New Learning Opportunities in a Networked World:

Developing a Research Agenda on Innovative uses of ICTs for Learning and Teaching

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Abstract
This technical report describes the objectives, research methodology, activities and some of the findings of the study ‘New Learning Opportunities in a Networked World: Developing a Research Agenda on Innovative uses of ICTs for Learning and Teaching’.

Objectives
The project aimed to (a) identify and prioritise key development problems that new digital learning opportunities can address; (b) identify key experts, researchers, and institutions in developing countries working on new digital learning opportunities; and (c) lay the groundwork for development of a new research network on new digital learning opportunities in developing countries.

Methodology and activities
The project combined both qualitative and quantitative methods for data collection and analysis such as desk research, expert consultation, Group Concept Mapping (GCM), and a face-to-face workshop. The desk research carried out a targeted (scoping) literature review applying both quantitative and qualitative analysis of the selected texts. The expert consultation included written reflections by experts on various advanced learning technologies. GCM depicted in an objective way the shared vision of educators and policy makers from developing regions on issues and challenges of using ICT for the education in developing countries. A face-to-face workshop for participants from developing countries was used to discuss possible research initiatives on the conditions under which new learning technologies can improve learning and teaching. The workshops debates were triggered by the results from the GCM.

Outputs
The main output of this project is a Research Report that includes results from the desk research, GCM, experts consultation and face-to-face workshop. Some of the findings are: (a) there is a considerable conceptual overlap between the topics identified in the project and those in comparable studies; (b) pedagogies, technologies, and context are inherently interlinked to a greater extent than the similar studies; (c) developing countries are adopting some of the recent advancements of technologies without the need to follow previous stages in the evolution of these technologies; (d) the research agenda should combine advanced technologies with evidence-informed learning and teaching methods, apply a range of research approaches (i.e., from design-based research to longitudinal studies to lab studies) and study issues related to teachers and teaching training.

Contributions to the field
The project’s contributions to the field of using ICT for the education in developing countries are as follows: (a) utilising an innovative research methodology such as GCM; (b) involving educators and policy makers from developing countries in getting first-hand experience with the GCM and inducing a possible use of the method in their practice; (c) applying a text mining analysis to the literature review; and (d) identifying and prioritising issues and challenges in regard to using ICT for education in developing countries.

Keywords: Developing countries, ICT, Education, Research, Group Concept Mapping
The Research Problem
A lack of high quality education (i.e., teaching and learning) is a major problem in developing countries. This research project - *New Learning Opportunities in a Networked World: Developing a Research Agenda on Innovative uses of ICTs for Learning and Teaching* – aims to help develop a research agenda focused on new opportunities / directions of learning and teaching in an increasingly networked world, and how they can benefit people in developing countries. This research agenda is aimed at studying how interconnected information and communication technologies (ICTs) can expand the reach of educational opportunities and improve learning outcomes (i.e., lead to more effective and efficient learning).

Objectives
The main purpose of the project is to establish an empirically based and developmentally relevant research agenda on issues of new digital learning opportunities in developing countries (DCs). More specifically it aims to:
1. identify and prioritise key development problems that new digital learning opportunities can address;
2. identify key developing country experts, researchers, and institutions in Latin America, Caribbean, Sub-Saharan Africa, and Asia working on new digital learning opportunities; and
3. lay the groundwork for the development of a new research network on new digital learning opportunities in DCs.

The first and third objectives were accomplished by carrying out desk research, an expert consultation on pedagogical implications of advanced educational technologies for developing countries, an online Group Concept Mapping (GCM) study, and a face-to-face 2-day practitioner workshop. The second objective was covered mostly by GCM, which identified prominent experts from different development regions and facilitated them in identifying and prioritising issues and challenges with regard to implementing modern technologies for education in developing countries. The desk research also contributed to achieving the second objective. The research activities that were carried out established an empirical ground for outlining the main contours of the research agenda on creating new learning opportunities by introducing advanced technologies in developing countries.

Methodology
The project originally planned to apply two research methods to solve the research problem, namely desk research (DR) and an online Group Concept Mapping (GCM – Kane & Trochim, 2007; Trochim, 1989) study, combined with a face-to-face workshop. To enrich the results from the DR, an expert consultation on the innovative uses of advanced technologies for the education in developing countries was added.

The purpose of the *desk research* was to identify and prioritise development problems with respect to innovative uses of ICTs for learning and teaching in developing countries that could be potentially tackled by applied research on achieving new learning opportunities via focussed use of ICTs. This desk research provided background on the current state-of-the-art of education, ICT and the use if ICTs for teaching and learning, as well as ‘scoping out’ those researchers around the world who are doing interesting work on these topics. It should be noted that the particular focus, but not the exclusive focus, was on researchers working in developing countries. The literature sources found were analysed *qualitatively and quantitatively* (i.e., via Leximancer® software that applies language technologies and machine learning to identify and visualise the main themes and concepts as conceptual maps).

We then asked some highly regarded experts to write down their reflections on modern technologies that could forcefully impact teaching and learning in developing countries (i.e., the *expert consultation*) .
**Group Concept Mapping (GCM)** is a research methodology that facilitates a group of people to arrive at a shared vision regarding a particular issue (e.g., what are issues, challenges and opportunities for innovative uses of ICTs for education in developing countries). The participants are asked to carry out a number of activities they are used to such as generating ideas, sorting ideas into groups, and rating ideas on some value-scales (i.e., importance and feasibility). While the participants generate, sort and rate ideas individually, two advanced multivariate statistical techniques - multidimensional scaling (MDS) and hierarchical cluster analysis (HCA) - aggregate the individual input to identify patterns in the data and show a common understanding of the group on the issue under investigation. The visualisation of the results (e.g., cluster maps, pattern matches, go-zones) helps in the interpretation of the findings.

**Project Activities**

**Desk research**
Although the desk research was aimed at conducting a targeted (scoping) literature review on innovative uses of Information and Communication Technologies (ICTs) for education in developing countries, efforts were made to cover as many of the characteristics of systematic review as possible, namely: an explicit search strategy, comprehensive sources of information, criterion-based selection, specific research questions, critical appraisal, and text mining (Travaglia, Braithwaite, & Debono, 2008). A combined search in databases Academic Search Elite®, Psychology and Behavioral Sciences Collection, ERIC®, PsycINFO®, and PsycARTICLES® was conducted to select the articles. The search was expanded to allow for related words and requiring a search within the full text of the articles, but limited to the period 2010-2014, available full text and peer-reviewed articles. The abstracts, and when necessary, the full texts of articles, were screened to identify those that were most relevant to the projects and the research questions. The articles selected were divided into four categories (i.e., Africa, Asia, Latin America, general) and given to four researchers for further examination of the full texts. During this stage, more articles were added by cross-referencing (i.e., snowballing), but a few were also discarded because they proved to not be relevant. A template was created for a uniform paper description. The papers were quantitatively analysed, applying text mining techniques and tools (Leximancer, 2014) and complemented by qualitative summaries of papers (see Chapter 1 of the Research Report).

As the qualitative and quantitative analyses did not identify the most recent ICT-enabled pedagogical innovations such as Massive Open Online Courses (MOOCs), networked learning, learning analytics, mobile learning, serious gaming and open linked data, we asked a number of prominent experts (one from each of a number of areas) to reflect on the most recent developments related to these technologies and how they could be used for the transformation of education in developing countries. The following technologies and their effect on education in the developing countries were discussed: Open Educational Resources (OER) and MOOCs, social networking, learning analytics, mobile and seamless learning, serious games, and open linked data (see Chapter 2 of the Research Report).

**Online Group Concept Mapping study and face-to-face workshop**
Group Concept Mapping (GCM; Kane & Trochim, 2007; Trochim, 1989) and a face-to-face workshop were carried out to provide additional insight into the issues, challenges and trends of using ICT in the education of developing countries.

The GCM and face-to-face workshop were initially considered as separate events. The face-to-face workshop was supposed to generate and discuss ideas, which would then be fed into the GCM process. To make the workshop more effective, efficient and appealing, the GCM was conducted prior to the face-to-face workshop via a dedicated web tool. This web-based GCM implemented the same activities that were
to be used in the workshop: generating ideas, structuring them through grouping, and prioritising them. The web-based GCM facilitated these activities online to collect and analyse the data so that they could be presented to the participants at the face-to-face workshop for interpretation and discussion. Web-based GCM gives participants more time for idea generation and structuring (i.e., 10 days for each as opposed to 90 minutes in a face-to-face procedure). In addition it prevents some known negative effects related to the process of face-to-face idea generation and structuring (e.g., brainstorming productivity loss, groupthink). The analysis, which features advanced statistical techniques such as multidimensional scaling and hierarchical cluster analysis, presents objectively the shared vision of the group on using ICT for education in developing countries. The outcomes of the GCM study are typically visualised in such a way as to facilitate their interpretation (see Chapter 3 of the Research report).

The selection of participants included three steps. First, we approached all experts suggested by IDRC and whose name were included in the project proposal. Almost all agreed to participate. Then we asked the UNESCO chair at the Open University of the Netherlands to provide names of possible candidates. This list consisted of 40 names representing research, education and policy in each of the three developing regions: Africa, Asia and Latin America. If an expert could not participate in the project (s)he was asked to recommend someone else with the same profile. Finally, we added 7 more names to the list, identified from the screening of the literature. All experts included in the sampling were invited to take part in the GCM study. Thirty-one experts participated in idea generation. Of them, 25 started the sorting, 17 finished it but the data from one of them was unreliable and was excluded from the analysis. 20 experts started rating the importance of the clusters, of whom 17 finished it. Of the 18 participants who started rating the feasibility of the ideas, 16 completed it.

Reflecting on what happened during the workshop and talking to people there we are convinced that moving the GCM before the face-to-face meeting was a good decision that made the discussion more effective and efficient.

The GCM study identified 16 areas of research interest, namely: international cooperation, learning platforms, research approaches, new job possibilities, integration of technology in the classroom, ICT-enabled pedagogy, teacher competences, teacher concerns, implementation of technology, context-based goals and solutions, accessibility, infrastructure, marginalising vs inclusion, ICT policy, diffusion of technology, and collaboration for cost-effectiveness (see Figure 1).
Figure 1. Themes identified in the GCM study

Figure 2 shows the relative position of the clusters on the importance and feasibility ratings.

Figure 2. Pattern Match of the Cluster Ratings on Importance (left) and Feasibility (right)
The GCM produced rich data. Given the study’s purposes and context we made use of only part of the findings (i.e., cluster maps, cluster rating maps, and pattern match on importance and feasibility) to identify and prioritise possible themes for the research agenda on the implementation of ICTs for education in developing countries. We presented pattern matches between different regions, clusters’ go-zones (i.e., graphs divided into 4 quadrants based on the mean of the rating values to show the position of the individual statements within a cluster – see Figure 3 ) only to illustrate the potential of this research methodology. They can be explored further at a later stage and possibly included in one of the journal papers that is going to be written.

Figure 3. A go-zone graph of the cluster ‘ICT-enabled pedagogy’

The presentation of the results from the GCM study was used as a trigger for small group discussions at the face-to-face workshop and was aimed at gradually refining the scope and themes of the research agenda. On Day 1, participants were asked to share their thoughts on innovative uses of ICT for education in developing countries in a plenary session. The themes discussed included: pedagogical issues related to the implementation of ICT for learning and teaching purposes, teacher training, policy issues, social justice, digital divide and infrastructure. The participants were also challenged to anticipate possible uses of advanced technologies such as learning analytics, cognitive tutors and learning networks. Some preliminary findings of the GCM study were then presented (refer to Chapter 3 of the Research report).

Prior to the workshop, participants received some results from the GCM – refer to Appendix A (i.e., ideas grouped into clusters) and Appendix B (i.e., rating of the ideas on importance and feasibility) of the Research Report. After the presentation, the participants were divided into small groups for further interpretation of the data. They were primed to look for more-general categories that subsume sets of clusters of ideas. The groups had a similar vision regarding how to further structure the data. The following, more general categories of clusters, were defined: pedagogical affordances of technology,
sustainable development with technologies, access, equity and inclusion, professional development / capacity building, barriers for adoption, teacher concerns and research method (see Appendix C of the Research Report). On Day 2, again in groups that were composed differently, the participants were asked to formulate more concrete themes or questions for the research agenda on innovative uses of ICT for the education in developing countries (see Appendix D of the Research Report).

We expected more engagement from the participants in the post-workshop activities. We stimulated them to contribute to a collective document on type of research they would like to carry out. Very little happened in respect to this activity. We also asked them to invite more experts from their network to contribute to the GCM study. The GCM environment stayed open for about four additional months with two reminders sent to the workshop’ participants. Unfortunately, no additional participants contributed to the GCM study.

Project Outputs
The main output of this project is a Research Report. It consists of three main parts: desk research, experts’ reflection on possible impact of modern technologies on the education in developing countries, and Group Concept Mapping with face-to-face workshop. Our intention is to produce at least two publications in high impact journals with a co-authorship from the IDRC. A summary of the findings from the report follows.

1. There is a considerable conceptual overlap between the topics identified in the GCM study and those in other studies on trends in learning technologies and innovating pedagogies (e.g., Horizon reports: Johnson, Adams Becker, Estrada & Freeman, 2014a, 2014b; Johnson, Adams Becker, Estrada, Freeman, Kampylis, Vuorikari & Punie, 2014c; Innovating pedagogies: Sharples, McAndrew, Weller, Ferguson, FitzGerald, Hirst & Gaved, 2013; Kennisnet trends in education 2014-2015; Mapping and analysing prospective technologies: Aceto, Borotis, Devine & Fischer, 2014).

2. Pedagogies, technologies, and context are inherently interlinked to a greater extent than the reports on trends in learning technologies. Advanced learning technologies such as Open Educational Resources (OER), Massive Open Online Courses (MOOC), mobile learning, learning analytics, networked learning, and serious gaming were not depicted in a separate cluster dedicated to technology, but were instead integrated in different contexts (i.e., clusters). The role of context is mentioned either explicitly or inferred implicitly across all clusters identified in the GCM study. This was also found in the desk research where the local context of the technology implementation was identified as an important / determining factor for the adoption and adaptation of the advanced learning technologies and methods in education. The workshop’s participants were aware that reuse of open educational resources, methods and tools did not mean reuse exactly as is (see the Reusability Paradox: the pedagogical effectiveness of a learning object and its potential for reuse are at odds with one another; Wiley, 2015a), but they knew that it was also about revise, remix and redistribute (see also the Remix Hypothesis – Wiley, 2015b).

3. The literature review and GCM detected some signs of technology leapfrogging (i.e., adoption of advanced or state-of-the-art technology in an application area where immediate prior technology has not been adopted) showing a clear link to relevant pedagogies. It seems that for OERs, MOOCs and mobile learning the stages of technology trigger, peak of inflated expectations, and even disillusionment have already passed (see Figure 4 - the Gartner’s Hype Cycle, 2002).
Research can start at the stage of slope of enlightenment but will require some time before arriving at the plateau of productivity. Relatively little was said in the GCM study with respect to serious gaming and networked learning, but the literature review and the expert reflection indicate that these research topics could also be positioned at the starting line of slope of enlightenment. Data-driven pedagogies, represented in this project by open linked data and learning analytics, can join the others at the starting line of slope of enlightenment if open linked data is considered part of OERs and learning analytics offers open source software for researching issues in OERs, MOOCs and serious gaming.

4. The learning technologies mentioned are closely related. For example, MOOCs could be considered a further development of OER, and data-driven learning technologies such as open linked data and learning analytics are also linked to OERs, MOOCs, serious gaming, and networked learning. Mobile technologies are considered a hub for access to other techno-pedagogical innovations: OER, MOOCs, serious gaming and networked learning.

5. According to the participants in the study, cloud technologies could be a solution to infrastructure and access issues. Examples include free general-purpose and specific educational applications from commercial vendors like Google®, Apple® and Samsung® and social network sites like YouTube®, LinkedIn® and Twitter®. Teachers could join professional social network LinkedIn® groups or become members of international communities of practice like Schoolnet eTwinning®.

6. Based upon the combination of the desk research and GCM study, the Call for Research Proposals within the Research Agenda should stimulate and support proposals that together:
   - exhibit a combination of advanced technologies with evidence-informed learning and teaching methods,
   - apply a range of research approaches (i.e., from design-based research to longitudinal studies to lab studies),
   - target different educational levels, and
   - take the local context into account.

A second strand of research relates to teachers and teacher training and specifically research on improving teachers’ skills, motivation and attitudes for using ICT in their professional practice.
Project Outcomes

The main contributions of the project to the research on education in developing countries are as follows:

1. **Utilising the Group Concept Mapping approach (GCM).** While GCM accommodates the strengths of other similar methods for collecting and analysing opinions (e.g., interviews, questionnaires, affinity diagram, Delphi, collective classical concept mapping), it mitigates their weaknesses. GCM differs from these methods in three substantial ways. First, the participants and not the researchers generate and structure the ideas. Second, the methodology implements some advanced multivariate statistics (e.g., Multidimensional Scaling and Hierarchical Cluster Analysis) that objectively identity emerging patterns in the data. Third, the methodology presents the results in visual formats (i.e., conceptual maps, pattern matches, go-zones) that are easy to grasp for further interpretation and implementation into practice. Other studies on learning technologies trends and innovating pedagogies (Horizon reports: Johnson, Adams Becker, Estrada & Freeman, 2014a, 2014b; Johnson, Adams Becker, Estrada, Freeman, Kampylis, Vuorikari & Punie, 2014c; Innovating pedagogies: Sharples, McAndrew, Weller, Ferguson, FitzGerald, Hirst & Gaved, 2013; Kennisnet trends in education 2014-2015; Mapping and analysing prospective technologies: Aceto, Borotis, Devine & Fischer, 2014) implemented mostly classical Delphi method and/or questionnaires.

2. **Participants’ experience with GCM.** The participants from developing countries were involved in all phases of the GCM so they got first-hand experience with the methodology. They might decide to use it in their own research and they know they could rely on our expertise in this respect.

3. **Quantitative analysis of the literature.** We also attempted a quantitative analysis of the papers included in the desk research using text mining software. This type of analysis provided a useful overview of the main themes and concepts in the literature reviewed and complemented more traditional qualitative analysis.

4. **Relationship technologies, pedagogies, and context.** In general, the project’s results are in line with those of studies on learning technologies trends and innovating pedagogies but the relationship between technologies, pedagogies and context are more apparent.

Overall Assessment and Recommendations

**Usefulness in achieving the project’s objectives through any partnerships with Canadian researchers**

The support from and the partnership with IDRC allowed for carrying out research that objectively identified a shared vision of experts from different development regions on issues, challenges, and opportunities about innovative uses of ICT for education in developing countries that need to be researched in the future. To the best of our knowledge this has not been achieved before. The project also laid out the foundations of network of researchers from different developing countries as well as the contours for a research agenda on this topic.

**Project’s contributions to development**

The results produced by the project are in some way unexpected as they are comparable with the outcomes of similar studies reflecting the situation in the developed world (e.g., technologies identified, trends in their development, open education, capacity building, infrastructure, ICT policy, and digital divide to mention some). However, the current project has shown stronger empirical support for the link between technologies, pedagogies and context. This is an often forgotten or neglected topic. Further, the research showed the extreme relevance and necessity of taking context into account when thinking about the possible use of ICTs in and for education and the innovation thereof.
The level of adoption of advanced learning technologies (e.g., Open Educational Resources (OER), Massive Open Online Courses (MOOC), mobile learning, learning analytics, networked learning, and serious gaming) in developing countries does not seem to be a barrier for initiating research on the conditions under which any or a combination of these technologies produce effect on learning and teaching.

Do differently as a result of experience and useful lessons for improving future projects
The literature search should include not only peer-reviewed academic papers but also other source of information (e.g., professional journals, blogs, organisations web sites or projects descriptions). More should have been done to keep the participant committed to the project after the workshop. A possible solution would be creating a web-based community of practice and organising live online events.

Value and importance of the project relative to the investment of time, effort, and funding
We believe that the project significantly contributed to the field of using advanced technologies for the education in developing countries, providing value for money. The project utilising an innovative research methodology depicted objectively and in a cost-effective manner the agreement of a group of experts representing different developing regions on possible directions of conducting research on innovative uses of modern technologies in the education of developing countries.
References


