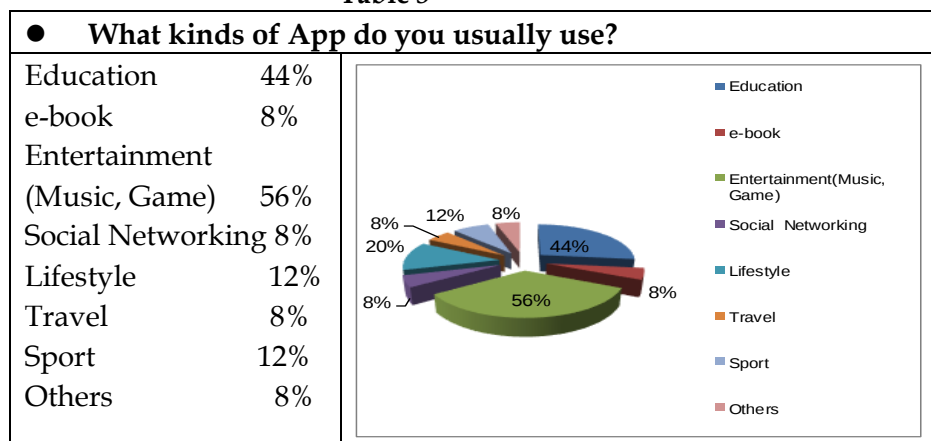
In the question “Will you practice English outside English class?” 32 % of the participants do not access English at all outside the classroom; 68 % of the participants said “Yes” among which 92 % of the participants practiced with others (ex: Family, classmates) and only 8 % of the participants practiced English through smartphones or tablet PCs (Table 1 & 2).

Table 1 & 2

● Will you practice English outside English class?	
Yes 68% No 32%	
● By which means?	
Use smartphones, tablet PCs Practice with others (ex: Family, classmates)	8% 92%
	

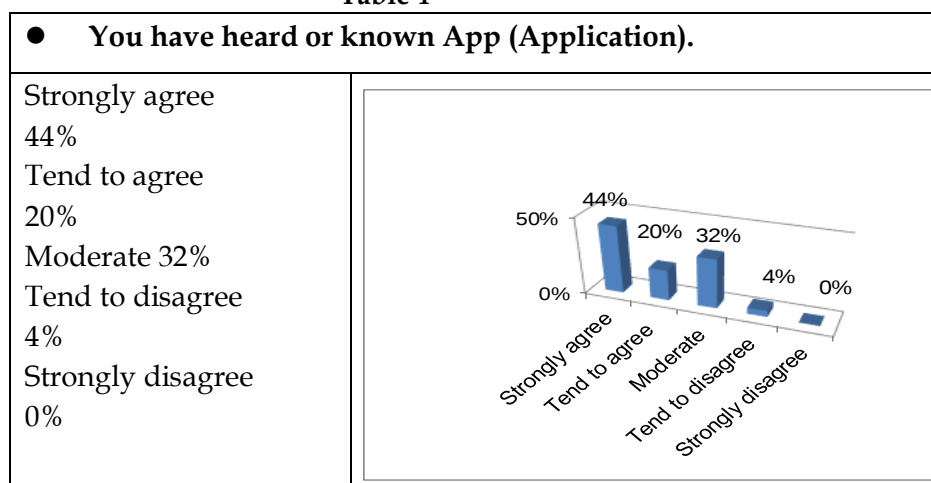
In terms of the question “What kinds of App do you usually use?” among the participants, 56% of the students reported that the main purpose of using App is for Entertainment, including music and games. 44% of the participants use App for Educational purpose; 12% for Lifestyle; 12% for Sport, and 8% for E-book, Social Networking, and tourism respectively (Table 3).

Table 3



Regarding question “You have heard or known App (application)”, the result revealed that the majority, 64% of the participant, have heard App and they usually download entertainment Apps (music, game). 32% of the participants have no opinion and remaining 4% of the participants have barely heard about App (Table 4).

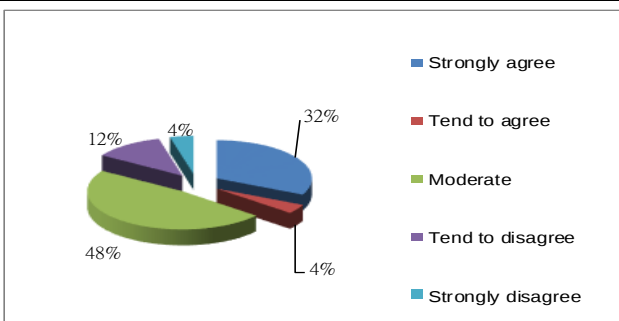
Table 4



With regard to question “You have ever downloaded some educational Apps software before.” 36% of the participants agree to the statement; 48% of the participants remain neutral and remaining 16% disagree on the statement and thought they have never downloaded any educational Apps before (Table 5).

Table 5

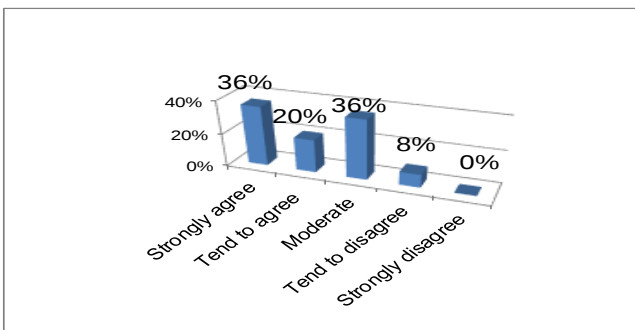
● You have ever downloaded some educational Apps software before.	
Strongly agree	32%
Tend to agree	4%
Moderate	48%
Tend to disagree	12%
Strongly disagree	4%



As for question “The synthesis of TTS (Text-to-Speech) and children English literature App is very useful after you use it”, the results indicated that over half of the participants (56%) satisfied with the overall design of the App and considered it really useful toward the synthesis. 36% of the participants think the synthesis of TTS (Text-to-Speech) and children English literature App had moderate effect. 8% of the participants disagree on this statement (Table 6)

Table 6

● The synthesis of TTS (Text-to-Speech) and children English literature App is very useful after you use it.	
Strongly agree	36%
Tend to agree	20%
Moderate	36%
Tend to disagree	8%
Strongly disagree	0%



In terms of question “In your opinion, the synthesis of TTS (Text-to-Speech) and children English literature App is well-designed”, 52% of the participants considered it well-designed. 48 % had a neutral stance and none of them responded negatively (Table 7).

Table 7

● In your opinion, the synthesis of TTS (Text-to-Speech) and children English literature App is well-designed.													
Strongly agree 36%	<table><caption>Data for Table 7 Bar Chart</caption><thead><tr><th>Response</th><th>Percentage</th></tr></thead><tbody><tr><td>Strongly agree</td><td>36%</td></tr><tr><td>Tend to agree</td><td>16%</td></tr><tr><td>Moderate</td><td>48%</td></tr><tr><td>Tend to disagree</td><td>0%</td></tr><tr><td>Strongly disagree</td><td>0%</td></tr></tbody></table>	Response	Percentage	Strongly agree	36%	Tend to agree	16%	Moderate	48%	Tend to disagree	0%	Strongly disagree	0%
Response		Percentage											
Strongly agree		36%											
Tend to agree		16%											
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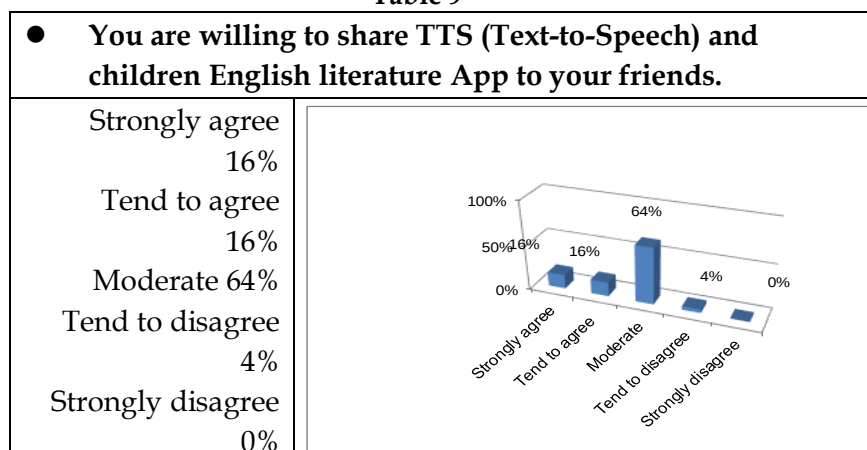
With regard to question “You want to download TTS (Text-to-Speech) and children English literature App”, 72% of the participants have ordinary feeling toward the App. 16% of the participants would like to download it and only 4 % of the participants disagree on the statement (Table 8).

Table 8

● You want to download TTS (Text-to-Speech) and children English literature App?													
Strongly agree 8%	<table><caption>Data for Table 8 Bar Chart</caption><thead><tr><th>Response</th><th>Percentage</th></tr></thead><tbody><tr><td>Strongly agree</td><td>8%</td></tr><tr><td>Tend to agree</td><td>16%</td></tr><tr><td>Moderate</td><td>72%</td></tr><tr><td>Tend to disagree</td><td>4%</td></tr><tr><td>Strongly disagree</td><td>0%</td></tr></tbody></table>	Response	Percentage	Strongly agree	8%	Tend to agree	16%	Moderate	72%	Tend to disagree	4%	Strongly disagree	0%
Response		Percentage											
Strongly agree		8%											
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Tend to agree 16%													
Moderate 72%													
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Strongly disagree 0%													

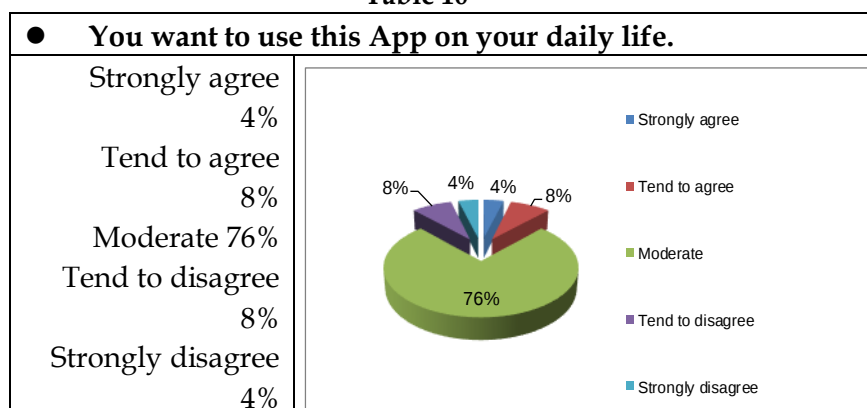
As far as the following question was concerned, 32 % of the participants are willing to share TTS (Text-to-Speech) and children English literature App to their friends. On the other hand, majority of the participants (64%) depended or had no idea and only 4 % of them are unwilling to share (Table 9).

Table 9



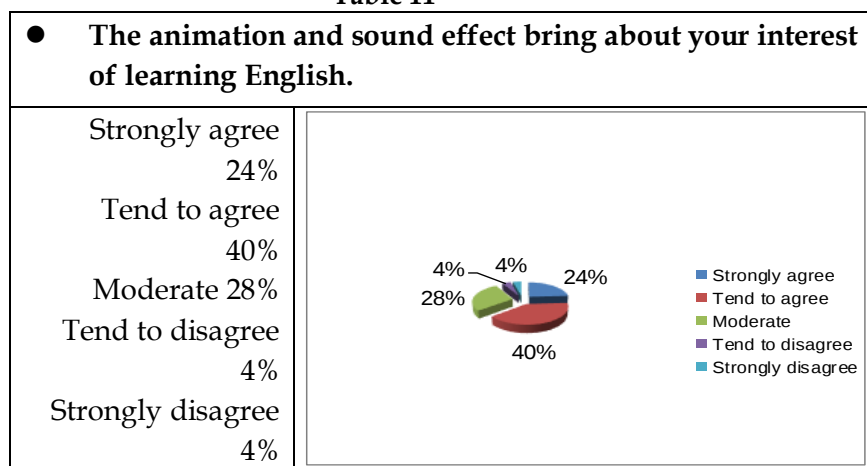
According to next question “you want to use this App on your daily life?”, 76 % of the participants considered it with moderate effect; 12 % of the participants agreed they felt useful and would like to download this App so that they can use anytime and anywhere and the remaining 12 % reported negatively (Table 10).

Table 10



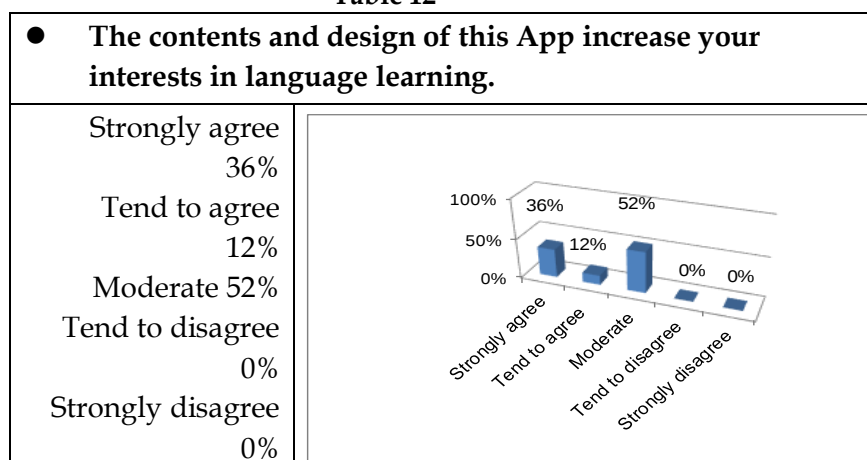
Regarding the question “the animation and sound effect bring about your interest of learning English”, over half of the participants (64%) supported the idea of using visual and sound media. 28% of the students considered it with moderate effect and the remaining 8 % implied the sound effect of generated speech is not natural enough to make the story lively and active which might influence the interest of English learning through this App (Table 11).

Table 11



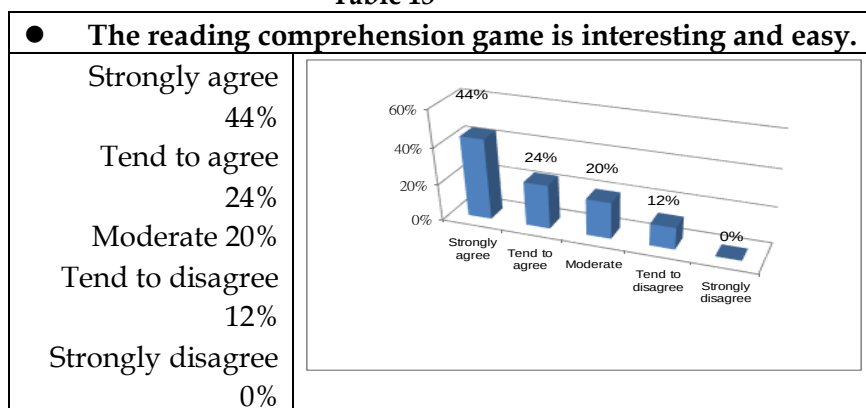
In terms of the following question “the contents and design of this App increase your interests in language learning”, 48% of the participants expressed they are familiar with the literature and extremely like the presentation and the contents. However, over half of the participants (52%) considered it with moderate effect and none of them disagree on this statement (Table 12).

Table 12



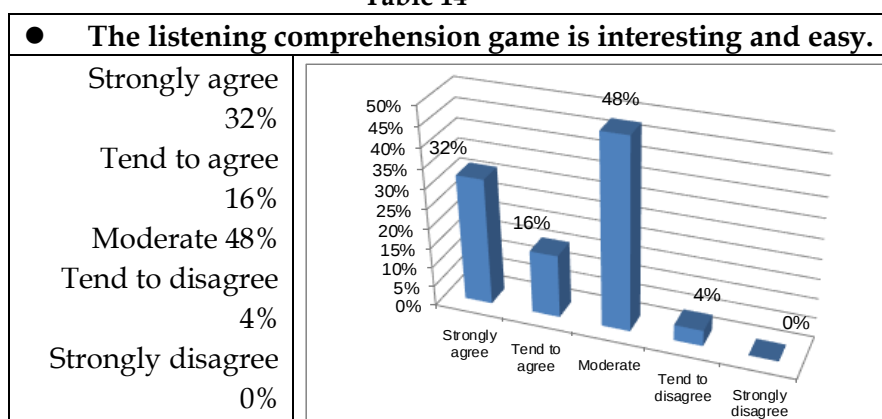
With regard to the question “The reading comprehension game is interesting and easy.” the results shows that majority of the participants (68%) thought it is pleasant and understandable toward operating the game; 20 % of them considered it moderate and the remaining 12 % disagree on this statement (Table 13).

Table 13



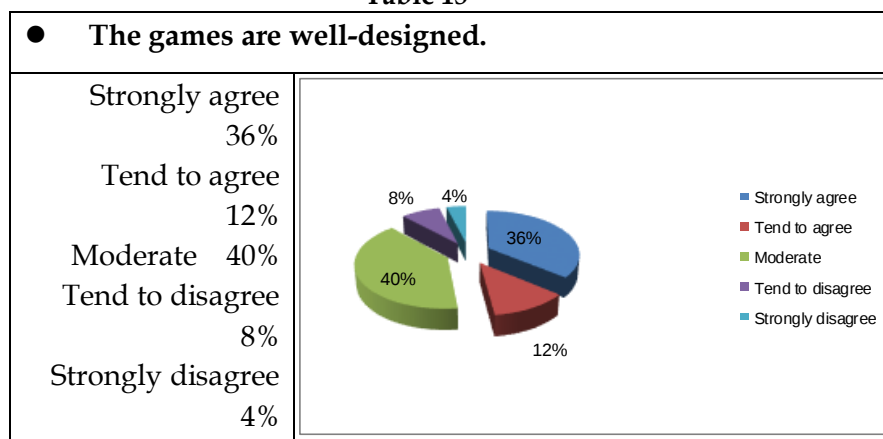
With regard to the question “The listening comprehension game is interesting and easy.” the results shows that 48 % of the participants thought it is pleasant and simple. On the other hand, 48 % of them considered it moderate and the remaining 4 % disagree on this statement (Table 14).

Table 14



According to the last question “The games are well-designed.” the results indicated that a majority of students (48%) satisfied with the overall design of the games and considered it really easy and understandable; 40% of the participants had no opinion and the remaining 12% of them implied they encountered a bit difficulty toward the game operation (Table 15).

Table 15



Discussion

In recent year, smartphones seem to be a trend in this society. With the great popularity of smartphones, there are lots of inventions coming up such as App, Android Market, QR Code, etc. In this way, students can download the App of English learning material and practice outside the classroom. After designing this App, the researcher did a survey toward App and investigated the satisfaction of this creation.

From written children story books in the past to the present e-books, the language learning system has shown a great advancement. With the voice, image and other modern technology, English learning has become to be abundant and practical. The effect of combining animation and sound is far better than the traditional children story books, which are more vivid and interesting as a whole. For children, this App not only possesses educational effect but it facilitates tem to download games with lively effects. In addition, due to the habitual behavior of Taiwanese, children are fond of sharing things with others once they get it.

Regarding the level of acceptance, participants express their preference toward the design of games and the app. In addition, majority of the participants considers this app helpful, which shows their great involvement of the operation. With regard to reading and listening comprehension games, participants think it is interesting and interactive because the content is well understood. In addition, sound effect such as hand clapping sound or spring sound coming with each question is really encouraging and inspiring. As a consequence, the synthesis of Text-to-Speech (TTS) and English children literature improves the interest of learning English of elementary students.

Nevertheless, few students reflect they do not like to be quizzed because they dislike the feeling of examination under huge time pressure. Moreover, there is no follow-up explanation section and learners might get confused. Among some questions, participants have no opinion toward the willingness and activeness of the usage. The reasons are provided as follows. First, TTS is mechanical voice, which is different from real man voice after all. Next, the

harmony of subtitles and sound does not reach at a satisfactory level. In addition, the story is more inclined to girls, which does not take general population into consideration. After that, some children indicate they are not familiar with the operation of the interface. Furthermore, most of the participants implied they prefer downloading Apps for entertainment or games. Few children have interests toward educational Apps. Finally, the researchers did not come up with the sequel or advanced level of the story so that it might be the main reason our educational App does not catch their eyes.

According to the results, children agree the design and content of this App has learnability and has aroused their interests of English learning. On the other hand, some children consider the content is too easy and it is not challenging enough. Furthermore, it is not easy to operate the app via mobile phone partly because the screen is too small.

The result of this survey showed that App is a powerful tool to deliver mobile information and knowledge in this E-era. Users may search and use appropriate Apps in daily life and learning. Mobile learning is a trend and more and more students may learn without time and space limitation. Learning languages by situational and simulating teaching is a good and life-long strategy. Additionally, TTS is an incredible tool to provide more authentic listening input. By using this App, learners can promote self-study in learning languages.

Conclusion

Generally, parents are aware of the tendency of the global village, and they are afraid that their children will fall behind others at the beginning in the fiercely competitive society. Therefore, the researcher hopes to establish a new learning mode, which can motivate children to learn English as well as arouse their learning interests.

It is estimated that the annual growth rate of children e-books are around 60% and can be up to \$1.3 billion in 2015. Mobile application can interact with books than traditional written books, which are more popular with the kids and their parents. The researcher observed this tendency and investigated the influence of one innovative learning mode regarding the effectiveness of English learning with the use of TTS technology and children English literature.

In recent years, many studies have confirmed that correct, appropriate application of using technology to assist teaching, effectively enhances learning (Kitao, 1993; Warschauer & Healey, 1998). In addition, according to Cheng (2001), his research shows that combining information technology with teaching not only increases the variability of the curriculum, but it also builds up autonomous English learning which is another way of teaching innovation. It helps children in the absorption of language knowledge, and cultivates the ability of language use.

Information technology uses the characteristics of information technology in teaching to create deep learning. According to Jonassen, Peck & Wilson (1999), their research shows by means of computer facilitates the children learn to break the bondage of written materials. Internet technology builds an online learning

environment to promote learning and create intellectual interaction, which is the manifestation of information science and technology into teaching.

This study adopts children's English literature as the topic featuring Text-to-Speech and animation in the context. Designing and establishing a lively teaching material assists teacher in English teaching. By the employment of animation as the teaching tool, students' learning motivation and comprehension will be more easily to be promoted and improved in order to replenish the deficiency of traditional English teaching methods. Students can learn the course materials either in class setting or e-learning with self-paced studying modes. In addition, constructing versatile English teaching/learning environment can enhance students' learning interests and willingness to boost learning effectiveness.

Designing an appropriate courseware along with App makes teaching resources varied and practical for learners in various learning domains. In light of this prospect, the researcher looks forward to providing teachers and students with more complete and diversified digital learning avenues. This project can be a good pedagogical reference for other researchers and educators to share technical English teaching.

Potential Implications and Contributions to Academics

With the advent of digitalization, more and more learning modes with diversification like APP, PDA, and digital passport are used more frequently. TTS engine relying on the current Android Platform supports several major languages, such as English, French, German, Italian and Spanish. TTS can freely converted text into any voice output of the above five languages. However, in the development of TTS technology, intelligibility and naturalness of the generated speech are the major issues being concerned in terms of system performance.

From the aspect of academic achievement, the educators can take advantage of technological innovation to edit their own teaching/learning materials. In light of the discrepancy of each learner, various teaching strategy should be put into consideration. This technology for English teaching is really a technical breakthrough. Students can learn the course materials either in class setting or e-learning with self-paced studying modes. In light of this prospect, the researcher hopes to achieve this expectation in the near future and looks forward to providing teachers and students with more complete and diversified digital learning avenues. This project can be a good pedagogical reference for other researchers and educators to share technical English teaching.

One goal of English education is to promote students' ability of independence, lifelong learning and learning motivation. In order to achieve this goal, continuity is an important factor influencing and motivating users to their mobile applications. The accessibility and interaction of information allows learners to access learning material in a variety of situations and will likely influence how they use their mobile devices. Rainger (2005) states that

accessibility is the “key to strategies to support inclusion, participation, and diversity within education and training” (p. 57). Therefore, educators should advocate uses of technology so as to maximize learners’ inclusion in the learning process.

In recent year, smartphones seem to be a trend in this society. Under this circumstance, using M-learning software combining TTS and Adobe Flash interactively and simultaneously enables students to become more versatile in language acquisition. Employing current constructed mobile learning application as a basis can continuously carry out the reinforcement of students’ foreign language ability. As for the future investigation, more technical breakthroughs in curriculum and instruction need to be put into consideration, in order to gain an overall picture of the optimal outcomes of language learning.

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Implementation of Peer Reviews: Online Learning

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Abstract. With the increasing use of online learning, many teachers and instructors are using peer evaluations to enhance the students' learning experiences. Peer reviews have shown a wide range of benefits, including increasing competency in the course material, yet there are some limitations stemming from lack of guidance or structure in peer review assignments. A lack of structure has continually been seen across disciplines. This was experienced in an English grammar, online learning course at a Southwestern Ontario university. Working with no clear guidelines for peer review assignments, a Four-Step Model was created that enhanced clarity, direction, and objectivity as well as detailed what students should and should not include when completing a peer review. Subsequent changes to the course were made to accentuate the benefits of peer reviews. The Four-Step Model can easily be adapted to suit any peer-based assignment, regardless of course subject or form of teaching.

Keywords: Peer Review; Online Learning; Four-Step Model

Introduction

The use of technology in the classroom is becoming increasingly popular, and "the growth of online courses does not appear to be slowing" (Atchley, Wingenbach, & Akers, 2013, p.104). The past decade has seen online instruction as a common delivery model in many higher education institutions (Green, 1997). Online learning allows students to complete courses from a number of colleges and universities, and traditional higher education institutions have begun to offer online courses (Brigance, 2011). Further, demographically diverse students, who are an increasing population, want options regarding the delivery of courses they take (Ulrich & Karvonen, 2011). Since online education is becoming a preference for higher education students, colleges and universities

need to adapt or risk losing a share of the market with respect to enrolment, which then impacts tuition money.

In 2000, there were approximately 275 million Internet users globally, and in 2002, this number increased to approximately 605.60 million (NOIE, 2001). It is difficult to determine the exact number of Internet users; however, the number of Internet users is expected to double every six months (Hosie, Schibeci, & Backhaus, 2005, p. 540). When Internet use and education is examined, Bell and colleagues (2002) suggest that by 2025, there will be 30 to 80 million online learners. This range of students (30 to 80 million) is large, since the definition of an online learner may be conceptualized in more than one way. This estimation demonstrates how learning will be delivered, and higher education institutions that do not start to provide online learning now may have to play catch-up in the near future.

According to the literature (see Bell, Bush, Nicholson, O'Brien, & Tran, 2002), one benefit of studying online is that students can self-pace their learning. For instance, students can watch tutorials as many times as they would like if tutorials are a part of that online course; however, this option may not exist in a traditional lecture. Online learning encourages independent learning, and it does not confine students to one location, as students can complete online courses with access to the World Wide Web (Rosenberg, 2001). It can also give students flexibility in their schedules (Dekhane, Napier, & Smith, 2011). Flexibility in schedules may decrease student drop-out rates, as students have more control of when to complete the online lecture.

Watson and Rutledge's (2005) study on student satisfaction asked student participants what they enjoyed most about taking an online course. The following themes emerged: "being able to complete the work at their own pace, convenience/accessibility/flexibility, not having to drive to campus, and being able to complete course work around their employment schedule" (p. 14). These student-identified advantages may provide students with empowerment compared to what a traditional lecture-style course would, as they have more control over their learning regarding when to do the online lecture, being able to stop it, and return to it.

The next section will provide a literature review regarding the potential benefits and limitations associated with incorporating student peer review into courses, as well as instructors' experiences of administering peer review into their courses.

Literature Review: Peer Reviews to Enhance Learning

Over the last decade, research (see Hu, 2005; Lundstrom & Baker, 2009; Rubin, 2006) has focused on the importance of incorporating student peer review as an assessment strategy to enhance learning. Mittan (1989) was one of the very few researchers who highlighted the various benefits of the peer review process, including how it allows students to receive varying views on their writing while gaining confidence in their ability to write and critically evaluate others' work. Although research is limited in this regard, some researchers have conducted studies to explore the advantages and drawbacks of the peer review process. This section of the paper explores the potential benefits and limitations

associated with incorporating student peer review into courses. It will also discuss instructors' experiences of administering peer review into their courses to provide new and critical understandings into aspects of university teaching and learning.

Implementation of Peer Reviews: Benefits. Lundstrom and Baker's (2009) research, which consisted of "ninety-one students enrolled in nine sections of writing classes at the English Language Center (ELC) at Brigham Young University" (p. 33), focused on who benefited most from the peer review process: givers or receivers. Students in an upper beginner's course and an intermediate course were each divided into either givers or receivers of peer reviews. Their findings demonstrated that giving feedback on writing was more beneficial than receiving feedback: the givers improved more on their essay scores than those receiving peer reviews. This effect was, of course, mediated by experience: no difference was found between givers and receivers amongst those individuals in the intermediate course group who were familiar with peer reviews. Their study demonstrated the effectiveness of peer review activities, as well as how this process can be very effective in developing student writers, especially at lower proficiency levels (see also Likkell, 2012).

In a study by Liu and Sadler (2003) the researchers investigated the effect and affect of technology-enhanced (Microsoft Word commenting) versus traditional peer review (face-to-face interaction). Their study consisted of 48 students enrolled in a second semester composition course located at a large Southwestern university in the United States. The researchers found that the combination of technology-enhanced and traditional peer review yielded many benefits for students: high motivation, low anxiety, and active participation (among others). However, the researchers found that while students preferred online interactions, the results demonstrated that face-to-face can be more effective, as the nuances involved in body language cannot be mirrored with online discussions. From this study, the researchers concluded that "the use of electronic peer review may serve as an effective tool for the peer review and revision processes" (Liu & Sadler, 2003, p. 221).

This discussion has explored some of the benefits of the peer review process. Aside from the previously mentioned studies, other researchers have also provided some critical insight on the benefits of peer review. In discussing the benefits of peer review, Stanley (1992) stated that peer review encourages students to develop productive attitudes toward writing. Hu (2005) discussed how peer review helps "raise students' awareness of their strengths and weaknesses as writers" (p. 324): it also fosters a sense of text ownership (opportunities for students to explain, defend, and clarify their arguments) (see also Tsui and Ng, 2000). Hu (2005) also argued that peer review provides "opportunities for students to detect mismatches between intended and understood meaning, helping them develop a sense of audience" (p. 324) (for further discussion see Liu and Sadler, 2003; Paulus, 1999). Further, Villamil and de Guerrero (1996) stated that peer review could help establish "the social basis for the development of cognitive processes that are essential to revision" (p. 67). Essentially, the authors highlight how the peer review process can improve the quality of student writing.

Implementation of Peer Reviews: Limitations. Mangelsdorf and Schlumberger (1992) conducted a study to explore the usefulness of the peer review process. Their study consisted of 40 students enrolled in a first-semester freshman English as a Second Language (ESL) composition course at the University of Arizona. Although students' perceived peer reviews as advantageous (e.g., in helping to revise their papers), the majority of the students (77 percent) stated that "peer reviews had neither helped them to be responsible for their improvement, nor to be confident in their ability to critique a text" (Mangelsdorf, 1992, p. 280) (see also Mangelsdorf and Schlumberger, 1992). Also, students consistently mentioned that a limitation for them was trusting in their peers' ability to accurately make revisions. Some students noted that others provided critiques which were not very useful (e.g., vague or complimentary comments). In short, students lacked trust in the feedback they received and questioned its validity. Some of the potential limitations of peer review have also been discussed by a number of authors. For instance, Villamil and de Guerrero (1996) discussed the potential drawbacks to student peer review, citing limited knowledge of the target language and difficulty in critiquing texts written by peers who have language barriers as examples. Hu (2005) argued that students may "lack the knowledge and skills to differentiate [between] valid and invalid peer feedback and to revise [their writing] accordingly" (p.325) (see also Leki, 1990; Stanley, 1992). Liu and Sadler (2003) discussed how some students tend to provide vague comments (e.g., fix this sentence) when critiquing content, organization, and idea development. When it comes to providing constructive feedback, Nelson and Murphy (1992) explored the implications of hostile, over-critical feedback. Essentially, there may be a fear associated with the peer review process: a fear of being ridiculed by peers due to language barriers, for instance (Nelson & Carson, 1998). Further, de Guerrero and Villamil (1994) noted how some students may react negatively to critical comments: "These attitudinal problems can generate a sense of discomfort and uneasiness among the participants" (Liu & Sadler, 2003, p. 194). Unfortunately, this can result in peer review turning into a damaging activity instead of a constructive one. It is essential to note, however, that carefully designed peer review training can help improve some of these concerns (Hu, 2005).

Executing Peer Reviews in the Classroom: Instructors' Experiences

A current trend in academia is a push to teach students effective communication of the course material (with their peers) in a professional and critical manner, rather than lecturing students who simply memorize information. To facilitate such learning, a promising method is to have students participate in the peer review process (Rieber, 2006; Topping, 1998). Exactly how peer reviews have been carried out in post-secondary classes has been widely diverse, from how often students participate in the peer review process, to the impact the peer reviews have on their final grade. Understanding how instructors approached the inclusion of peer reviews highlights some of the effective aspects of participating in the peer review process.

Mangelsdorf (1992) implemented the peer review process in her first-year composition course. She offered a guideline for how to conduct peer reviews, identifying some key steps for implementation. First, students must be taught

how to conduct a peer review: this is followed by an interactive learning session where the process is modelled by the teacher with the involvement of the students. In this interactive learning session, the instructor would read a few sample drafts (with student permission granted) and discuss the strengths and weaknesses of the draft, as well as discuss how the student could revise their paper. At this stage, the focus is on content and organization, rather than style and grammar. Then, it is important to practice how to make suggestions for revision, focusing on how to be polite, clear, and specific. After a peer review assignment is completed, Mangelsdorf stated that the instructor should discuss with the class whether the peer reviews were helpful or unhelpful. This early suggestion, as to how to conduct reviews, offers a very basic outline for implementation – Mangelsdorf did not highlight what to teach. This problem has been pervasive as researchers consistently use varying ways to implement peer reviews.

Lundstrom and Baker (2009) conducted peer reviews throughout the semester (on four separate occasions) in order to train students on (1) how to write effective introductions; (2) how to use feedback to revise an introduction; (3) how to give effective feedback on introductions; and (4) how to improve a thesis statement when given a sample essay by another student. Students were asked “to look at the same issues in [a sample] essay [and] were [asked] to revise the paper and provide suggestions on how to improve the paper” (Lundstrom and Baker, 2009, p. 33). “[The] findings may suggest that reviewing peer writing helps students learn global aspects of writing more than does learning how to interpret peer feedback. However, the lesson plans given ... focused solely on global aspects of writing, so this result is not surprising” (Lundstrom & Baker, 2009, p. 38). In summary, Lundstrom and Baker expressed the complexity of setting up peer reviews as how to train students, create groups (receivers vs. givers), determine the types of assignments, and how to go about peer reviews, which all need to be taken into consideration. Although their implementation of the peer review process seems useful, it would appear as though it would be a daunting task for instructors to implement into their courses.

Marcoulides and Simkin (1991) used the peer review process for a term paper for 60 students in two sophomore computer classes. Prior to participation, instructors fully explained what was required of the assignment: students had a choice regarding topic, paper length, bibliography, and format. On the day the assignment was due, students were required to grade one another's paper in class. Students marked based on subject matter, content, and writing mechanics. Term papers were reviewed separately by three students blind to other comments and were then collected and redistributed (at random) two more times for reading and evaluation purposes. The researchers found that student raters were reliable in scoring, grading a paper (on average) within 2 points of each other on a score out of 20, and also valid, as the instructor's grade differed from the average of the three grades by 1 point. The authors highlighted that “one finding of the present study is that, when provided with a predefined evaluation form, students are consistent in their overall assignments of grades to papers. Our analysis also reveals that students are not always consistent in the specific reasons or criteria they use to downgrade papers, but only marginally so” (Marcoulides & Simkin, 1991, p. 83).

Rubin (2006) was interested in implementing the peer review process in his business management course. As an assignment, teams of four were required to write a business report. Each team submitted four copies of a draft that was at least 80 percent complete. The four drafts were stripped of identifiable information and circulated to other students in the class. Each reviewer then resubmitted two copies of their review (within a week): one was retained by the professor and the other was handed back to the original group. To make sure peer reviews were optimally completed, recommendations by DeNisi and Kluger (2000), Schein (1999), and Nadler (1977) were followed. First, “feedback should be concrete, specific, and emphasize [description]” (Rubin, 2006, p. 385). To do this, Rubin (2006) asked students to follow four screening questions to complete a thorough review (no verification of this review was reported). Second, feedback should be presented in a non-threatening manner, where constructive intentions of both giver and receiver are present, and negative information is withheld. Here, the instructor coached students with examples of poor, average, and good quality assignments, and he explained to the teams to look for “the nugget of truth” within the reviewers’ comments. Third, information regarding how to improve the submitted work must be included in the feedback: this advice was followed by instructing students to evaluate the reviewers’ comments and indicate if all comments needed to be incorporated. Finally, there was a reward attached to working with the feedback data. Here, the instructor allotted 5 points (3 percent of the grade) for completing peer reviews. In regards to the effectiveness of this process, Rubin found that students preferred to give rather than receive feedback (this was based on a voluntary survey created by Rubin where 70 percent of the class completed the survey).

Hu (2005) used the peer review process with Chinese ESL student writers. Most students had studied English for six years; however, few had experience in academic writing in English. Students produced three drafts for six writing assignments. For each assignment, the process included the following: (1) writing a first draft; (2) receiving peer review (both oral and written); (3) writing a second draft; (4) receiving teacher feedback; and (5) writing a third, final version for the assignment. The author’s first attempt at the peer review process proved to be unsuccessful: students either rushed through the peer review process, or they did not dedicate time to complete the peer review process. Hu (2005) also found that students distrusted their peers’ abilities to critique, felt unable to judge valid comments, “focused on language and mechanics in response, expressed comments in inappropriate ways” (p. 331), did not incorporate peer responses, and felt as though there was not enough teacher follow-up with the students’ reviews.

To improve the peer review process, Hu (2005) researched and created 13 new training activities with varying aims and functions, in order to raise students’ awareness of the importance of giving and receiving peer review. To do this, Hu adopted a 3-step procedure: (1) read to look for meaning; (2) respond to macro issues; and (3) deal with language problems. To improve the major contributing factor of lack of adequate teacher follow-ups to student work, Hu (2005) went from “simply collecting written peer comments [to] marking [the] peer comments, presenting useful and problematic peer comments, responding to

written peer comments, demonstrating how to make helpful comments, [and] providing feedback on peer responses" (p. 336). Moreover, she also checked whether or not the student had included the peer reviews, and if they failed to do so, how it may have disadvantaged them. Hu found that students' attitudes towards the peer review process greatly changed from wanting to discontinue peer reviews during the first year, to appreciating its presence.

One final method that will be discussed is the Calibrated Peer Review (CPR), which was developed by the University of California, Los Angeles' (UCLA) Chemistry Department, supported by the National Science Foundation and Howard Hughes Medical Institute. CPR has been used as a way to integrate writing into classes which have a large number of students (Russell, Chapman, & Wegner, 1998). CPR is an online writing software that requires the class instructor to submit and mark an example of an assignment the class is required to complete. A student can then evaluate the calibrated assignment and compare their mark to the professors', thereby evaluating the peer review performance. CPR has been shown to help students score higher on traditional exams, where CPR was utilized with coursework (Enders, Jenkins, & Hoverman, 2010; Pelaez, 2002; Stokstad, 2001).

Likkel (2012) incorporated CPR into her introductory astronomy course (Survey of Astronomy) at the University of Wisconsin-Eau Claire. The participants in her study were students in three sections of her course: one section used the CPR system, whereas the other two did not use the CPR system. She found that the class that used CPR had a better idea of a well-written essay, had a better perception of the peer review process, and had a better "perception of their ability to evaluate their own [writing]" (Likkel, 2012, p. 42). Similarly, Hartberg, Gunersel, Simpson, and Balester (2008) also compared two sections of their senior-level biochemistry course, where they compared CPR feedback with Teaching Assistant (TA)-generated feedback. Students were required to submit research abstracts, including a background, methods, results, and discussion sections. In comparison, receiving TA-feedback produced a decrease in quality of abstracts submitted, while CPR improved abstracts. Moreover, TA-feedback only outperformed CPR on the background section of the abstracts.

Peer Review Development at a Southwestern Ontario University

Ambiguities: Unclear Guidelines

An online English course was implemented at a Southwestern Ontario university over a decade ago. The course was introduced to help university students develop effective writing skills for communicating ideas in academic and other contexts (the topics covered include grammar, the audience, the writing process, and peer reviews). In the early stages of this online English course, peer review marking was unstructured and students were given few guidelines. Although peer review assignments were graded out of ten (five for submitting a draft on time and five for the quality of peer review feedback), the criteria for specific marks was not provided. For instance, to receive a mark of 10/10, students needed to submit their draft (worth 5 marks) and then provide several pieces of constructive criticism (worth the other 5 marks). Since

“several” was not defined, the number of constructive criticism comments needed was interpreted differently by TAs when grading. This created issues regarding the standardization of marking. It was not uncommon for students to complain that they had received a lower mark than a peer in the course, yet provided the same number of constructive criticism comments. Students did not have explicit guidelines outlining what was expected from them.

The students were not provided with a substantial amount of information on the peer review process. It was not uncommon for students to ask several questions regarding how to effectively review others’ work. The peer review information that was available to them consisted of a few websites that were posted in the online class platform. These websites briefly discussed some do’s and don’ts when participating in peer reviews, such as “do use polite language” and “do not belittle the author.” Although students were asked to read and apply the information on these websites, they were still unaware of how exactly their peer review assignments would be graded. Not knowing what was expected caused frustration for some students, and, in turn, some may have opted not to complete these assignments altogether. Further, students reviewed four anonymous random assignments and provided feedback that varied in quality, accuracy, and number of comments due to vague instructions. Similar to students, the TAs were unclear about how to mark peer reviews, and many were not confident with their grading of these assignments. These TAs received similar vague guidelines for peer review marking during the TA orientation meeting for the course at the very beginning of every semester. Without clear structure, the TAs eventually created their own marking guidelines, and due to the lack of standardization in marking these assignments among TAs, it was not uncommon for TAs to remark assignments after learning other TAs may be marking “easier.” For example, some TAs focused on how many reviews were given as grading criteria, while others focused on usefulness of reviews. This, in turn, could bias the final class average, as TAs may have given inaccurate grades based on factors irrelevant to the actual grading process; for example, TAs giving higher grades to students who would not complain to the instructor or giving lower grades to students who visited the TA during office hours and came across as hostile.

Developing the model

To create a more structured marking rubric, TAs, at times, would consult with each other on how to grade peer reviews according to the marking scheme, but were often confused due to the many inconsistencies in marking. As this situation became more apparent, and to create a more standardized version of a marking scheme, criteria were sought after that would be important for a standardized set of rules for marking a peer review. The decision to create a

standardized marking scheme for peer reviews was initiated as few guidelines were available. After an extensive search, the only resources that were found included general tips and broad categories that failed to provide specific details on how to meet such criteria. To create an objective marking scheme, the course TAs were consulted due, in large part, to their experience with marking peer reviews and the creative ideas that some had adopted in their marking criteria. TAs shared feedback regarding what they thought were necessary criteria for a peer review and what would be helpful for the authors of the assignments. After receiving feedback from many TAs, a list of over twenty recommendations was compiled. These recommendations were organized into two separate areas: items of commission (statements that should be included but often are not) and items of omission (statements that should not be included but often are). For clarity, each peer review grade was assigned to how much of the commission and omission lists were adhered to, such that a “great peer review” would include all of the items in the list of commission and no items in the list of omission.

The list of commission revolved around removing confusion for the students receiving the feedback. Moreover, the student who is critiquing understands the nuisances of his or her comments, while the receiver may not. Further, the student writing the review and the receiver often differ in their depth of understanding of the multitude of areas within the course. The peer reviews given at the time often did not help improve an essay (or paragraph) due to the lack of guidelines and understanding of how to complete a peer review. The major concerns that most often were reported by students were clarity, direction, and objectivity. Clarity became an issue when the receiver was not able to determine where the error was, what the error was, and why the issue was an error. Students were allowed to write their comments below the author’s work, but sometimes did not reference the location of the error in each of their comments. Another example regarding lack of clarity was when students would give vague explanations when commenting on an issue, for example, by stating that the error was a “comma error” without explaining which of the many rules for comma usage was broken; even if a specific rule was mentioned as being broken, how that applied to the author’s work was often lacking.

Clarity helped the receiver of the feedback understand what the error was, but understanding the error is only half the solution. Students who understood the feedback, but did not understand how to change the error, were left directionless. Giving guidance on how to improve was imperative. This was done by having the students include in their reviews specific examples on how to fix the errors and not just general or rote instructions, as in the often used and limited instruction to “remove the comma.” Offering specific and guided instructions also enhanced the objectivity of the critique. If the student writing the peer review could actually show the correction, the greater the chance was that the student knew and understood the rule under revision (though this was not always the case). To enhance objectivity, a useful inclusion was a page reference to the course guide indicating where the rule was to be found. Although this might seem tedious, the nature of the course was an introduction, and students would be referring to their guide to find mistakes to begin with. Including the reference page gave the reviewer greater credibility but also

provided the receiver with a chance to quickly determine whether the correction is legitimate. For first year students, this was of particular importance, as students often found it difficult in determining the legitimacy of a review.

The list of things to not include in a peer review was based on removing confusion but also in ensuring standards and professionalism. This meant that along with the restriction of adding in subjective reviews was the restriction to not include any disparaging or derogatory comments, thereby eliminating comments such as “you have been careless in your work, as you have committed the same mistake three times so far.” Although the author may have been careless, the reason might have been a misunderstanding or lack of understanding of the topic, which is insight the reviewer is not privy to.

The Four-Step Model

These two lists worked well for about a year, until the lists were brought to the attention of the head TA. The lists were integrated into the marking scheme for all TAs to use and resulted in a step-by-step model (See Table 1) that established clarity, provided direction, and shored up credibility. Another important reason to create a simple framework was for better adherence by students in their peer reviews and by TAs in their marking.

Table 1: The steps in the Four-Step Model

Step 1	Identify the error (specify to the author where the error is located)
Step 2	Explain why it is an error
Step 3	Show the author how to correct the error
Step 4	Reference the page in the [appropriate guide/manual/textbook] where the rule is found

The model shown gives clear instructions to help students provide the most useful comments when critiquing. Students receive marks by adhering to the model. Although absent from the model, another list of faults was compiled that negated marks received (see Table 2). This list consisted of six items focusing on ensuring the model would be followed in a professional and accurate way.

The first in this additional list of requirements was to ensure that no spelling mistakes were found in the peer review comment. The nature of the course was to improve the spelling and grammar of the undergraduate populace. As such, when correcting another’s error, the least the student must do was ensure the spelling in the comment is correct. Next, students were required to avoid using language that would criticize the work or the person. Following this, students were not permitted to give opinions in their comments. This restriction was included as an opinion brought unnecessary subjectivity to the review. Opinions were determined depending on the wording of the comment; for example, students were required to use absolute language, such as “this is an error” or “this period does not belong here” and avoid phrases demonstrating uncertainty, such as “I think . . .,” “Maybe . . .,” or “In my opinion . . .” Again, from the perspective of the receivers of the peer reviews, students receiving feedback cannot be confident in implementing the correction when those critiquing are not sure of what they are marking. An opinion undermines the validity of the comment.

The first three items in the list consisted of things to avoid including in a comment, whereas the last three refer to what should be included in the comment. The fourth in the list stated that students must use proper terminology. This was included to help remove ambiguity by changing vague terms to more informative ones, such as changing “comma error” and “too long of a sentence” to “comma splice” and “run-on sentence.” Students were also required to provide ample indication of where the error is located to the receiver of the peer review. There should be no doubt to the receiver as to where the error took place. Finally, the last item in the list of things the peer reviews should include was to only correct an error that needs correcting. Although similar to the notion of not giving an opinion, this facet focuses on a correction that has no legitimate basis. For example, students might correct the make-up of a sentence, citing improved flow in the sentence as justification. This may or may not be correct but creates unneeded difficulty, as there is no clear rule to follow, and that was above the level of the introductory course with a focus on basic grammar.

Table 2: List of six additional requirements for each comment

1.	Not have spelling mistakes in the comment
2.	Not be degrading or detrimental in the comment
3.	Not give an opinion as a correction
4.	Use proper terminology
5.	Indicate clearly to the student where the error is located
6.	Avoid correcting something that does not need to be corrected

Positive Constructive Comments

In the development stage of the model, a concern arose when students could not legitimately locate any errors in a narrative. The positive constructive comment was endorsed to provide an avenue where students were still required to practice the model and offer helpful feedback. The Four-Step Model was adapted for this particular comment as in Table 3. Some students might have found the point of this comment inconsequential, but many students coming into the course lacked the basic understanding of many grammatical concepts. The positive constructive comment forces students to still apply the rules they learned in the course and creates an environment of repetition to hone one’s grammar skills.

Table 3: The steps in the four-step model for positive constructive comments

Step 1	Identify the rule that was correctly followed (specify to the author where the rule is located)
Step 2	Explain why it is correct
Step 3	State that no correction is necessary
Step 4	Reference the page in the [appropriate guide/manual/textbook] where the rule is found

The Peer Review Guide

Although these steps and requirements seem obvious to include (or not include) in a review, many students do not have the experience or skills yet to ensure that

these steps are followed. A guide for the course was created to teach the theory behind what makes an effective peer review, answer potential questions, and offer a plethora of practice examples for all skill levels. The guide included a section on the how-to of writing a peer review for the course (the guide was tailored to the specific course), the advantages of participating in the peer review process, the outline of the model, the need for the list of additional requirements, the use of positive comments, definitions, and practice questions with an answer key. The practice questions include true-or-false, multiple-choice, progressive fill-in-the-blanks, and a critique using the model of a short essay (see Appendix 1 for examples). Each student is required to purchase a peer review guide as a text for the course. These activities are assigned to students prior to completion of the first peer review assignment. Although the activities are assigned, they are not graded. It is the students' responsibility to complete the practice activities and check his or her answers.

Similar to the students, the TAs are provided the same peer review guide. The TAs are required to read this guide at the beginning of the semester. When the peer review guide was implemented into the course, TAs reported that they felt more at ease with marking these assignments, since they had a marking scheme to follow. With a standardized marking scheme, the TAs guessed less when marking since it was now objective. Also, they had a resource to refer the students to for additional help. Prior to the model, the TAs would spend additional time explaining to students via email what they felt is needed to receive a decent mark on these assignments. After this model was designed, the TAs could refer the students back to the model and provide page numbers as well.

Marking

With an easy-to-follow guide and a clear model, marking of peer reviews transformed from a subjective experience to a more objective experience. The marking scheme was changed to reflect the importance of completing the peer reviews. The formula developed was 10 marks for submitting a draft and 5 marks for each draft that must be critiqued. In the course, students were required to review 4 drafts, resulting in each peer review assignment worth 30 marks (10 for submitting a draft on time and 20 marks for the reviews). In each draft, students were required to complete five positive constructive comments, each comment worth one mark. Later, this grading was changed slightly, as each of the four steps in the model were worth .25 marks, allowing for part marks if the student did not follow one of the steps. This also gave greater clarity to the student when attempting to understand why he or she lost marks, as the exact steps that were not included or were incorrect were highlighted. Positive constructive comments were only allowed when less than five errors in a document could be found. Any errors that were located had to first be corrected before the positive constructive comments could be used. The time required to complete the peer reviews and their marking was greatly extended, but the course was adapted to allow for this extra time by removing an assignment. This decision was made due to the importance placed on providing effective peer reviews.

Validation from the model was not explicitly tested but was indicated through TAs' consistent grading, as well as an abundance of helpful reviews for authors. This was evident through comments from TAs on the greater quality of students' work they had witnessed and through fewer complaints regarding discrepancies in marking between TAs. After the implementation of the Four-Step Model, many reviews were more constructive than before the change in the marking scheme. The requirement to follow the model did not improve all reviews after implementation as some students produced low quality work by failing to follow the model and its additional requirements. Although the model did not improve the quality of these students' reviews, the model allowed TAs to assign low grades to those students, resulting in greater consistency and objectivity to the marking.

Overall, the model and the guide have strengthened peer reviews in the course.. They provide an understanding of what is required from students and how students will be graded with the opportunity to practice these skills. The TAs are provided the exact same information and trained to use them. Less confrontation regarding the grading of these assignments has arisen, since the guide clearly outlines the marking scheme. When the model is followed, peer reviews are far less ambiguous. These points give some indication of the validity of the model.

Conclusion

The Four-Step Model, which has been presented in detail in this article, is certainly adaptable. Although the Four-Step Model is presented in written form, it can be used orally in a variety of educational and professional settings, for example, in primary, secondary, and post-secondary education, in laboratories, or in a number of other business settings as well. The Four-Step Model can be best described as a universal model: a grade school geography teacher could implement this model when asking students to create legends for maps; a chemistry high school teacher could create group review projects for laboratory assignments that require students to use this model; university (or college) professors could implement oral examinations in their courses utilizing this model; and professionals could use this model to critique a business plan, for instance. In essence, any project requiring a critique from peers can use this model. The model is useful in critiquing reading and writing skills, but it can be a useful tool in other areas to formulate and communicate constructive feedback, as well as to gather and respond to feedback. Essentially, this approach to peer review provides an opportunity to teach critiquing skills (reading, writing, and how to collaborate effectively) to students, workers, and professionals in academic and non-academic settings.

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Application of Conditional Means for Diagnostic Scoring

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Abstract. In educational assessment, demand for diagnostic information from test results has prompted the development of model-based diagnostic assessments. To determine student mastery of specific skills, a number of scoring approaches, including subscore reporting and probabilistic scoring solutions, have been developed to score diagnostic assessments. Although each approach has a unique set of limitations, these approaches are, nevertheless, often used in diagnostic scoring, whereas an alternative approach, Complex Sum Scores (CSS), has not received much attention yet. With the process of developing model-based diagnostic assessments becoming increasingly complex, we revisit the CSS and demonstrate two applications of the CSS in the development of diagnostic assessments. Two applications include: (a) illustrating and validating skills within the model, and (b) partial mastery scoring using model-based distractors. By demonstrating the two applications, we aim to show how model-based diagnostic assessments can be developed and scored using the CSS scoring approach, the results of which can be used by teachers to inform teaching and learning.

Keywords: Model-based diagnostic assessments; diagnostic scoring; complex sum scores

Introduction

Demands for diagnostic and formative feedback on student learning have led to significant changes in student assessment, including the ways tests are developed, administered, and scored. One such example is cognitive diagnostic assessment (CDA; Nichols, 1994). A cognitive model of task performance is used

to guide the development of a CDA, specifically when constructing test items that probe student mastery on a specific set of skills (Leighton & Gierl, 2007). In order to make inferences about student mastery on a set of assessed skills, various probabilistic scoring methods have been developed, with each method suited to measure different types of skills. The increasing complexity of probabilistic scoring methods, however, has raised the question of interpretability of the results obtained when such methods are used. To ensure diagnostic results are clearly understood by teachers and parents, subscore reporting has been used as an alternative to probabilistic methods (Wainer et al., 2001; Sinharay, Puhon, & Haberman, 2010). In this approach, scores on each cluster (i.e., subscale) are reported as diagnostic information about students' mastery/non-mastery on the skills assessed by a test. Although both approaches (probabilistic scoring and subscore reporting) are possible in scoring cognitive diagnostic assessments, the two approaches differ substantially in several ways (i.e., complexity, precision, etc.).

In this article, we address the complexity associated with diagnostic scoring and introduce an alternative approach that, in our opinion, can (a) ease computational intensity without unduly sacrificing precision, and (b) assist test item writers in developing cognitive diagnostic assessments and teachers in using CDA results to inform instruction. In our proposed alternative approach, skills to be assessed are organized using a cognitive diagnostic modeling method, Attribute Hierarchy Method (AHM; Leighton, Gierl, & Hunka, 2004), and students' responses are scored using a conditional score method, Complex Sum Scores (CSS; Henson, Templin, & Douglas, 2007). Before describing the alternative approach in detail, we start with a review of existing methods commonly used in the development and scoring of diagnostic assessments, highlighting the advantages and limitations of these methods. Using the real response data from an existing CDA program, we then demonstrate two applications of the proposed scoring approach, namely: a) illustrating and validating of the skills specified in the attribute hierarchy model, and b) partial mastery scoring using model-based distractors. We conclude with a discussion of why the proposed approach is a better alternative to more complex diagnostic scoring methods and, thus, may be appealing to testing programs that are interested in implementing cognitive diagnostic assessment but lack psychometric resources for this.

Review of Frameworks for CDA Development

Gorin (2007) conceptualized the development of a cognitive diagnostic assessment (CDA) consisting of two components: a) development of cognitive models to be used subsequently in item development, and b) statistical methods to be used in scoring students' responses. Various CDA development frameworks are used in defining cognitive models and creating items (see Mislevy, 1994; Embretson, 1994; Luecht, 2008). For the purposes of this paper, a CDA development framework can be generalized to include the following principles or assumptions: a) the assessed skill attributes are such that they can

be classified in the mastery/non-mastery manner, b) items are developed to probe a specified pattern of attributes, and c) the correct response on an item implies *evidence* for mastery of the probed attributes. To operationalize the CDA framework, cognitive psychologists and subject matter experts are involved in developing cognitive models, which item writers use to guide them in the development of items that probe the patterns of attributes as specified in the cognitive models (see Figure 1). After CDA models and items are developed and administered to students, statistical methods are required to determine student mastery of the assessed skills.

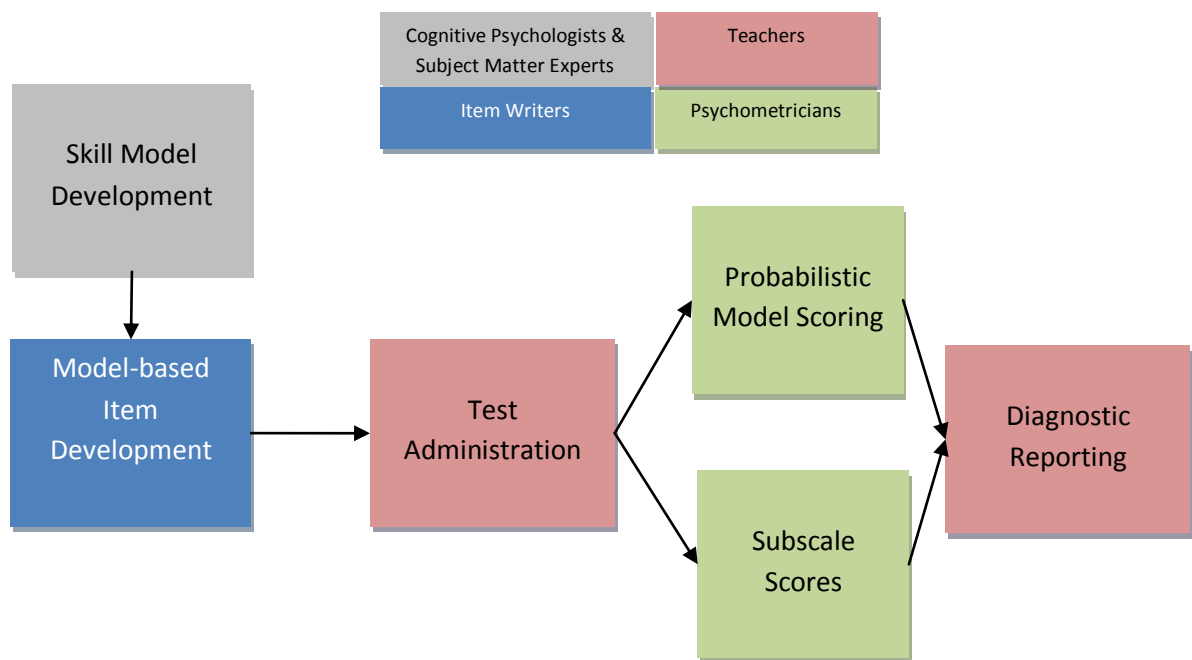


Figure 1. Illustration of the general CDA process

Two diagnostic scoring methods are used: probabilistic modeling and subscores. For probabilistic models, Fu and Li (2007) summarized 62 different methods that had been developed for diagnostic scoring. According to Sinharay, Puhon, and Haberman (2010), these methods have the following features in common: 1) test items require one or more skills to elicit a correct response, 2) students are assumed to have a latent ability associated with each skill, and 3) the likelihood of a correct response is a probabilistic function that can be determined based on the interaction of item characteristics and student's ability level. Each diagnostic scoring method differs in the assumptions made about the assessed skills. Specifically, models are created to describe skills that may be unidimensional or multi-dimensional (de la Torre & Patz, 2005), skill mastery may be classified dichotomously (DINA; Junker & Sijtsma, 2001) or polytomously (GDM; von Davier, 2008), and the structure of skills may be rigid (AHM; Leighton, Gierl, & Hunka, 2004) or flexible (RUM; Hartz, 2002). That is, characteristics of the assessed skills inform the choice of a diagnostic scoring method to be used to score student responses on a CDA.

In addition to the assumptions made about the assessed skills, there are several data requirements associated with the use of probabilistic scoring methods. First, these methods often require large data for estimating item parameters and student ability levels; however, such data are often not available at the initial development stage. Second, in the absence of real data, scoring methods are validated using simulated data; however, simulated data can provide invalid evidence of performance when students' actual responses do not fit the expected response pattern. To address these concerns, educational researchers have suggested the use of subscores for scoring student responses and reporting diagnostic results.

Subscale scores or subscores are parts of the total score that reflect student mastery on specific content areas that comprise the whole domain assessed by the test. Correspondingly, all subscores on a test can be summed to obtain the total score for each student, provide that each item is referenced to one and only one subscale. With each item being referenced to only one skill, subscores allow for a straightforward interpretation of the CDA results. However, in the CDA context, this is problematic because CDA items are designed to probe more than one skill. Earlier research also suggests that subscores provide little or no added value when subscale reliabilities are not high (Sinharay, 2010; Babenko & Rogers, 2014). Given the limitations associated with probabilistic scoring and subscore methods, we propose an alternative diagnostic scoring approach that will be of interest to assessment programs that may lack the expertise required for developing and scoring cognitive diagnostic assessments.

An Alternative Framework for CDA Development

Schematically, the alternative framework for CDA development is shown in Figure 2, and explained in subsequent sections. Development of cognitive diagnostic assessments requires a structure or model of cognitive skills. In this study, we applied the Attribute Hierarchy Method (AHM; Leighton, Gierl, & Hunka, 2004) to frame the skills to be assessed and provide guidance for item development. In AHM, skills are assumed to be mastered by students in a progression of an ordered hierarchy. This process requires involvement of experts familiar with both the cognitive processes of the target students and the content being assessed by the test. To validate the attribute structure, model data fit indices such as the Hierarchy Consistency Index (HCI; Cui & Leighton, 2009) are used to verify student response patterns against expected patterns from the model. Although the HCI and other indices provide an overall model data fit measure, they are of little help for item writers seeking to inform and refine their item development process. Further, little has been done to verify whether diagnostic scoring outcomes follow expected trend as specified by the attribute model. To address these limitations, we introduce an alternative scoring method, Complex Sum Scores (CSS), which also is used for the partial mastery scoring in the alternative CDA framework (see Figure 2). First, we review the sum score approaches, with a focus on the CSS method.

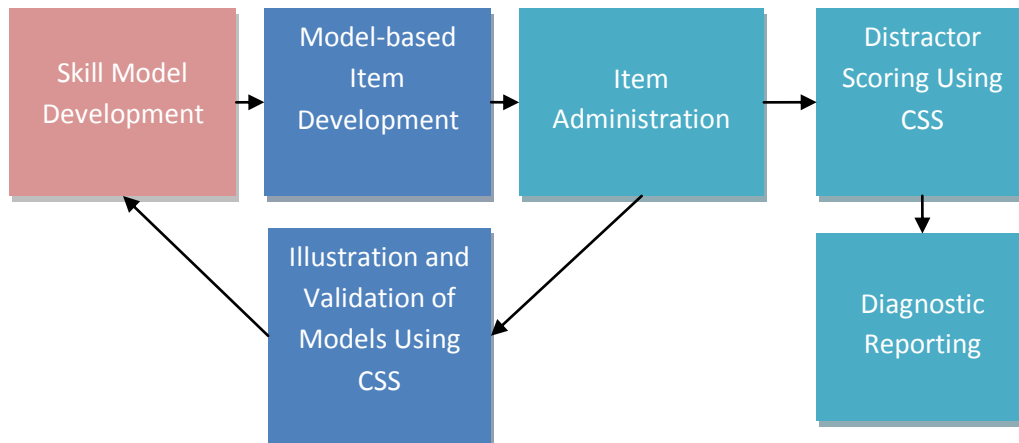


Figure 2. An illustration of the alternative framework for CDA development

Sum Score Approaches

Sum score approaches can be conceptualized as a compromise between subscore and probabilistic scoring methods. Recognizing the need for simplified model-based diagnostic scores, Henson, Templin, and Douglas (2007) proposed diagnostic scoring methods using sum scores. In diagnostic assessments, the relationship between test items and specific sets of skills they probe is defined by a Q-matrix. Henson et al. (2007) suggested that skills could be scored using the conditional sums of the correct responses to corresponding items as defined under the Q-matrix. For example, under a dichotomously classified Q-matrix, where each row represents an item and each column represents a skill or attribute, the concept of sum scores is represented as:

$$X_k = \sum_j (x_j \times q_{jk})$$

where x_j is the dichotomously scored student response for item j , with the responses being summed if item j requires the use of attribute k in the Q-matrix. Based on this concept, Henson et al. (2007) introduced three types of sum scores. The first and the simplest, called simple sum score (SSS), is statistically identical to the subscore method used in diagnostic scoring, with each item representing only one attribute. Recognizing that each item may probe more than one attribute as specified in the Q-matrix, the complex sum score (CSS) method was introduced, with items contributing to more than one sum score. The third and most complex type, called weighted-complex sum score (WCSS), was introduced to provide weighted representation of skills on a given item, because a dichotomous representation of skill mastery used in CSS and SSS may not reflect the process of skill acquisition as it occurs in reality. In the present study, we extend the use of the sum score methods, in particular the CSS method, to scoring diagnostic assessments and demonstrate that the results obtained using sum score methods may be as accurate as the results obtained using probabilistic scoring methods.

CSS is a conditional sum approach to diagnostic scoring. What it means is that for an item that probes, for example, attributes 1 and 3 out of four attributes assessed by a test, the correct response on the item contributes to the conditional sum of attributes 1 and 3, whereas an incorrect response does not change the conditional sum of the attributes. The higher the value of the conditional sum, the higher the level of attribute mastery is inferred (Henson et al., 2007). In order to provide a better measure of skill mastery, we suggest the use of conditional *means* in place of conditional *sums*. The conditional mean of the CSS is given as:

$$X_k = \frac{\sum_{j=1}^j x_j}{n_k},$$

where CSS of attribute k is a factor of the number of items probing attribute k , n_k . This modification makes a CSS a *proportional measure* of mastery rather than being a raw value that depends on the number of items probing each attribute. Next, diagnosticity of a scoring method is highly dependent on both the specificity of the attribute and the alignment of the item with the attribute it is supposed to probe (Gierl, Cui, & Zhou, 2009). Therefore, CSS is a model-dependent scoring method, requiring attributes to be defined in a structure (such as a hierarchy) prior to item development. The next section describes how CSS can be applied to provide validation and illustration for the structure of attributes, and in assessing partial mastery using distractor responses.

Illustrating and Validating the Structure of Skill Attributes

The CSS scoring method provides a raw-score measure for multidimensional diagnostic data and can be used to describe individual attributes and their interactions. Consider the model of attributes in Figure 3 to be probed or assessed by a diagnostic assessment. This model includes six attributes that are organized linearly.

A model of linearly ordered attributes (i.e., skills) suggests that: (a) each attribute is acquired in a sequential manner, and (b) each attribute is a pre-requisite of subsequent attributes. This implies that the mean CSS for one attribute should not exceed the ratio of its parent or previous attributes:

$$CSS_{A2} = CSS_{A1} + CSS_{A2|A1}$$

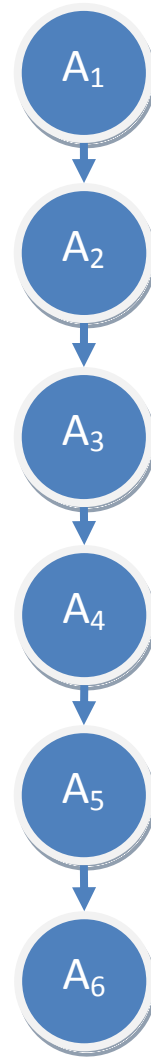


Figure 3. A model of linearly ordered attributes

The mean CSS on attribute k represents the average proportion of mastery for this attribute from the given sample of students. This information is important because it provides a p -value equivalent or difficulty at the attribute level. To confirm or validate the hypothesized structure of this model, we expect that the size of differences between mean CSSs should be in the order specified in the model. That is, the expectation for the structure of attributes to be valid is that the differences increase between non-adjacent attributes (e.g., the difference between A_1 and A_2 is smaller than the difference between A_1 and A_3 , which in turn is smaller than the difference between A_1 and A_4 , etc.). To describe distances between attributes, a mean deviation statistic is applied to the obtained CSS's. In the present study, the Mean Absolute Difference (MAD) is used to describe the relationship between pairs of attributes, and to quantify the distances among attributes in order to make meaningful inferences about student mastery. For example, to determine MAD between attributes A_2 and A_1 , with A_1 being a prerequisite skill of A_2 (see Figure 3), the average of absolute differences across all examinees is computed using the formula:

$$MAD_{A2-A1} = \frac{\sum_n |CSS_{A2} - CSS_{A1}|}{N},$$

where CSS is the complex sum score of the respective attribute, and N is the total number of examinees. This outcome can be used to describe differences between two attributes.

Distractor Scoring

In multiple-choice tests, examinees are required to select the correct response from a set of options. Options that do not contain the correct response (i.e., distractors) are created based on common misconceptions or errors that examinees are likely to encounter when solving the item. Until recently, it was considered that inferences about skill mastery could be made based only on the correct response on a test item, whereas an examinee's choice of a distractor was scored as non-mastery. For example, on a CDA of a skill with six attributes, the following is an example of how a multiple choice item would be scored:

Response Option	Associated Attribute Pattern
A	0,0,0,0,0,0
B*(correct)	1,1,1,1,0,0
C	0,0,0,0,0,0
D	0,0,0,0,0,0

* indicates the option selected by a student

Given B is the correct response for this item, two inferences can be made under this approach. First, if the examinee selected the correct response, then he/she has demonstrated mastery of the skill (Associated Attribute Pattern). Second, if other responses (i.e., any of the three distractors) were selected, then the student has not demonstrated any evidence of mastery. This approach is inefficient in the sense that information from distractors is not used in the scoring process, and a large number of test items are required to probe a small set of attributes because each attribute pattern needs to be probed by a set of items.

Although various scoring methods are available, distractors are rarely used in scoring because of the difficulty of incorporating them into scoring models (Luecht, 2007). A general approach to distractor scoring is through the use of item response theory (IRT), in which polytomous or graded latent response models can incorporate distractor information in the scoring process (Thissen et al, 1999). Luecht (2007) suggested the use of multiple scoring strategies to produce multiple scoring matrices in order to incorporate information from distractors. To implement this concept, Luecht (2007) suggested a set of Augmented Data matrices to be added in addition to a matrix of correct response used for scoring. For example, an augmented data matrix may include student responses to an often selected but incorrect option. In the present study, Luecht's (2007) approach is used with the CSS scoring method.

For distractors to be used in the scoring of diagnostic assessments, distractors must be developed diagnostically. Specifically, distractors have to represent mastery of a subset of attributes in the correct response. That is, it is

assumed that an examinee's response to a distractor indicates that the student has demonstrated mastery of a limited set of attributes (i.e., partial mastery). To incorporate this additional information in the scoring process, each distractor contributes to the CSS using its own associated attribute pattern. As a result, one additional inference can be made based on the examinee's response. Consider an examinee who answers incorrectly on the same item, for example, by selecting response option A.

Response Option	Associated Attribute Pattern
A*	1,1,0,0,0,0
B(correct)	1,1,1,1,0,0
C	1,0,0,0,0,0
D	0,0,0,0,0,0

* indicates the option selected by a student

Two inferences can be made. First, the examinee did not master the entire attribute pattern associated with the correct response (i.e., option B). Second, the examinee demonstrated mastery of attributes associated with one of the distractors, namely response option A. Conceptually, the overlapping attributes (the first two attributes in the Attribute Pattern) provide partial mastery evidence, and attributes probed by the correct response (i.e., option B) but not the distractor (i.e., attributes 3 and 4 in the Attribute Pattern) are considered as not mastered. From this approach, the length of patterns to be considered is no longer the number of items presented, but with a minimum of the item length and a maximum of twice the item length. Consequently, a conditional average (i.e., CSS) is needed to score a diagnostic assessment with distractors because both attribute patterns (i.e., options A and B) are used in scoring.

Method

Data

To demonstrate our CDA development framework, field test results from a provincial diagnostic assessment program were used. In total, 680 Grade 3 students participated in model-based diagnostic assessments for Mathematics. Within this program, a total of 48 items were administered to probe student mastery in two skills that are taught in classrooms as part of the Grade 3 Mathematics curriculum. To provide diagnostic information on student mastery, each of the two skills is further broken into hierarchies of attributes, with each skill described by a hierarchy of 8 attributes, organized in a linear pattern. Hierarchy A probed student mastery on place value representations (Figure 4), and hierarchy B probed student mastery on the ordering of numbers (Figure 5). Each unique attribute combination is probed by three items, with a total of 24 items for each hierarchy. The hierarchies were developed by cognitive and subject matter experts and based on cognitive models of task performance (Gierl et al., 2007).

Hierarchy A

- Represent and describe numbers to 1,000, concretely, pictorially and symbolically.
- Illustrate, concretely and pictorially, the meaning of place value for numerals to 1,000.

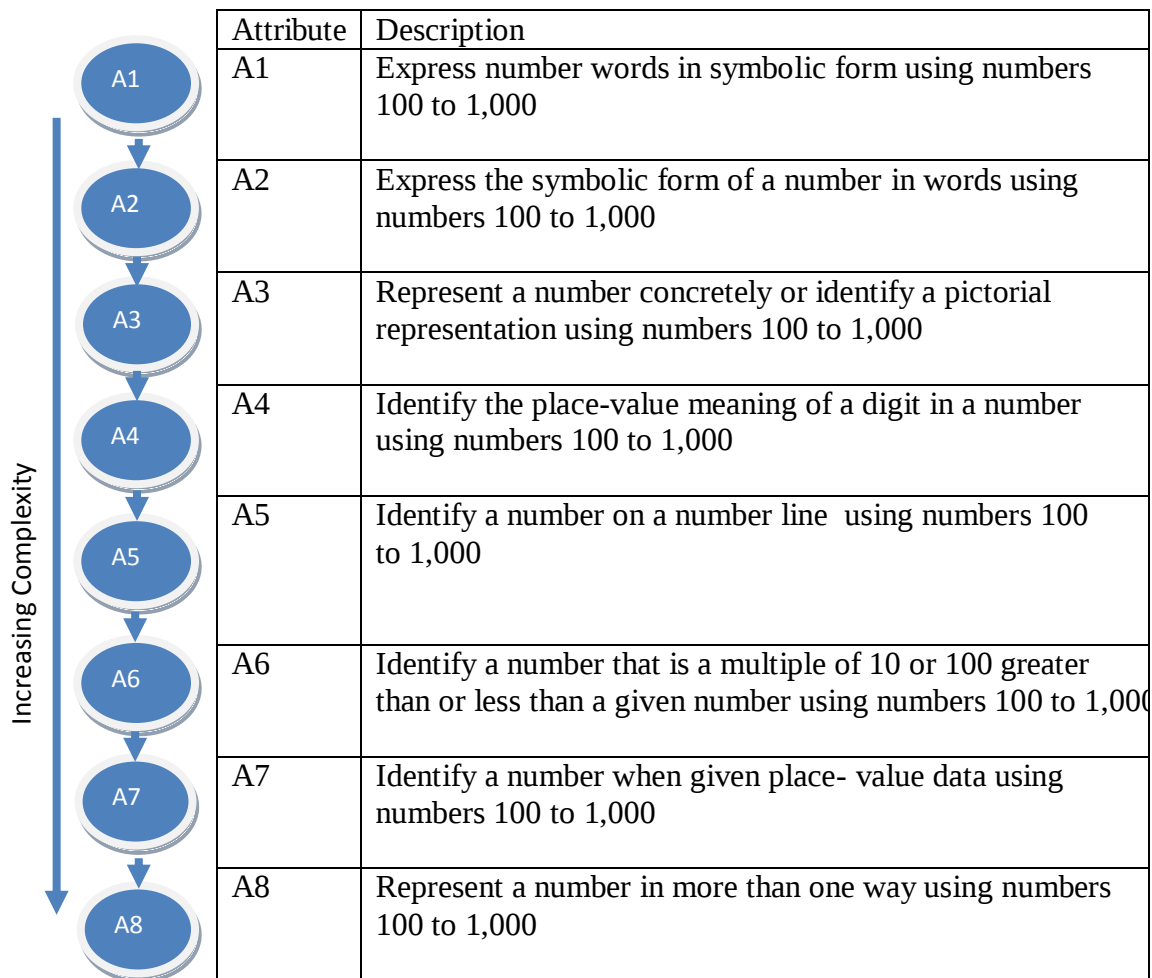


Figure 4. Hierarchy A – Place Value Representations

Hierarchy B

- Compare and order numbers to 1,000.

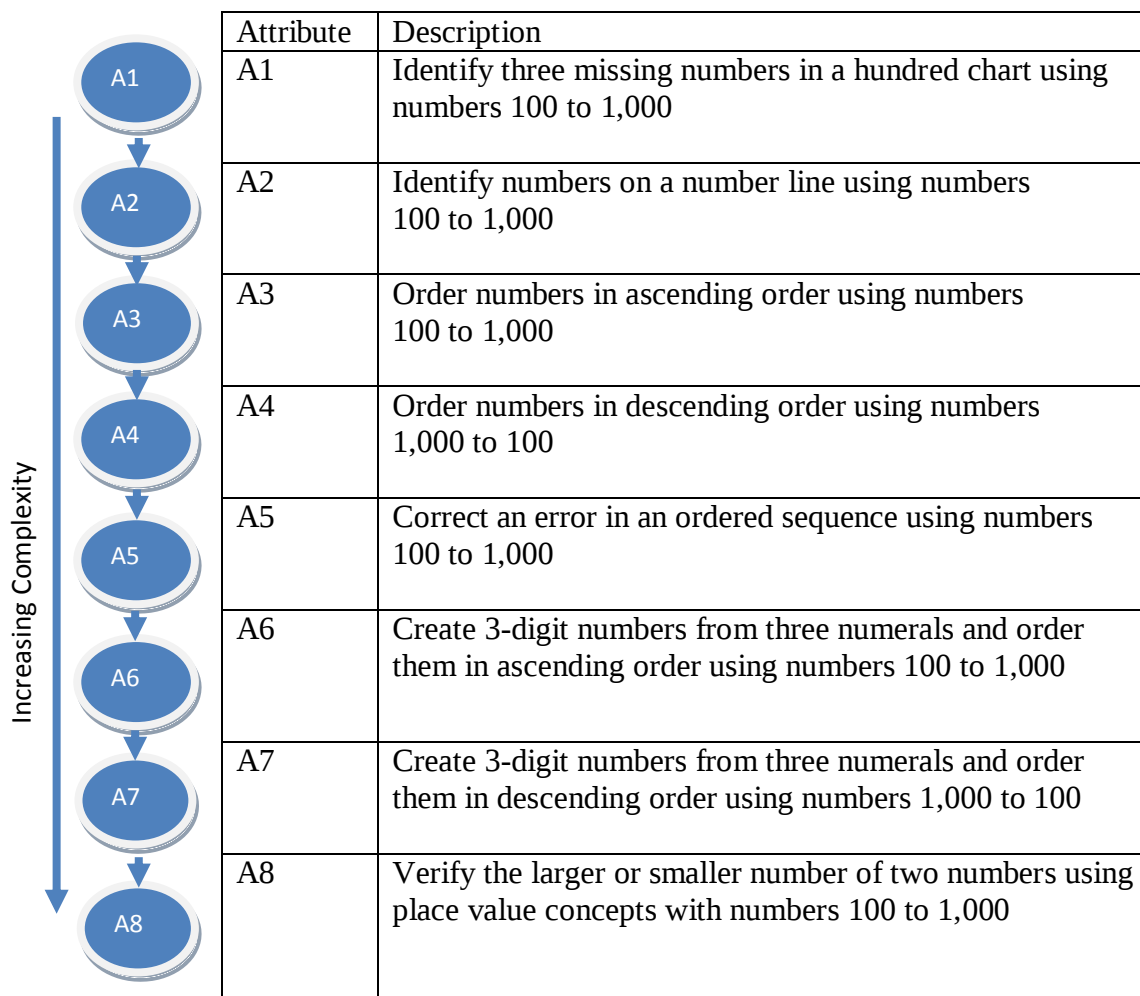


Figure 5. Hierarchy B – Ordering of Numbers

Results

Results of the analyses carried out in the present study are organized in three parts. First, the descriptive results for the two diagnostic assessments are described. The results are summarized at the examinee, item, attribute, and hierarchy (i.e., test) levels. Second, we demonstrate how CSS results can be used in the model illustration and validation, using the mean absolute difference (MAD) of CSS. Third, the CSS results when distractor scoring is used are presented and compared with the results from the CSS without distractor scoring.

Descriptive Statistics of CSS

The results of diagnostic assessments are examined at four levels: examinee, item, attribute, and hierarchy or test. In total, 295 students participated in the diagnostic assessment for hierarchy A, and 385 students

participated in the diagnostic assessment for hierarchy B. As shown in Table 1, at the examinee level, student responses for the two hierarchies (A and B) follow a normal distribution, with the mean correct responses on hierarchy A and hierarchy B being 12.06 and 14.05, respectively.

Table 1. Diagnostic assessment results at the examinee level

	Hierarchy A	Hierarchy B
Mean	12.06	14.05
SD	5.62	4.72
Min	0	0
Max	24	24
N	295	385

The results at the item level are presented in Table 2. The percent correct for each item (i.e., p-values) indicated that, as expected, the test items that probed the attributes of higher complexity tended to have lower p-values than the items that probed the attributes of lower complexity.

Table 2. Diagnostic assessment results at the item level

Attribute	Item	p-value	
		Hierarchy A	Hierarchy B
A1	Item 1	0.824	0.820
	Item 2	0.753	0.870
	Item 3	0.610	0.747
A2	Item 4	0.631	0.698
	Item 5	0.363	0.589
	Item 6	0.668	0.620
A3	Item 7	0.590	0.758
	Item 8	0.722	0.646
	Item 9	0.597	0.716
A4	Item 10	0.481	0.802
	Item 11	0.566	0.760
	Item 12	0.512	0.820
A5	Item 13	0.488	0.599
	Item 14	0.393	0.372
	Item 15	0.495	0.635
A6	Item 16	0.559	0.354
	Item 17	0.393	0.456
	Item 18	0.319	0.417
A7	Item 19	0.444	0.378
	Item 20	0.380	0.438
	Item 21	0.458	0.500
A8	Item 22	0.237	0.435
	Item 23	0.231	0.375
	Item 24	0.353	0.286

At the attribute level, the CSS's were computed for each attribute of hierarchies A and B. The results are shown in Table 3, with the number of items probing each attribute shown in the last column on the right side. As described earlier, the CSS is the mean proportion of correct responses out of the total number of examinees' responses on the items used to probe each attribute. As seen in Table 3, the CSS values decrease with the increase in the attribute level. To corroborate the CSS results, the AHM results are also shown in Table 3. As mentioned earlier, the AHM is a probabilistic scoring method used, and indicates a probability of mastery for a student on a given attribute (i.e., attribute probability). Similar to the CSS values, the AHM values decrease with the increase in the attribute level, although in a non-linear way as compared to the linear nature of the CSS (see Figure 6).

Table 3. Diagnostic assessment results at the attribute level

	Hierarchy A		Hierarchy B		Items
	AHM	CSS	AHM	CSS	
A1	0.926	0.496	0.960	0.607	24
A2	0.924	0.466	0.959	0.577	21
A3	0.862	0.454	0.932	0.562	18
A4	0.804	0.418	0.882	0.529	15
A5	0.712	0.395	0.766	0.455	12
A6	0.559	0.378	0.587	0.421	9
A7	0.425	0.357	0.403	0.419	6
A8	0.154	0.274	0.304	0.375	3

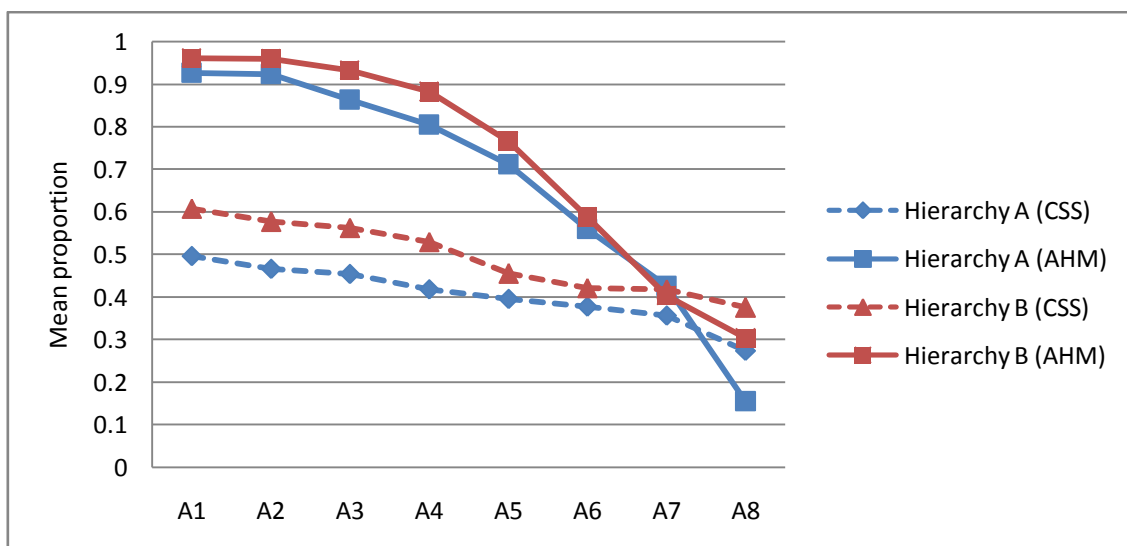


Figure 6. Diagnostic results at the attribute level

At the hierarchy level, different statistics or indices can be used to determine the overall fit of examinee responses with the design of the hierarchy.

A summary of results using two statistics at the hierarchy level are shown in Table 4. First, Chronbach's alpha, a coefficient often used to determine the internal consistency of items on a test, indicates that both assessments had high internal consistency (Cronbach's $\alpha > 0.80$). Second, the Hierarchy Consistency Index (HCI) indicates a fit between the observed response pattern and the expected response pattern (i.e., model-data fit), with larger HCI values indicating a better fit. In this study, the distributions of the HCI were determined to be bi-modal; therefore, medians were used to describe the central tendency of the HCI. The medians of the HCI indicated that, overall, hierarchy B tended to have a better model-data fit than hierarchy A. Next, percentages of examinees with an HCI value greater than 0 were computed to determine the percentage of examinees with the same patterns of observed responses as those expected for each hierarchy. With 59.5% and 78.4% examinees for hierarchy A and hierarchy B, respectively, this suggested that each hierarchy or the arrangement of the attributes used in the two assessments fit moderately well with the observed response patterns.

Table 4. Diagnostic assessment results at the hierarchy (test) level

	Hierarchy A	Hierarchy B
Median HCI	0.254	0.464
Examinee with HCI > 0	59.50%	78.40%
Cronbach's Alpha	0.863	0.801

Overall, the results for diagnostic scoring using the CSS method indicated an adequate model-data fit for the items representing the attributes and confirmed the order of the attributes in each hierarchy. Based on these results, the novel applications of the CSS method are demonstrated next.

Illustrating and Validating the Structure of Attributes

To demonstrate how the CSS method can be used to refine and validate the structure of attributes specified by test developers and content specialists, the mean absolute difference (MAD) is computed to determine the mean differences between any two attributes in the hierarchy. These values are then used to describe the distance or relatedness of attributes in terms of their complexity levels. The mean differences of the CSS's between any two attributes in hierarchy A and hierarchy B are shown in Tables 5 and 6, respectively. Distractor scoring was not used at this stage.

Table 5. Mean absolute differences (MAD) between two attributes in Hierarchy A

	A2	A3	A4	A5	A6	A7	A8
A1	0.04	0.06	0.09	0.13	0.15	0.19	0.30
A2		0.03	0.06	0.10	0.13	0.17	0.28
A3			0.05	0.08	0.12	0.15	0.27
A4				0.05	0.09	0.13	0.24
A5					0.06	0.10	0.22
A6						0.09	0.20
A7							0.16

Table 6. Mean absolute differences (MAD) between two attributes in Hierarchy B

	A2	A3	A4	A5	A6	A7	A8
A1	0.04	0.06	0.09	0.16	0.20	0.22	0.29
A2		0.04	0.07	0.13	0.17	0.19	0.27
A3			0.05	0.12	0.16	0.18	0.26
A4				0.08	0.13	0.15	0.23
A5					0.07	0.12	0.21
A6						0.09	0.18
A7							0.15

As shown in Tables 5 and 6, the mean absolute differences between any two attributes follow the expected linear pattern, namely the absolute CSS differences become larger as the level of attribute complexity increases. This is consistent with the structure of the hierarchy, the attributes in which are organized linearly. Next, the MAD values on the diagonal in Tables 5 and 6 provide a measure of differences that can be used to illustrate the distance between any two adjacent attributes. As the differences in the complexity among attributes become larger, the MAD values increase respectively, providing validation evidence for the attribute structure of both hierarchies.

Distractor Scoring

In order to incorporate distractors into the CSS scoring process, distractors need to be coded using partial mastery attribute patterns. In the present study, such coding was performed by two subject matter experts. Attribute patterns for each response option are shown in Table 7 for all the items for hierarchy B. As shown in Table 7, some distractors were not coded for any attribute mastery because these distractors did not elicit any skill related to the hierarchy.

Table 7. Attribute patterns for all the items with distractor scoring for Hierarchy B

Item	Key	Options	Attribute Mastery							
			A1	A2	A3	A4	A5	A6	A7	A8
1	2	1	0	0	0	0	0	0	0	0
		2	1	0	0	0	0	0	0	0
		3	0	0	0	0	0	0	0	0
		4	0	0	0	0	0	0	0	0
2	3	1	0	0	0	0	0	0	0	0
		2	0	0	0	0	0	0	0	0
		3	1	0	0	0	0	0	0	0
		4	0	0	0	0	0	0	0	0
3	4	1	0	0	0	0	0	0	0	0
		2	0	0	0	0	0	0	0	0
		3	0	0	0	0	0	0	0	0
		4	1	0	0	0	0	0	0	0

Item	Key	Options	Attribute Mastery							
			A1	A2	A3	A4	A5	A6	A7	A8
1	3	2	1	1	1	0	0	0	0	0
		2	1	1	1	1	1	0	0	0
		3	1	1	0	0	0	0	0	0
		4	1	1	0	0	0	0	0	0
1	4	2	1	1	1	1	0	0	0	0
		2	1	1	1	1	1	0	0	0
		3	1	1	1	0	0	0	0	0
		4	1	1	1	0	0	0	0	0
1	5	3	1	1	1	0	0	0	0	0
		2	1	1	1	0	0	0	0	0
		3	1	1	1	1	1	0	0	0
		4	1	1	1	0	0	0	0	0

4	4	1	0	0	0	0	0	0	0	0	1	6	4	1	1	1	1	1	0	0	0	0
		2	0	0	0	0	0	0	0	0	0			2	1	1	1	1	0	0	0	0
		3	0	0	0	0	0	0	0	0	0			3	1	1	1	0	0	0	0	0
		4	1	1	0	0	0	0	0	0	0			4	1	1	1	1	1	1	0	0
5	2	1	0	0	0	0	0	0	0	0	1	7	1	1	1	1	1	1	1	0	0	
		2	1	1	0	0	0	0	0	0	0			2	1	1	1	1	0	0	0	0
		3	0	0	0	0	0	0	0	0	0			3	0	0	0	0	0	0	0	0
		4	0	0	0	0	0	0	0	0	0			4	0	0	0	0	0	0	0	0
6	3	1	0	0	0	0	0	0	0	0	1	8	4	1	1	1	1	0	0	0	0	0
		2	0	0	0	0	0	0	0	0	0			2	1	1	1	0	0	0	0	0
		3	1	1	0	0	0	0	0	0	0			3	1	1	1	0	0	0	0	0
		4	0	0	0	0	0	0	0	0	0			4	1	1	1	1	1	1	0	0
7	1	1	1	1	1	0	0	0	0	0	1	9	4	1	0	0	0	0	0	0	0	0
		2	0	0	0	0	0	0	0	0	0			2	1	1	1	0	0	0	0	0
		3	0	0	0	0	0	0	0	0	0			3	0	0	0	0	0	0	0	0
		4	0	0	0	0	0	0	0	0	0			4	1	1	1	1	1	1	1	0
8	3	1	0	0	0	0	0	0	0	0	2	0	3	1	1	1	1	0	0	0	0	0
		2	0	0	0	0	0	0	0	0	0			2	1	1	1	0	0	0	0	0
		3	1	1	1	0	0	0	0	0	0			3	1	1	1	1	1	1	1	0
		4	0	0	0	0	0	0	0	0	0			4	0	0	0	0	0	0	0	0
9	4	1	0	0	0	0	0	0	0	0	2	1	2	1	1	1	1	1	0	0	0	0
		2	0	0	0	0	0	0	0	0	0			2	1	1	1	1	1	1	1	0
		3	0	0	0	0	0	0	0	0	0			3	1	1	1	1	0	0	0	0
		4	1	1	1	0	0	0	0	0	0			4	0	0	0	0	0	0	0	0
0	1	1	1	1	1	1	0	0	0	0	2	2	1	1	1	1	1	1	1	1	1	1
		2	0	0	0	0	0	0	0	0	0			2	1	1	1	1	0	0	0	0
		3	0	0	0	0	0	0	0	0	0			3	1	1	1	1	0	0	0	0
		4	0	0	0	0	0	0	0	0	0			4	1	1	1	1	0	0	0	0
1	3	1	0	0	0	0	0	0	0	0	2	3	4	1	1	1	1	0	0	0	0	0
		2	0	0	0	0	0	0	0	0	0			2	1	1	1	0	0	0	0	0
		3	1	1	1	1	0	0	0	0	0			3	1	1	1	0	0	0	0	0
		4	0	0	0	0	0	0	0	0	0			4	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	0	0	0	0	2	4	2	1	1	1	1	0	0	0	0	0
		2	0	0	0	0	0	0	0	0	0			2	1	1	1	1	1	1	1	1
		3	0	0	0	0	0	0	0	0	0			3	1	1	1	0	0	0	0	0
		4	0	0	0	0	0	0	0	0	0			4	1	1	1	0	0	0	0	0

With response patterns added to the scoring process in the form of distractors to probe for partial mastery, there are more opportunities for examinees to demonstrate skill mastery. Given that two attribute patterns can be used per each item with distractor scoring, the total number of opportunities to demonstrate mastery of a given attribute across the entire test increases, and thus, contribute to the precision of the estimation of attribute mastery. Table 8

summarizes the number of opportunities for demonstrating attribute mastery for the two hierarchies, both when the CSS is used with and without distractor scoring. As shown in the table, using distractor patterns with the CSS method increases the number of opportunities for examinees to demonstrate mastery as compared to the CSS method when used without distractor scoring. However, attribute 8 in hierarchy A and attributes 5 through 8 in hierarchy B were not affected by distractor scoring because no partial mastery patterns were found to be associated with these attributes.

Table 8. Summary of the number of items representing each attribute

	A1	A2	A3	A4	A5	A6	A7	A8
CSS								
Hierarchy A	24	21	18	15	12	9	6	3
Hierarchy B	24	21	18	15	12	9	6	3
CSS with Distractor Scoring								
Hierarchy A	54	51	45	42	17	14	11	3
Hierarchy B	54	51	46	24	12	9	6	3

The means and differences between the CSS method with and without distractor scoring (DS) are shown in Table 9. The mean proportions of CSS values with distractor scoring increased as a result of the increased number of opportunities for examinees to demonstrate attribute mastery when partial mastery patterns were used in scoring. As expected, there were no changes for the attributes for which partial mastery patterns were not used in scoring (i.e., A8 in hierarchy A and A5-A8 in hierarchy B).

Table 9. The CSS results (means and mean differences) with and without distractor scoring (DS)

	Hierarchy A			Hierarchy B		
	CSS	CSS + DS	Difference	CSS	CSS + DS	Difference
A1	0.50	0.67	0.17	0.61	0.69	0.08
A2	0.47	0.61	0.14	0.58	0.67	0.09
A3	0.45	0.63	0.18	0.56	0.67	0.11
A4	0.42	0.58	0.17	0.53	0.59	0.06
A5	0.40	0.45	0.05	0.46	0.45	0.00
A6	0.38	0.49	0.11	0.42	0.42	0.00
A7	0.36	0.51	0.15	0.42	0.42	0.00
A8	0.27	0.27	0.00	0.38	0.38	0.00

Conclusion

In educational assessment, demands for diagnostic information from test results have prompted the development of model-based diagnostic assessment to inform teaching and learning. To determine student mastery of specific skills,

a number of scoring methods have been developed to score diagnostic assessments. However, current diagnostic scoring methods are at two extremes. On the one hand, probabilistic scoring methods are complex to be implemented in educational assessment programs, with results being difficult for teachers to understand and use in class. On the other hand, the method of subscore reporting provides little information about the level of skill mastery. Depending on the context and purposes of diagnostic assessments, the scoring approach presented in this paper – Complex Sum Scores (CSS) – can be a useful scoring solution, in particular when there is a shortage of psychometric resources required for implementing diagnostic assessment. If the purpose of a diagnostic assessment is to determine the level of an examinee's skill mastery based only on the evidence available from the test, or if there is a small number of students whose skill mastery is assessed by the test, then the CSS method can be a viable alternative to estimate skill mastery in such assessment programs.

However, several limitations associated with the CSS scoring method need to be acknowledged. First, given that the CSS method is a raw score approach to diagnostic scoring, the CSS scale can be problematic. Thus, some transformation of the raw score scale would be needed. Second, no comparisons of classification rates for the CSS and other diagnostic scoring methods have been provided in the present study. Although classification rates can be obtained using cut-score methods (Henson, Templin, & Douglas, 2007), a comparison of classification rates for the CSS and other methods was not a purpose of the present study. Rather, the purpose was to demonstrate the CSS method as a less complex alternative to current diagnostic scoring methods. Further, in the context of this study, a comparison of classification rates would involve the use of simulated data, and thus, make the accuracy of the results dependent on the simulation environment. However, since the CSS method is a non-probabilistic alternative to Gierl et al.'s (2007) neural network approach for diagnostic scoring and classification, recurrent neural networks can still be easily adapted with the CSS method to perform classification tasks.

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Institutional Strategies and Practices for Integrating Learning Technologies in the Inner, Outer and Virtual Spaces

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Abstract. When we talk about innovations in the educational institutions we can check experiences or even the adoption of new procedures only in the early grades. All originality and change seem to disappear as soon as we arrived at the university level. The most recent change in high education areas, far from achieving unanimous approval and with few supporters, is centred on problem-solving ability. Is a way of learning that, although not a panacea, does not find – so far – equivalent methodology, interesting or even practice. Massify, decentralize and popularize should be the goals of higher education, but institutionalize the education practices mediated by the different technologies in a particular university is much more than installing a version of a learning management system, that don't attract so much attention and became part of the scenery.

Keywords: e-technologies, strategies, infrastructures, inner space, outer space, virtual space

Introduction

Observe the strategies of counterpart institutions, related to the integration of learning technologies, can corroborate in several ways: we can follow the same path, apparently safe (cake recipe); don't repeat the same mistakes (learn from the mistakes of others) or even follow a completely different option not to fall into the commonplace, innovate, or even establish a market spread.

In this article, we perceive inner space as the own infrastructures of each university; outer space as being shared and/or third parties' infrastructures; and virtual space as all kinds of infrastructures: own, shared and/or third parties, based on the internet. The text draws on findings from the research "Building an Immersive Distance Learning Experience beyond Massive Open Online Courses with Web Conferencing, Socratic Method, Problem-Based Learning and Social Networks" funded by the CAPES foundation.

With the supposed adoption of informatics and subsequently the internet and social networks, the technologies were used and manipulated from the marketing point of view by the universities themselves as a panacea for the education problems and, thereby, representative of an alleged contemporary education, pedagogically and technologically sound.

According to Hannon, Riddle and Ryberg (2013) the widespread adoption of social media by students and professors in learning settings has confronted universities with digital practices that don't readily fit traditional education, and challenges institutional strategies for integrating learning technologies.

When we talk about innovations in the educational institutions we can check experiences or even the adoption of new procedures only in the early grades. There are well-known practices observed in several incredible schools around the world. Some of them can be considered hors concours: Escola da Ponte (2015) in Portugal, Green School (2015) in Indonesia, Ørestad Gymnasium (2015) in Denmark, Rauma Freinetkoulu (2015) in Finland and Vittra Telefonplan (2015) in Sweden – a country that is proud of its experimental education – although the venture is sometimes perceived as being far-fetched even by Swedish standards (Labarre, 2012): it's a school without walls.

But all originality and change seem to disappear as soon as we arrived at the university level. Or anyone ever read something about amazing universities?

The evolutionary or revolutionary educational practices follow excluded from universities. The most recent change in high education areas, far from achieving unanimous approval and with few supporters, is centred on problem-solving ability, since the current needs should not be focused more on accumulation of knowledge. Memorizing contents should not be considered important, although the Organization for Economic Cooperation and Development (OECD), still believes so...

The global school rankings published by the OECD in 2015 recalls – in gender, number and degree – the absurd college rankings system and their misguided forms of assessment and evaluation. At this year's edition are on the podium Singapore, Hong Kong and South Korea (Coughlan, 2015).

Please forgive me the parties involved – and especially the top of the pyramid – but this is just plain absurd. These rankings are based on an amalgamation of international assessments, including the OECD's PISA tests, the TIMSS tests (run by US-based academics) and TERCE tests in Latin America, putting developed and developing countries on a single scale (as if it were possible). And they do so based on the results of conventional tests (archaic) carried out by 15 year olds, only in areas such as math and science...

It is this kind of ranking that can set the level of education practiced by any country?

This vision (and limitation) is the equivalent to the outdated IQ tests that gave good rates to who had the ability to perform calculations automatically – but without the possibility to solve complex real problems. That is, people who had

a skill (mechanical) that were not giving them a status of superior intelligence than to perform activities such as a supermarket cashier (in the absence of electricity).

The European country better ranked was Finland (6th), followed by Estonia, Switzerland and Netherlands. Poland appears in 11th and Germany in 13th. United Kingdom at 20th position. Denmark only in 22nd (which has one of the most technologically advanced educational systems), followed by France. Italy appears in 28th place, after Spain.

Portugal 30th was ahead of Sweden 35th (country that is proud of its experimental education and received a nonsense warning from the OECD to solve some “serious” problems in education). Brazil appears bitterly at 60th place and Indonesia appears in the 69th position...

At first I thought this was a bad joke... Will it be that this table was published reversed? Or did some “trainees” (always taking the blame) manipulated wrongly this data?

I think that the OECD should be the one alerted to solve their serious methodological problems.

After all what's the benefit of these misguided rankings? Sounds more like a form of pressure on anyone who challenges the educational status quo.

Anyway we intend to form our children for the past or for the future?

To prohibit innovation is not the answer, much less to cling to outdated forms of education and assessment.

Problem solving vs. memorize answers

The problem solving (unlike traditional “memorize answers” and “knowing theories”) is a way of learning that, although not a panacea, does not find – so far – methodology that is equivalent, interesting or even practical. “Knowing theories is one thing, but everything takes on new light when you try to implement theories in real life”, said Beau Tippetts (Madsen, 2015).

According to the definition of Barrows (1996), “Problem-Based Learning (PBL) as the constructivist answer to traditional learning theories is based on three main preconditions for successful and comprehensive learning process: it is student-centred; follows an active process of knowledge construction; and it is collaborative”.

However, the origin of PBL seems to follow the *modus operandi* of official history: many inaccurate versions, nebulae, mysterious, full of gaps, not always showing what really happened, since that end up being filled with the most amazing odds – many of them called conspiracy theories – based on different points of view, serving interests of certain groups, without letting people know the truth. What would have actually happened?

The most commonly accepted version is the same available at Wikipedia (Problem-based learning, 2012): “PBL is a student-centred pedagogy in which students learn about a subject through the experience of creating a problem. Students learn both thinking strategies and domain knowledge. It was developed at the McMaster University Medical School in Canada in the 1960s and has since spread around the world”.

Even so, the inaccuracies remain. According to Neville (2009), PBL was pioneered in the medical school program at McMaster University in Hamilton, Ontario, Canada in the late 1960s by Howard Barrows and his colleagues. To Neufeld and Barrows (1974), the modern history of PBL starts in 1960, where several schools used similar methods for educational questions. However, the credits for introducing the first PBL curriculum belong to the McMaster Medical School in Hamilton, which started in 1969. The first European PBL curriculum was introduced 1974 in the Maastricht University Medical School. According to Clandfield and Sivell (1990), “the origin of PBL, goes back to 1920. Celestin Freinet, a primary school teacher, came back injured from World War I. He saw himself incapable of speaking and teaching in front of a class for extended periods of time. His injuries forced him to seek a new methodology that would allow him to continue his professional activities in a satisfactory way. He established a system, in which the pupils played an active role in learning. Mainstays of this approach were communications skills, cooperative learning, self responsibility and self evaluation of their learning process: all elements and features of PBL”.

Maurer and Neuhold (2012) commented that “nearly 50 years after its introduction in university education PBL is still considered an alternative way of teaching and learning”.

Probably referring to the year 1962...

McMaster states that “Howard Barrows, a McMaster architect of PBL who pioneered the concept of using simulated patients to train medical students” (Accidental educator, 2011). And about him “A professor of medicine at McMaster from 1971 to 1980, Barrows created educational tools and learning methods that have defined modern medical training. His innovations included standardized patients and performance-based testing. His research encompassed the problem solving skills of physicians and PBL as a structured teaching/learning method.”

Soon the information (it was developed at the McMaster University Medical School in Canada in the 1960s and has since spread around the world) may not be correct (Problem-based learning, 2012). Or can? PBL was first started by Barrows and Tamblyn (1980) at McMaster University, Canada in September 1969 for educating medical students to become physicians. The roots of PBL can be traced to the progressive movement, especially to Dewey’s (1944) belief that teaching should appeal to students’ natural instincts to investigate and create. Inspired by Dewey’s maxim, Howard Barrows, a physician and medical

educator at McMaster University developed PBL for educating physicians to foster their own capabilities for reflection outside of school in ordinary life.

We can't take away the merit of Barrows (in develop, standardize and use the method in the university environment), but either he reinvented the wheel or "forgot" to reference the creator. In September 1969 Barrows was not a professor at McMaster (only two years later).

What would be the correct reference? The year 1980, 1974, 1971, 1969, 1962, 1960 or 1920?

A little hazy. May have spent more or less than 50 years, but the vast majority of universities (including European) is not yet there (does not practice, ignore)...

Anyway, the PBL was published only in 1980 (Barrows & Tamblyn, 1980). Subsequently in 1985 (Barrows, 1985) and 1988 (Barrows, 1988).

Patangi K. Rangachari, a professor emeritus of medicine who was working on a book with Howard Barrows, stated that he presented himself as an accidental educator: "He called himself an accidental educator. He drifted into education, but his contributions were tremendous. He invented the simulated patient program and consolidated the body of knowledge around problem-based learning." (Accidental educator, 2011).

The paradigm shift usually happens with those who are from outside (in this case, the area of education)...

Educators are like soldiers in the hierarchical structure of an army, far away from mass thinking, dominant and power structures. They just fulfil orders and strive to maintain the current situation represented by the resilience of things "as they should be" and "as ever have been". In this way, hardly innovate in their teaching practices or even are friendly with possibilities outside of the commonplace.

If schools and universities were kitchens, educators would not be the chefs, but replicators of cake recipes (created by others). Not that this has to be seen necessarily as a problem. Better replicate a good recipe than produce something original unpalatable.

But the innovation and breaking paradigms usually comes from those who have different backgrounds of education and outside vision, away from the eye of the storm: Jean Piaget (biologist, Swiss), John Dewey (philosopher, American), Lev Vygotsky (lawyer, Belarusian) and Paulo Freire (lawyer, Brazilian). Regardless of the career of each and the different complementary formations during their lives was the simple fact that they did not start their careers as educators (or trained in education) which enabled an innovative and uncompromised vision with the dominant format (including today).

McMaster University (2015) was established in 1887. The Maastricht University (2015) is much more recent, 1976.

Although the first may be considered traditional, neither of the two is medieval...

It's certain that absolutely nothing is forever, and that the paths that brought us to today are not the same that will lead us to the future. But we have to change because society today is changing every day. Often, new approaches are seen as a source of danger to the current system, but the real danger is to refuse to understand the languages and the strategies that are related with these new methodologies, keeping the university further away from the real world. (Roth, 2013).

Steve Jobs said that: "We have always been shameless about stealing great ideas." (Roth, 2011), (Denning, 2011). Ethics aside, what can be seen as lesson is that not necessarily developing an original solution – such as PBL – can lead to success. More important than this would be to use effectively than there is already available, often free of charge, although developed by others (such as the PBL, for example).

And the case of the universities of McMaster and Maastricht is exemplary.

Regardless of who the father of the child is, the important thing is that PBL is an innovative methodology that has come to stay. It should receive greater care on the part of universities that could invest in its development coupled with ubiquitous technologies and the irreverent Socratic method of inquiry (maieutic).

The Maastricht University (2015) is, arguably, the main user of PBL, but at the same time the vast majority of European university professors have no idea how to use the technique. For lack of curiosity or even interest not even try to use it; and not even seek examples and practical uses. To Lee and Kwan (1997) there are also some perceived weaknesses to PBL, which include a lack of traditional structure and progression, and a lack of depth in the knowledge acquired. Professors with these concerns do not recognize the integrative nature, and the aspect "you learn what you need" of PBL.

Guerreiro (2009), on behalf of the GUE/NGL Group (PT) and referring to the various demands said that the European Parliament should stop having the pretension that they can give lessons to the world. In some aspects, such as democracy, discrimination and respect for human rights, for sure. However the Maastricht University (2015) can and has many lessons to give. And not only to traditional European universities that remain entrenched.

This spirit of trying to do things in a way we think is correct or even appropriate to the present day coming up in resistance by maintaining the current situation that remains acting in the universities where prevail concepts such as tradition and resilience in always doing things the same way, albeit with some possible contours of modernity. Just a gloss, an eternal paving the cow paths...

The step forward, contemporary and verified only in some schools, it would be fully release the use of the internet, including tests and exams. A total of 14 colleges in Denmark participated in the pilot project of a new system of exams since 2009 (Hobson, 2009) and all schools in the country have been invited to join the scheme by 2011 (Cisco Systems, 2011). Students can use all sources of information available to solve a particular problem that simulates real needs unlike theoretical questions, without practical application, that only requires the memorization of content. This is another resource in the same way as occurs in real life when we use all possible means to get answers and solutions (Roth, 2014a).

Currently it is possible to apply, with security, evaluations either offline or online through different technologies (blogs, case study analysis, chat room responses, end of semester paper, group projects, interactive video, journals, podcasts, reading responses, threaded discussions participation, videoconferencing – individuals, small groups or large groups – voice-based discussion boards, weekly tests and wikis). (Brady, 1998), (Poe & Stassen, 2002), (Rogerson-Revella, 2015). The differential should be mainly in the type of issues raised (that do not have simple and ready answers available on the internet) as well as in the individualized edition of the problem for each student or groups of students: the proposed problems should not be exactly the same for all.

The questions that students have to answer in this kind of exams forces them to relate the facts and not just debit them: “Our exams have to reflect daily life in the classroom and daily life in the classroom has to reflect life in society. The internet is indispensable, including in the exam situation”, argued Bertel Haarder, Minister for education in Denmark (18/02/2005 – 23/02/2010). For him, the actions may be followed by other countries: “I’m sure that is would be a matter of very few years when most European countries will be on the same line.” (Hobson, 2009).

This evolution does not necessarily pass by information technology or internet, but by the producing an assessment of better quality, customized, which is not reproduced and applied to the same group of students, or worse, maintained year after year without substantial changes – as if the knowledge did not evolve over time or even if the evaluators do not update their skills.

Demonstrate interest in developing an updated assessment meets the need to develop an updated education (not only technologically) and is part of the job of a professor in the same way that update the course syllabus and the relevant bibliography.

The creation of problems and different situations for each student inhibits the behaviour, sometimes verified, of reproduce the answers produced by others. And the release of the use of all possibilities – including the internet – such as occurs in real life, comes not only to meet the new needs (problem solving) as reproduce our “normal” behaviour of using every possible means to find a solution.

Correctly used (as a means and not an end) the technologies don't become a problem for the evaluations (hypothesis of copy ready answers found on the internet or obtaining the results through the internet contacts), but an ally both in the generation (sequential or random) as well as in the supervision process (face-to-face or at a distance).

The school at all levels – including university – must be aligned to the world around them and not indifferent, castellated, resilient and averse to changes; using content, means and archaic methods that are reused every generation of teachers, as if the world did not evolve.

But it is not enough provide “computers and internet” and refrain from the process. Even the best orchestras can play without a conductor, but it is he who gives the interpretation to the piece of music being performed – and “life” to their musicians. There are cases where we can even say that the orchestra would play better without them, but without a “real” conductor there is no music, they simply reproduces what's in the score.

And, certainly, the question is not architectonic...

We can create and deliver modern spaces, of excellence, with all available and imaginable computing resources and still not get anything beyond the dispersion, use of electronic messages, social networks and access to inappropriate content.

Without a problematic to be solved, without a proposed objective, without a guide to accompany the journey, connect the dots and to establish goals to be achieved we will not going anywhere... With or without internet we will just pass the time.

The rite (without the pretence of becoming a cake recipe) passes through a contract between the parties (and I don't mean the bureaucratic and/or legal issues), but an agreement involving areas of individual interest with objectives to be met, possibilities available (materials and technological) and limits (they always exist) to obtain and/or achieve the minimal results proposed. In addition to a timely manner, that can be set (with clearances) based on prior experimental achievements that validate and support the methods.

For decades Brazil was appointed as the country of the future (Zweig, 1941). The time passed and this “future” apparently never came. What about in terms of education when we are not yet able to offer universal access – and free of charge – for all without exception and/or discrimination (positive or negative) as opposed to the dominant model that favours those considered as “best” (in some abstract sense), that is, those who find themselves in a privileged situation economically, socially, geographically – or even with the support from who indicates them.

We might have thought that Europe (broadly speaking) due to the tradition in the area (cradle of the universities) was ready to provide answers, not

necessarily to the world, but to the resolution of their own problems in overcome the difficulties to provide education, at all levels, for everyone and free of charge and sustainable. But it's not what happens. The good exceptions, and the best examples are verified only in northern European countries, not only in the countries considered as Nordics (Scandinavia) that, in general, have better quality indicators of life and educational levels of their populations.

To Reginaldo Carmello Correa de Moraes, the university must desist from "cathedrals" to get to the student (Lucena, 2015), opting for more affordable models, making small buildings and taking advantage of the existing infrastructure. Massify, decentralize and popularize should be the goals of higher education in Brazil (not only in Brazil). His analysis on the models of education in several countries shows how Americans turned an elitist and private model in other, flexible and mostly public. He points the capillarization as the most important factor due to multiple access points for higher education that were made available.

This capillarity can be facilitated through the proper use of the technologies (which hardly happens), through inner, outer and virtual spaces.

Inner Space

A conceptually innovative model of inner space is the CFZ Zattere (2015), Cultural Flow Zone, developed by the Ca' Foscari University of Venice (UNIVE). To Roth (2014a), it is a cultural centre, an open space, comfortable and multi-purpose, dedicated to the meeting and exchange among students. In the CFZ is possible to find services and training courses, extracurricular activities that complement the studies, projects designed and carried out by students and spaces for relaxing, reading, studying and consulting books.

From the University of Western Sydney (2015) we have the Innovative Learning Spaces: Collaborative Learning Space, Collaborative Computer Lab, Collaborative Theatre Space, Learning Commons, Social Learning Space and The Academy Learning Space.

The Penn State College of Education (2015) presents the Krause Innovation Studio and defines its work in terms of interactions and activities, rather than tools and technologies.

Their vision is of a physical and intellectual space focused on developing 21st century educational leaders who engage in innovation and research with emerging technological tools, and achieve excellence in teaching and learning. The reversal of the traditional educational technology paradigm (teaching first, technology second) addresses the needs of an increasingly diverse and geographically dispersed student population.

From Aalto University Helsinki (2013), one particular learning space that is innovative, practical and upholds their student centred pedagogy. Called "The Stage" this is a flat learning space for up to 100 students, it was not purpose built

but is a visionary re-design, on a low budget, of an existing space previously used by the Engineering School.

The “Lectorial” Innovative Learning Space from University of Melbourne (2013), project of 2010, represents a range of new learning spaces developed across the campuses.

City University London (2015) current vision for new and refurbished buildings now has the paramount opportunity to be truly visionary, by projecting forward to Future Learning Space.

And Karp (2014), co-founder of the Design Engineering Collaborative at UC Berkeley, gives many architectural suggestions, discussing how to really transform a design and innovation space from an idea into a reality. A summary of a few lessons learned: don't take no for an answer; be humble but be strong; create a vision; believe in yourself and your vision; pay attention to how you brand yourself on campus; be clever and creative; keep the momentum and foot on the accelerator; don't be afraid to do something drastic; care about what your doing and your involvement; have fun!

Outer Space

With regard to shared infrastructures the UNIVE had until 2014 with the International Centre for Educational Research and Advanced Training (CIRDFA, 2014) that was used by the four universities in the Veneto (Italian region where it originated about 30% of the Italian immigrants in Brazil), Università Ca' Foscari Venezia, IUAV University of Venice, University of Padua and University of Verona.

However, despite the amount of projects advertised in UniVirtual (completed: Bridging, CHISS, LNV, Lethe, PACE, emett, MiforCal, Permit, SFP, CLIMA, uTeacher, Share.Tec, SEMLANG, 3EMI, Mabe, SUV, Pinokio, SSIS, Rapvite; ongoing: OMD, ISDERA, Progetto PRIN 2009, RAPVITE, IRIC, ESSTIC, SUSTCULT, ALICE) it is not clear a real transformative innovation of university practices of the UNIVE, but a mere glaze under the traditional format of e-learning/blended learning that abducted the universities with false promises of low cost and massive reproduction.

The only active reference that remains related to the acronym CIRDFA is the IRIC-CIRDFA (2009), an academic cooperation project with the Institute of International Relations of Yaoundé II (Cameroon). Probably the same resilient European rhetoric seen in Roth (2013) and Roth (2014b) where through agreements and projects financed by the European Commission (EC), some universities imagine that they have a vocation to teach others, to give “lessons”, to perform some “training” workshops, demonstrating the uses of the basic and most elementary of an education system pseudo-technological, outdated and that has never been didactically correct.

Currently the Centro Internazionale di Studi sulla Ricerca Educativa e la Formazione Avanzata (CISRE/UniVirtual) has the Laboratorio RED (laboratory of educational research), Laboratorio Univirtual and the European Centre for Women and Technology (ECWT).

Paths and models for “innovative” teaching...

Companies such as JISC (2015), an United Kingdom non-departmental public body, present themselves as being a “charity” institution, but provide digital solutions for UK education and research, being funded (over 80%) through the body financing UK HE and FE, with additional support coming from higher education institutions.

Harrow (2014) points out the benefits of this shared infrastructure: “The last few years have not been easy for UK universities. They have had to deal simultaneously with policy uncertainty, technological innovation, greater competition as a result of internationalization and globalization, rising expectations from students and of course, new pressures to tighten budgets and get the greatest return from their scarce resources.” But in the past JISC has just been, part of the furniture of the higher education sector, so there is no frame of reference for assessing the value of than they did.

It is similar to the situation of FCCN (2015), which was a Portuguese non-profit private institution and public utility in the period 1987 to 2013, when it became a unit of the Foundation of Science and Technology (FCT) thus integrating this public institution.

Another example is the four universities of Virginia (George Mason University, University of Virginia, Virginia Tech and James Madison University) who joined forces in a public-private partnership called 4-VA with Cisco Systems to pilot a shared infrastructure and implementation of the company’s TelePresence technology (Rich, 2011). The technology for the project will improve access to academics, reduce time to graduation and reduce costs.

Institutionalizing the education practices mediated by the different technologies in a particular university is much more than installing a version of a Learning Management Systems (LMS). But once these client institutions learn the cake recipe they “become free” and create their own structures (using the same methods and materials under which they were “trained”). Most often paying to similar institutions (there are no disinterested partnerships in a market under competition), with own resources from their budgets or from the EC - to “learn” how to practice wrongly the use of technologies.

The EC, which maintains one of the funding schemes (FP7, Horizon 2020) more perverse with regard to new entrants, always giving priority to – and dishonestly – those that have already been covered previously (teaching or research projects), that is, always maintaining the same beneficiaries. They should move in the opposite direction. Do not award grants for those who have previously obtained previously (forcing them to grow up and go to the market)

and allow a general renovation of structures and beneficiaries, at least without discrimination and favouritism – and this includes renewing the judges and administrators so that the system does not create addictions and relationships. Allied to this corrupt structure also has a total lack of justice – when it comes to appeals (redress procedure) filed against the denials verified. Come to be absurd verify that the Europe – that prides itself on having one of the most advanced justice systems in the world – does not allow an application denied to one of your lines of financing be object of appeal, namely, the redress procedure introduced for FP7 (and valid for Horizon 2020) does not give a new right of appeal (Fumero, 2012). The argument that “it ensures a consistent and coherent approach to complaints, upholding the principles of transparency and equal treatment” is absurd. If European judges don’t make mistakes so why we need higher national courts, the European Court of Human Rights and four international courts in The Hague?

There are also foundations of public and private universities; and private companies that also try to explore this aspect (provide services to universities), but they will always be mercenaries in this area. Most often it is the same team originating from the same universities or even, from other similar institutions. People who did not develop this type of activity in the institutions as employees, but that subsequently imagine themselves able to give lessons (sell information) to the same institutions or to others.

Sharing infrastructures seems to be an interesting possibility economically if we can keep the control and the privacy over our relevant information. But we should not make the same mistake of the Trojans, as in the case of Google (Roth, 2015).

Shared projects by universities are usually dated, or have a limited lifespan. After the “technology transfer” each goes its own way...

Virtual Space

The UNIVE following the minimalist trend of use, practiced by their European counterparts, offers an outdated LMS in several instances (Roth, 2014a). But with the latest technology and web application advancement, a new generation of LMS is expected and should have some new features. These include: the need to be open, personal, social, flexible, support learning analytics, and properly support the move to mobile computing. This new generation of LMS must be able to meet the need of the changing environments of business and education to allow these institutions to reach their potential (Stone & Zheng, 2014).

Find a virtual space updated as the Schoology (I am not referring to the updates, but the current needs of the “new” customers) it is rare, and the experimentation with 3D immersive environments such as Second Life does not have led the institutions anywhere – the worst, many have returned to the “past” (through the archaic ways to educate and assess)...

After an initial phase of excitement with the technologies we find four distinct situations: some institutions have returned to traditional practices; others accommodated themselves with the initial situation of basic and limited use; some, correctly, started to pay more attention to teaching than to technology; and many are floundering, remaining in the same place while trying to innovate. The fundamental question seems to be: where to go?

The results of the 8th Annual Learning Tools Survey (Hart, 2014) show old acquaintances and some new features. The top 100: Twitter, Google Docs/Drive, YouTube, PowerPoint, Google Search, WordPress, Dropbox, Evernote, Facebook, LinkedIn, Google+ & Hangouts, Moodle, Prezi, Pinterest, Slideshare, Blogger, Word, Wikipedia, Feedly, Diigo, Articulate, Audacity, Camtasia, Yammer, Skype, TED/TED Ed, Google Chrome, Google Scholar, Scoopit, Snagit, Gmail, Adobe Connect, Adobe Captivate, Flipboard, Kindle (& App), Outlook, iSpring, Coursera, Hootsuite, Khan Academy, Edmodo, Adobe Photoshop, Excel, Google Maps, Zite, Powtoon, iPad & Apps, Padlet, Pocket, Udutu, Tweetdeck, Voicethread, Explain Everything, Jing, Flickr, Nearpod, Keynote, Quizlet, Storify, WebEx, Mahara, SurveyMonkey, iTunes, Google Translate, SharePoint, Haiku Deck, IFTTT, OneNote, Google Apps, Poll Everywhere, Blackboard Collaborate, Socrative, Wordle, Notability, Google Sites, Delicious, Glogster EDU, Canvas, Tumblr, Vimeo, Kahoot, OpenOffice, WhatsApp, Wikispaces, Instagram, Pearltrees, Easygenerator, Voki, Lectora, EDpuzzle, Blackboard Learn, Firefox, Paperli, TodaysMeet, LINE, ProProfs Quizmaker, Moovly, Schoology, Blendspace and SoftChalk.

The novelties of this edition were: Powtoon (6), Explain Everything (53), Nearpod (56), Haiku Deck (66), IFTTT (67), Notability (74), Canvas (78), Kahoot (81), Instagram (85), Easygenerator (87), EDpuzzle (90), LINE (95), Moovly (97), Schoology (98), Blendspace (99) and SoftChalk (100). It is perceived by rating that the most used options are free of charge (even if that compromise the privacy of users), and that the most interesting tools only at this time begin to find more users. This is due also the accommodation of all of us to remain doing the same things in the same places. In the LMS area the Moodle stays ahead and this is due only for the simple reason it does not have direct costs of acquisition.

Conclusion

There are several papers, highly speculative, trying to explore and question everything that we think that we know not only how it should be the modern education (through a new didactic or of a correct technological mode), but about all areas of knowledge. It seems to be much easier to criticize than to act and it is obvious that someone who acts always deserves greater consideration than the one that only opines.

In the report's recommendations "Designing tomorrow's education. Promoting innovation with new technologies" suggested an awareness of what is at stake at the European level and to pencil in the outlines of a common policy (RCCEP, 2000). The text brings several references to these experts, namely "analysis" and

“evaluation” – which is always a risk because the “experts” of the EC constitute a mafia who settled in the structures – in addition to cite and criticize the initiatives of several member countries, such as “In many respects Finland is a genuine information society laboratory in Europe”. Seeks to build and promote a virtual European education area.

All areas that imagine living under absolute and unquestionable truths constantly are faced with information and possibilities considered impossible in the eyes of the dominant paradigm, judging by everything we thought we knew about the issue. But, many times, even a small discovery to put in check all the fragile models developed, inspired many times in an orthodox view, not necessarily who created them, but of those who have power or position to propose them.

The most honest answer we can give, not only in education, but absolutely in all areas of human knowledge is, we don't know. We think we know, we feel we know, but we don't know. Something that refers to a self-referential Socratic paradox: “I know that I know nothing” or “I know one thing: that I know nothing” (*ipse se nihil scire id unum sciat*)...

All pseudo-experts, pseudo-researchers, pseudo-educators or even those who imagine themselves experts, researchers and educators should start from this premise: that the first step to wisdom is to recognize that we are basically ignorant and we must always remember that we don't know anything. That we are nothing, we are just exercising certain position, often temporarily and conquered in a dishonest way, patronized or even undeserved. And that no one gets different results doing the same things and the same way (Roth, 2014b).

To Seixas (2013), “in Brazil, everything becomes fashion. Even street demonstration”...

Although she considers being a cliché this story to go to Europe and back talking about a “civilization shower”, the writer defines the Brazilians in general as being frivolous and superficial; and Brazil as a country that “seems to have passed, in mass, from functional illiteracy to the Facebook – nonstop.”

Generalize concepts or opinions about any country (even though our) or continent, that we do not know properly, it's always a big risk. Much more based on a trip of less than 30 days only in Germany – and after referencing to “Europe”, ignoring the immense cultural diversity of the continent. The Brazilian universities, for example, with all its difficulties – including budgetary – has “generically” a much less conservative stance regarding the correct use of technologies in support of teaching than the vast majority of European universities.

Universities generally are cake recipes and after implementation of the EHEA the European cakes all look the same (independent of the factory), though some are fully or partially paid and other totally free of charge.

We need to stop thinking that keeping a false presence on the internet and providing some outdated LMS – for the deposit of files – means some innovation. It is not, on the contrary, it is a disservice to education and customers will be the first to notice that this is a misuse of technology these days.

Absolutely nothing replaces the video and video conferencing, whether in high quality facilities (and high cost) as well as through software-based clients.

Video conferencing (synchronous) can be recorded and made available asynchronously, as the videos. Properly used, with the support of an actual LMS and a contemporary rereading of the Socratic method; weighted use of social networks and the PBL may permit the construction of a truly immersive experience, face-to-face or at distance, where the education (end) is ahead of the technology (means).

With the universities' routine, the pretentiously modern professors and the various LMS – traditional, little or barely use, not updated, limited, without adjustments or even evolution, such as Moodle – no longer attract so much attention and became part of the scenery – like some writers...

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Funding and Spending for Mainstreaming Support for OVC in Public Nursery Schools in Nyeri Country, Kenya: Practice, Constraints and Policy

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Abstract. The goal of expanding educational opportunity for Orphans and Vulnerable Children (OVC) is extricably linked to the amount of funding invested in education to maximise student learning and participation. Deprivation of interventions during the early years results in lifelong deficiencies and disadvantages. Therefore, substantial disparities in the amount of funding in Public Nursery Schools (PNS) may cause substantial disparities in the quality of educational opportunities for OVC. The amount of funding provided in PNS influences the specific instructional, curricular and psychological components necessary to deliver national education standards in PNS. Provision of special attention to mitigate barriers that impede OVC access to equal benefit with all children involves adequate funding to establish and sustain support structures in schools. The purpose of this study was to find out the influence of adequacy of funding and spending for mainstreaming support for OVC in PNS in Nyeri County. The study employed a descriptive survey design with a sample of 19 PNS. Data was collected through questionnaires for head teachers and preschool teachers and an interview with the District Centre for Early Childhood Education (DICECE) programme officer. The study found out that funding for OVC support compromised continuity of OVC, continuous staff development, staff motivation and allocation of funds to support structures such as feeding programmes and provision of bursary funds. To avert this crisis the study recommends that the Ministry of Education in Kenya, the Children's Department and NGO's should increase intersectoral linkages for more budgetary allocations to ECE. More so funds specifically earmarked for OVC support could mitigate challenges experienced by OVC in preschools.

Keywords: Financing ECE, Orphans and Vulnerable Children, Adequacy of finance, Public Nursery School.

1. Introduction

Education as a basic right for all children and finding the necessary resources to protect OVC has become a priority in international instruments. This right is enshrined in the United Nations Convention on the Right of the Child (UNCRC) of 1989, Millennium Development Goals (MDG) of 2000, Education for All (EFA) of 2001 and the United Nations General Assembly Special Session on HIV/AIDS (UNGASS) of 2010 which provide rights based approaches to child welfare Abebe, (2009). In this context Early Childhood Education (ECE) centres have become important institutions both as centres of learning and channels through which support services such as daily meals, provision of clothing, learning materials and psychosocial support are provided to OVC. However funding for vulnerable children in ECE is one of the greatest challenges faced in educational transformation as the percentage of the influence of adequacy of finance on support services for OVC is higher compared to how culture treats children outside their maternal homes (Foster and German 2002 in Abebe, 2009). Major global disparities in provision of ECE continue to divide the world's richest and poorest children as the provision of quality education and establishment of OVC support systems is dependent on funding received in PNS. Despite significant increases in basic education enrolment and completion rates, access to and quality education remains low among disadvantaged children in many countries.

Statistics collected by UNICEF in 2008 revealed that pre-primary gross enrolment ratios averaged 79% in developed countries and 36% in developing countries and falling as low as 14 % in Sub Saharan Africa implying that children from wealthiest households and those who receive funding are more likely to attend preschools than those from poor households UNESCO, (2008). For OVC poverty, illness or death in the household may lead to reduction of resources allocated for the child's schooling creating barriers to access to and retention in education. Survey data by UNICEF (2004) revealed that by 2003 there were 143 million orphans aged 0-17 years in 17 countries of Sub-Saharan Africa, Asia and Latin America and Caribbean. Out of the 143 million, 12% are below 6 years and require early intervention. Kenya has 2.4 million orphans of these, 47% are due to HIV/AIDS. The estimated number of Orphaned and Vulnerable Children (OVC) below 5 years rose from 399,298 to 409,071 in 2007 USAID, (2009). This signifies that access to ECE for OVC aged 3-5 years remains a challenge as only 28.2 % attend school MGCSD, (2007). The rest (71.8%) miss or drop out of school as they are exposed to facets of deprivation, poverty, lack of care, inadequate shelter, lack of access and retention in education, malnutrition and lack of psychosocial support which stems from the unavailability and inadequacy of financial resources for their upkeep Carroll and Boker, (2003). In Kenya, households are the main source of domestic funding not only for tuition fees but also payment for other inputs needed for children to attend school. The government contribution to ECE is less than 0.1% compared to 61% in primary schools UNESCO, (2005) making coverage extremely variable and largely dependent on family income or the extent of community involvement. Statistics collected by Children's Department in Nyeri county shows that the number of households with OVC had reached 4,261 in 2013 with 14,061 OVC yet only 358

households benefitted from Cash Transfer Funds. Access to education for children in low income groups is therefore poor as provision is underfunded. Adequate funding for PNS where poor households opt to enrol children therefore provides better human resource through capacity building, give payments in time, and develop sustainable feeding programmes and provision of learning resources for OVC.

Financing of human resource and school feeding programme

According to American Federation of Teachers (2012), the success of a school depends mainly on the quality of its human resources. In Kenya the responsibility of staffing pre-schools rests with the school managers, sponsors and proprietors. Akiba *et al.*, (2012), indicates, since teachers have to be remunerated by school owners, many of the bodies who own schools are unable to pay higher salaries which impacts on the ability of the teacher to implement ECE programme effectively. The level of teacher pay is critical to the quality of education equation. If a teacher is well paid it will positively influence the quality of care given to OVC. A study carried out in Johannesburg to explore the viability of school based support for vulnerable children found out that remuneration was a point of dissatisfaction for teachers as the pay was low yet they were expected to perform outside the roles such as meeting the needs of OVC Williams, (2010). Studies by Oleke (2007) found out that households receiving external support were likely to have all OVC under their care in school. This findings occurred in the midst of evidence showing that the range of barriers to school attendance includes OVC being obligated to work and lack of food even when the education itself is free. Feeding programme has been implemented in schools as a strategy to reduce the cost of education to parents and as incentives of sending the children to school. UNESCO (2008), points out that malnutrition is a global epidemic that affects one in three children under the age of five years and undermines their ability to learn. UNICEF (2006) indicates that under nutrition has a negative impact on school participation and achievement and children from poor families are more likely to be undernourished and to remain out of school.

Financing facilities and curriculum support materials

Accurate costing of OVC activities is essential to achieving sustainable response, Swindale (2006). Government planners requires several levels of costing data to inform sound programming, decisions including cost data that informs basic budgeting which indicates the potential outcomes to be achieved. Global figures by World Bank ((2008), pointed out that 12% of all resources should go towards supporting OVC and more than 9-10% of the 12% should go to sub-Sahara Africa. Curriculum guidelines developed in Kenya at the national level aim at ECE programme to address natural, cultural and social economic features of each local area. The curriculum is meant to nurture effective, cognitive and physical abilities in a child. Among the most important instructional materials that have significant influence on teaching and learning process are resource books for teachers, charts, posters, work cards, drawing books. Availability of such material has positive effect on school effectiveness and has a direct and

positive correlation with pupil achievement in developing countries (Otieno and Colclough 2009).

World Bank (2002) states that the cost of writing materials, uniforms and development of curriculum hinder access of OVC to education. Chernet (2001) lists problems associated with orphan hood as: inadequate funding, shortage of trained personnel, inadequate skills and lack of psychological support, medicine, clothing and educational materials. Carroll and Boker (2003) reports that OVC are likely to drop out due to unaffordable school fees, uniform and inadequate learning materials. Further still, Carroll and Boker (2003) highlight that schools need to abolish school fees and change policies around uniform which leads to retention of OVC in schools. Smart (2003) reported that responding to OVC involves sensitizing and training teachers together with other stakeholders to support vulnerable children through provision of stationary and clothing. Textbooks and other learning materials need to be available and provided at little or no cost to reduce school drop out for OVC. To add to this, Kabiru and Njenga (2007) reports that swings, balls and other play materials need to be available in nursery schools since play is the most natural way in which children learn. Inadequacy of toys, play facilities and development education leaves many children with reduced motor skills and language abilities. Children learn to share play materials, take turns for example when they use the swing and to cooperate with others yet the purchase of play materials and construction of play facilities require more financing.

Nursery schools facilities exhibit great variety in terms of quality and quantity depending on the resource capacity and the general awareness of the community Baker *et al.*, (2012). An evaluation of ECDE programme in Tanzania revealed that furniture provided in rural schools consisted of desks meant for older children and were unsuitable for young children especially the physically challenged Vavrus, (2003). In Kenya, the National Center for Early Childhood Education (NACECE) coordinates the development of both centralized materials and decentralized curriculum and support materials. District Centers For Early Childhood (DICECE) officers organize workshops and seminars in which parents and communities are encouraged and empowered to increase their participation beyond the provision of physical facilities (GOK, 1991). The parents assist in buying and developing learning and play materials and provide Community Based Growth Monitoring Programme (CBGMP). For OVC the participation of guardians in curriculum development through purchase of play materials becomes a challenge due to inadequacy of funds for family upkeep. A study carried out in Zambia in 2009 on Education and Early Childhood revealed that the major problem that OVC faced was that some went to school without school requisites such as exercise books, pencils, and for some the uniform was torn and unappealing. This obliged some of the teachers to buy the books and uniform for the children (Mbozi, 2009).

Financing school based health services and OVC support

According to USAID (2008) health affects the degree to which school children benefit from education as poor health impacts brain development, cognition and

behavior. Lusk *et al.*, (2000) further says that children less than 5 years are infected with HIV/AIDS are vulnerable to serious illness as elderly caregivers are frequently uninformed about nutrition, immunization and diagnosis of serious illnesses. These children have high rates of anaemia and other nutrient deficiencies such as vitamins and zinc caused by poor families' inability to afford fortified foods and supplements to address these concerns. School age children have the most intense worm infestations such as roundworms, whipworm or hookworms. This infestation causes anaemia and poor physical, intellectual and cognitive development, resulting in a detrimental effect on students' educational performance (UNICEF, 2009). Deworming is thereby essential in order to maintain good nutritional status and achieve better absorption of food as well as improved cognition. It is a significant step that the US allocated 10% of global funding for OVC. It is therefore essential to use this commitment as leverage with other donor nations to create and ensure that they provide funding to much the needs of OVC. More still the US supports OVC through the funding of other mechanisms by supporting the global funds to fund AIDS, Tuberculosis and malaria. Even with such support less than 15% of OVC receive any kind of international support, the majority of people support they receive comes from their own communities (UNAIDS, UNICEF, and USAID, 2004)

2. Statement of the Problem

Expanding and improving comprehensive Early Childhood Education (ECE) for the most vulnerable and disadvantaged children is the first of the international communities commitment to ensure that basic learning needs of every child are met. This goal was adopted in the Dakar Framework for Action in 2000. However the progress since Dakar has been driven partly by strong policies in education but more so accelerated growth and poverty reduction in various countries UNESCO, (2010). However slower growth and declining revenue are jeopardizing public education especially in Sub-Saharan Africa UNESCO, (2007). National goals of education can only be reached through adequate funding and spending starting from early years. Funding and appropriate spending therefore guarantees all children an opportunity for success by ensuring that teachers are more qualified and well paid, ongoing teacher training, sustainable school feeding programme, reduction of direct and indirect of education for OVC and provision of curriculum support materials UNICEF, (2009). Requirements to pay for such inputs may prelude OVC from attending school as households with OVC opt to enrol them in PNS as the cost of provision in private schools is higher. It is in this view that the study sought to establish how funding and spending has influenced mainstreaming support for OVC in PNS in Nyeri county.

3. Research Methodology

Research Design

The study applied a survey design to source for primary data from PNS head teachers, teachers and District Centre for Early Childhood Education (DICECE) programme officer. Secondary data was sourced from wide range of literature

review which comprised of documentary sources on similar studies and policy documents on ECE.

Sampling Technique and Sample size

The study covered a population of 40 PNS in Nyeri central sub-county. Krejcie and Morgan (1970) equation was used to get a sample of 36 schools. However the sample size was big and Bartlett, Kortlik and Higgins (2001) correction formula for large samples was used to narrow the sample size to 19 PNS. The respondents were sampled using simple random procedures and purposive sampling for the DICECE programme officer.

Research Instruments

The main instruments for collecting data were questionnaires for head teachers and teachers. An interview was conducted with the DICECE programme officer.

4. Research Findings and Discussions

Sources of funding and mechanisms through which revenues are raised and spent have implication on adequacy in education finance. Achieving adequate educational outcomes therefore requires a reliable and adjustable supply of resources Emiliana, Alexandra and Chelsea, (2011). The study sought to establish the main source of funding for the sampled PNS based on the fact that mainstreaming support for OVC is enhanced by a major supply of funds. There was unanimous response 16 (100%) that the major source of funds for ECE centers was levies paid by parents. On the same note the DICECE programme officer stated that ECE department at the district level was financed by government, parents and community support programmes but financing from the government did not cater directly for education of children in ECE centres. The funds were used for coordinating DICECE programmes and in-service training for preschool teachers. Support for OVC was compromised as head teachers of PNS had the jurisdiction of developing mainstreaming policies for OVC support and implementation.

Specific Funding for OVC in PNS

In order to retain disadvantaged children in school and realize equality, schools need additional resources for children with special needs such as the physically challenged, orphans and HIV/AIDS infected and affected. All the 16 (100%) schools, lacked specific funding sources earmarked for OVC support. Earmarked vote head for OVC support though necessary seemed to be a challenge in all schools which jeopardized head teacher's ability to mainstream maximum support for OVC. The allocation of specific grants for schools enables institutions to provide school based care and to meet material needs of learners where appropriate. On the same theme the DICECE programme officer said that there were no specific funding systems for OVC at the ministry of education office although some benefited from community support grants and sometimes from NGO's for some children living in charitable children's homes. This situation left those OVC outside children's homes more vulnerability due to

lack of funds as other institutions that offered supports were the schools yet they mostly relied on fees paid by parents.

Funds Received, Expected Expenditure and Support for OVC

The study sought to find out whether funds received annually were equivalent to expected expenditure per child within the ECE centres. Respondents were asked to indicate the levies received and the expected expenditure for each child annually. Table 1 shows the responses.

Table 1. Funds Received and Expected Expenditure

Category	Average of Funds received per child (in Ksh)	Average Expenditure per child (in Ksh)	Expected Deficit
Southern zone	1542	3350	1808
Northern zone	1080	3500	2420
Average	1311	3425	2114

On average, schools in the Northern zone received Ksh 1,080 annually from each child which was less compared to schools in the Southern zone which received Ksh 1,542. On average schools received Ksh 1,311 per child with the expenditure being more thrice the consumption value; Ksh 3,425. This implies that the economic cost per child in each school was too high compared to available funds. Head teachers faced challenges in scaling up interventions for OVC as adequate funding was required for each student in order to guarantee the opportunity for an appropriate education for all children. The findings further indicate that in both Southern and Northern zone there was a deficit in terms of the amount received and the expected expenditure per child with the Northern zone having a larger deficit of Ksh 2,420 compared to the Southern zone with Ksh 1,808 annually. The unexpected fluctuations in per pupil funding hampered the ability of schools to provide a constant educational experience for all children each year.

Equivalence of Funds Received and Provision of Basic Educational Inputs.

When asked whether the funds obtained were equivalent in provision of basic educational inputs of ECE centres, 12 (75%) out of 16 (100%) respondents said that funding was inadequate for all schools. In the same context those who responded on the negative were asked to explain the reason why funds available did not cater for provision of educational inputs. Respondents indicated that the demands of some vote heads such as paying of wages for staff and purchase of teaching and learning materials were not met as the level of default was higher compared to irregular payments of school levies by parents. This culminated to challenges for school head teachers in establishing school support systems for OVC. This situation heightened the risk of OVC missing out on education.

Finance and Record Keeping for OVC

Record keeping for OVC in schools is essential for the formulation of effective policy, planning and budgeting for education. In the absence of such data, policy makers would not comprehend the magnitude of children's needs and the financial resources needed to address them. On this note teachers were required to indicate the different types of records kept for all children in their classes. All the respondents 15 (100%) indicated that class registers were used for class attendance, child's age and names of parents and guardians. In contrary teachers did not keep specific documents with OVC data for follow up and their participation in school. Respondents stated that it was expensive to buy files for each individual child. This adversely affected interventions for OVC as details on the plight of OVC could not be documented for ease of follow up. On the same context the DICECE programme officer said that the education office at the district level was aware of some vulnerable children especially orphans, HIV infected, jigger infested, children living with grandparents and destitute among others. However the office did not have concrete data on the number of OVC enrolled in PNS as the interviewee claimed that getting data for OVC in school was not within the scope of MOE office at the district level but that of the Children Department. The office also depended on verbal reports given by the school teachers and head teachers during routine inspection. Though aware of the magnitude of vulnerable children in the nursery schools the education office lacked concrete data for follow up and financial sustainability of OVC support programmes. This can be supported by Smart (2012) sentiments that though education sectors have good data systems where information is gathered and analysed annually on pupil enrolment, pupil drop-out, teacher/pupil ratios, teacher attrition, facilities at schools, and provision of infrastructure but as far as OVC are concerned, these regular assessments do not capture any information about OVC. Lack of funding specifically by the government for OVC culminated in negligence of the situation at the school level.

Finance, Teacher Remuneration and OVC Support

Remuneration as well as staff working conditions affects a teacher's motivation levels. A satisfied teacher is likely to offer quality services to OVC compared to a dissatisfied one. It is on this view that the study sought to find out the range of teachers' salaries. Table 2 shows the findings.

Table 2 Monthly Income of the Teacher

Salary (Ksh)	Northern zone		Southern zone		Total	
	N	%	N	%	N	%
Below 3,000	1	14	-	-	1	7
3,000-5,000	6	86	8	100	14	93
6,000-7,000	-	-	-	-	-	-
Total	7	100	8	100	15	100

On teachers' salary, cumulatively majority 14 (93%) of the 15 respondent teachers earned between Ksh 3000-5,000 per month while 1 (7%) earned less than Ksh 3,000. This indicates that teachers' earnings were relatively poor in both categories. Similarly all teachers 8 (100%) from the Southern zone earned less

than 5,000 whereas in the Northern zone majority 6 (86%) earned between Ksh 3,000-5,000 with 1 (14%) earning less than Ksh 3,000. The findings depict that 14 (93%) of teachers were not in a capacity to financially assist OVC due to poor pay. These findings concur with UNESCO (2005) that preschool teachers in Kenya earn a monthly salary that is generally less than half of that of primary school teachers. This low and irregular pay makes the profession unattractive to many. On the same note a poorly paid teacher may not offer any financial and psychosocial support to OVC as low pay leads to low teacher morale in curriculum implementation and response to emerging issues such as children vulnerability.

Respondents were further asked whether salary paid at the school was commensurate with the services rendered by teachers especially for OVC support. All the respondents 15 (100%) indicated that the salary did not commensurate with the services rendered. In the same theme the DICECE officer stated that though teachers in the district were qualified to handle ECE and care for OVC, they lacked support from head teachers. Sometimes teachers stayed for months without pay which placed them at a disadvantage as they could not support OVC out of their irregular earnings. The officer further said that ECE teachers should be better remunerated as better salaries would enable them to support OVC in situations where there is no specific funding for OVC through paying fees and provision of learning materials. From sentiments of the DICECE officer, teachers were poorly paid thus implying that their financial capacity was too low to enable them support themselves and OVC in classes.

Adequacy of Finance and Feeding Programme for OVC Support

School feeding is seen as one of the many interventions that support nutrition for pre-primary children as it gives children a healthy head start and paves way for a promising future Subbarao and Coury, (2004). School feeding is therefore a productive safety net for children aged 3-5 even those already enrolled in ECE centres. Respondents were asked to estimate the percentage of funds allocated to feeding programme. The findings indicated that 4 (25%) out of the 16 schools did not have a school feeding programme as no funds were allocated to it, 6 (37.5%) allocated 1-19% and 6 (37.5%) allocated 20-39% to the feeding programme. (Table 3). Due to inadequacy of funds 4 (25%) of the head teachers had done very little to support OVC in terms of provision of a daily meal.

Table 3 Funds Allocation to Feeding Programme

Allocated Funds (%)	Northern zone		Southern zone		Total	
	N	%	N	%	N	%
None	2	25	2	25	4	25
1-19	4	50	2	25	6	37.5
20-39	2	25	4	50	6	37.5
40-59	-	-	-	-	-	-
Total	8	100	8	100	16	100

The data further shows that though majority 4 (50%) of the schools in the Northern zone had managed to have a feeding programme yet the allocation was too little (1-19%) to fully cater for good and balanced meals for OVC.

Southern zone schools allocated more with 4 (50%) allocating 20-39%. It can be concluded that very little was allocated to feeding programmes both in Northern and Southern zone schools. The implication of this little funding and less allocation affected any efforts aimed at assisting OVC through viable school feeding programmes. In the same context the study sought to find out whether there were funds specifically earmarked for OVC support. The findings are summarised in Table 4.

Table 4 Percentage of Funds Allocated to OVC Support

Allocation (%)	Northern zone		Southern zone		Total	
	N	%	N	%	N	%
None	3	37.5	5	62.5	8	50
1-19	3	37.5	1	12.5	4	25
20-39	2	25.0	2	25.0	4	25
Total	8	100	8	100	16	100

The findings in Table 4 indicate that majority 8 (50%) of the 16 schools did not allocate any funding to specifically support OVC implying that retention of OVC in school was jeopardized as OVC specific interventions such as school subsidies and abolition of school fees were unmet. The other 8 (50%) schools had to some extent managed to support OVC as 4 (25%) allocated between 1-19 % the other 4 (25%) allocated between 20-39%. When schools were further stratified into Northern and Southern zones the study found out that 5 (62.5%) of the 8 Southern zone schools and 3 (37.5%) in the Northern zone did not allocate any funds to support OVC. When head teachers who had not allocated any funds for OVC were asked to cite the reasons for non-allocation, majority said that funds received from parents were meant for school programmes such as teachers' salaries and furniture. Earmarking funds for OVC meant that needs such as teachers' salaries were not met.

Adequacy of Finance and Continuity for OVC

In this question head teachers were asked to state how often they sent children home to collect school levies as abolition of tuition fees would benefit all children especially OVC living in resource constrained households. Table 5 summarizes the findings.

Table 5 Frequency of Sending Children home for School Fees.

Responses	Northern zone		Southern zone		Total	
	N	%	N	%	N	%
Every month	3	37.5	5	62.5	8	50.0
Once per term	3	37.5	3	37.5	6	37.5
Never	2	20.0	-	-	2	12.5
Total	8	100	8	100	16	100

The findings in Table 5 shows that cumulatively 8 (50%) out of the 16 head teachers sent the children home to collect school fees every month, 6 (37.5%) sent them once per term and 2 (12.5%) never sent children home. This implies that majority of the schools 14(87.5%) had very low capacity to support OVC as they lacked steady flow of finance to sustain support systems. In the same context the study found out that out of the 8 schools in Northern zone 3 (37.5%) sent children home for school fees every month, 3 (37.5%) once per term with a few 2 (20%) who never sent children home. Schools in the Southern zone faced more challenges on adequacy with all 8 (100%) of the schools sending children home to collect school fees. From the findings it can be concluded that 14 (87.5%) out of the 16 schools did not have steady flow of finances for supporting school operations and head teachers had to remind the parents to pay by sending children home. This posed challenges in 8 (50%) of the 16 schools in providing support for OVC in the school as support for OVC is possible if there is a reliable source of funds that are adequate in the support for school operations. After establishing that Children were sent home for fees, teachers were asked to state whether OVC were among those sent home. The responses are summarized in Table 6.

Table 6: Responses for Sending OVC Home for School Fees

Responses	Northern zone		Southern zone		Total	
	N	%	N	%	N	%
Yes	6	75	5	62.5	11	68
No	2	25	3	37.5	5	32
Total	8	100	8	100	16	100

The findings in Table 6 indicate that there was a significant number of schools 11 (68%) out of the 16 in both Southern and Northern zones that sent OVC home for school fees implying that the schools did not have enough funds for mainstreaming support for OVC by not sending them home for school fees. This placed a burden to families with OVC as these findings concur with Belfield (2006) who says that while school fees may be needed as a source of revenue for the schools in the low income families it represents a burden to the parents with low income, the poor and disadvantaged. Though this is the case the findings also show that there is quite a substantial number of schools 5 (32%) out of 16 that had managed to retain OVC in schools. This is in line with recommendations by Boler and Carroll (2003) that schools should abolish school fees or create inclusive policies and practices in order to avoid drop out of OVC due to unaffordable school fees.

Finance and Relevance of Teacher Qualifications for OVC Support

In order to check the specific contributions made by teacher qualifications in supporting OVC respondents were asked to indicate whether their qualifications were relevant in handling preschool children and giving support to OVC. This was based on the fact that funding for school improvement and for teachers professional development is essential in any education institution. The responses are summarized in Table 7.

Table 7 Relevance of Professional Skills

Response	Northern zone		Southern zone		Total	
	N	%	N	%	N	%
Relevant	2	29	3	37.5	5	33
Fairly relevant	5	71	4	50.0	9	60
Not relevant	-	-	1	12.5	1	7
Total	7	100	8	100	15	100

The findings from Table 7 revealed that cumulatively 5 (33%) out of the 15 teachers felt that their professional skills were relevant in supporting OVC, 9 (60%) felt that their professional skills were fairly relevant while 1 (7%) felt their skills were irrelevant in supporting OVC. From the findings it can be concluded that there was a substantial number of teachers 10 (67%) in both zone who needed financing for capacity building through refresher courses in order to enhance their skills for curriculum implementation and OVC support. In the same theme respondents were further asked whether they had been sponsored by the management of their schools to attend professional refresher courses. Table 8 summarizes the findings.

Table 8. Sponsorship of Teachers for Refresher Courses

Response	Northern zone		Southern zone		Total	
	N	%	N	%	Frequency	%
Yes	2	29	-	-	2	13
No	5	71	8	100	13	87
Total	7	100	8	100	15	100

In both zones a few 2 (13%) of the 15 (100%) had been sponsored for refresher courses while majority 13 (87%) of the teachers had not secured sponsorship to professional refresher courses from the management of the schools. Inadequacy of funds had jeopardized capacity building for majority of the teachers in order to enhance their skills in class integration of OVC. A closer look at the findings indicate that Southern zone was more affected with all 8 (100%) responding on the negative. Similarly very little had been done to equip teachers with relevant skills to support OVC in the Northern zone as only 2 (29%) of the 7 (100%) teachers had been sponsored for refresher courses. Conclusively, the findings depict that inadequacy of funds for capacity building caused teachers to be ill equipped for support of OVC. As such, the teachers lagged behind in key

developments taking place in their areas of concern such as the increased enrolment of OVC in their classes and the mechanisms for scaling support which impacted negatively on their effectiveness. Policy makers have a responsibility to ensure that teachers within the schools engage in continuous professional learning and apply that learning to increase student achievement. Since teachers face familiar and unfamiliar issues, with extra financial support they become more effective in overcoming daily challenges such as those facing OVC in schools and at home.

5. Conclusion and Recommendations

The findings of this study indicate that funds were inadequate for mainstreaming support for OVC. Funding for school operations were acquired through levies paid by parents. This caused a big financing gap between funds received and expected expenditure which compromised establishment and sustainability of support structures such as low allocation to feeding programme, capacity building and better pay of staff and record keeping for OVC.

The study recommends that PNS should seek for alternative sources of funding such as global grants for OVC and community based support to facilitate OVC interventions at the school level. The fact that school fees from parents constitute the main source of funding in PNS is critical considering the high poverty levels of families taking care of OVC.

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