Mobile Learning on Smartphones for Teachers in Developing Countries

Diplomarbeit

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vorgelegt von

Name: Roll Vorname: Philip

[redacted] [redacted]

Erstprüfer: Michael H. Breitner

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Erklärung CXLIII

1. Introduction

"Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling."

(2nd Millennium Development Goal of the United Nations)

Education is more important than ever because it determines our chance to take part in the modern knowledge-based society. However, for developing countries the role of education has a broader meaning because it is able to reduce poverty and social inequality. And moreover education leads to build up human capital which would make developing countries more interesting to foreign investments. As a result a better education would strengthen the economy and increase the wages. This is also a reason why universal primary education was announced as the 2nd Millennium Development Goal by the United Nations showing the importance and topicality of this issue. Education has the potential to generate knowledge to enable developing countries for capacity building. A question that arises is how it is possible to let everyone participate in this global knowledge community or economy and provide education for all.

Many developing countries started Universal Primary Education (UPE) programs during the last decades and started training sometimes up to 40.000 new teachers at a time. But one reason why these programs failed was the high demand for qualified teachers that could not be met. On the one hand teachers have a multiplier effect on the educational system and on the other hand they are the major factor for a quality improvement of education in a country. An effective strategy to address this structural problem of many developing countries includes training for teacher trainees as well as the training of in-service teachers. The main problem is the cost for this training, for the government and the teachers. Therefore, conventional, residential training methods are mostly not possible.

In this context the tradition of distance education in many African countries has come at a time of huge growth in telecommunications. In general the developing world has seen a remarkable growth in mobile technology and mobile telecommunication in the last ten years which is underlined by Figure 1. In this case especially the ratio of lan-

dlines to mobile subscriptions is significant. While in developed countries there are approximately three mobile devices for every landline, in developing countries, there are five mobile devices relate to every landline. The low level of landlines in developing countries is marked in green in the figure below.

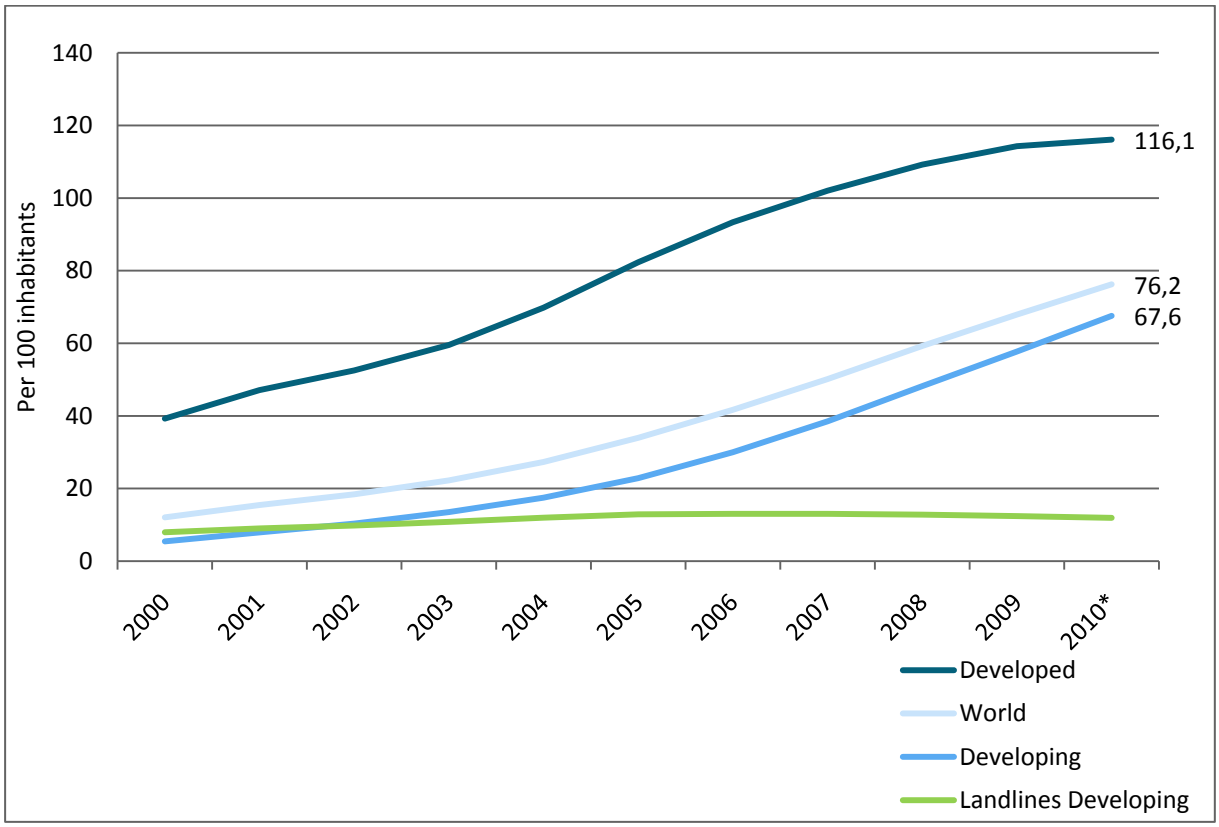

Figure 1: Mobile Cellular Subscriptions per 100 Inhabitants
Reference: Own illustration following International Telecommunication Union (2010d).

While markets for mobile devices are mostly saturated in industrialized countries, markets in developing countries are still growing. Therefore the interest of network operators, hardware manufactures and infrastructure producers is growing in these new markets with millions of new customers. One concern might be that people in developing countries are less likely to spend money for mobile communication but still they spend large portions of their income for this purpose. Moreover, it is as well the quantity of potential customers in these markets which is significant. The hardware aspect on the mobile telecommunication market has been dominated by the rise of smartphones in the last few years. Still the focus is on North America and Eu-

rope, whose sales account for 52% of the worldwide smartphone shipments. However, this technology is rapidly adopted in developing markets, too.[1]

1.1. Objective and Motivation

Since smartphones are already widely adopted, this thesis focuses on the potential of mobile learning on smartphones because it enables the use of rich multimedia elements and faster Internet connections. However, the use of smartphones for this purpose in developing countries has been sparsely researched. Nevertheless it is a very interesting, forward-looking topic.

The objective of this thesis is to estimate the potential of m-learning on smartphones in developing countries in the context of teacher training. Therefore two research questions need to be asked. First, what is the potential of smartphones in developing countries as a source of mobile communication? Second, what is the suitability of mobile learning as a way of learning in these countries? In order to answer these questions the main emphasis of the paper is on the creation of a mobile learning program and the implementation of a survey. During the creation process of the m-learning program the use of different multimedia elements and tasks is one purpose. It should measure the appropriateness of different learning methods inside the m-learning approach, too.

Yet, mobile learning is not a household name to many people in developing countries nor to many teachers. Therefore, the target group is introduced to this approach of learning in the first place which is achieved through testing the m-learning program. One question that arises in this case is whether the teachers already have a sufficient level of computer literacy to use the technology. Then, will it be possible to generate first-hand information about the situation in developing countries from the survey? In this context it is interesting to find out more about the acceptance and spread of smartphones and the interest in mobile learning in general. Finally the two topics need to be connected to determine whether the potential for a connection of smartphones and m-learning in developing countries exists.

The initial motivation for this topic and underlying research questions were the reflections on how to connect an interesting and relevant IT issue with developing coun-

[1] cf. International Telecommunication Union (2011b).

tries and the improvement of their situation. In the end this process led to the topic of the thesis. In the end this reflection led to the topic of this thesis. Mobile learning and smartphones are two current trends in education and technology. The progress that has been made in terms of the sophistication and the price of smartphones in the last three to four years is remarkable. But why should only the developed world benefit from these educational approaches and new technologies while a digital divide is already present? The field of mobile learning in developing countries is therefore very interesting and multifarious but unfortunately this leads to the exclusion of many aspects which could not be addressed in this thesis. For example the cultural and local adjustment of m-learning is only quickly seized although it determines the design for developing countries. It would just go beyond the scope of this thesis to fully cover this aspect. Moreover, an analysis of the acceptance of smartphones and a market research of their spread would have been interesting, too. Whereas the spread is thematized later on, a more detailed market research could not be provided. It is not feasible to interview a large number of potential customers in the selected countries due to a lack of resources and possibilities to reach them.

1.2. Structure

The introduction and objective have given insight into the overall topic and the thesis, which is structured into eight main parts. Figure 2 illustrates this structure in a graphic description. The first section includes the introduction into the topic, the objective and motivation of the paper and the explanation of the structure.

In the second part all necessary definitions and fundamentals are explained to give the reader the required background for this paper beginning with a definition of mobile learning. The underlying educational concepts include the three major learning theories that are also the theoretical base for m-learning. In addition, different approaches to mobile learning are listed, and an insight in the African context is given. The other basics include a technological overview of smartphones and an overview of the situation in developing countries like Kenya, Tanzania and Uganda with particular attention to their educational systems and the situation in the telecommunications sectors.

Section three describes the history of distance learning in Africa and four projects from the three countries. Two of these projects are still running, while the status of the other two is not clear.

The fourth section describes the m-learning program and the process of its development. First, the platform of the program is introduced and the choice of the topic is explained. In addition, the first part includes the design process of the m-learning program and the handheld devices used by the participants. The other three parts in the fourth section consist of the launch process and its challenges, possible modifications for implementation in developing countries and a discussion of programming a native or web-application.

Section five outlines the design and administration of the survey. The single subsections describe the online platform used for the survey, the questionnaire, the selection of the sample and the analysis. The section on the questionnaire explains the methodology that is used, the requirements for the construction of the questionnaire and the creation of the questions.

Section six includes many of the results from the survey and connects the earlier sections to move towards an appraisal on the initially asked research questions. This section is divided into a technological section, two sections about smartphones and one section about the educational system in developing countries. In the technology section the relevance of mobile telecommunication, the availability of required technology and the role of energy are explained. Furthermore, the distribution of smartphones in the sample countries is described and their role in leapfrogging the computer age is discussed. In the last part of this section the potential of mobile learning to solve the problems of the educational system, described in section three, is presented.

In section seven the disadvantages of mobile learning as a learning theory in connection with the limitations of the handheld devices is thematized. Afterwards the general risks of m-learning and the specific risks in developing countries are addressed.

The last part of the thesis contains a summary of the previous sections. Furthermore, some recommendations in terms of the use of m-learning in developing countries are given and a brief outlook is given.

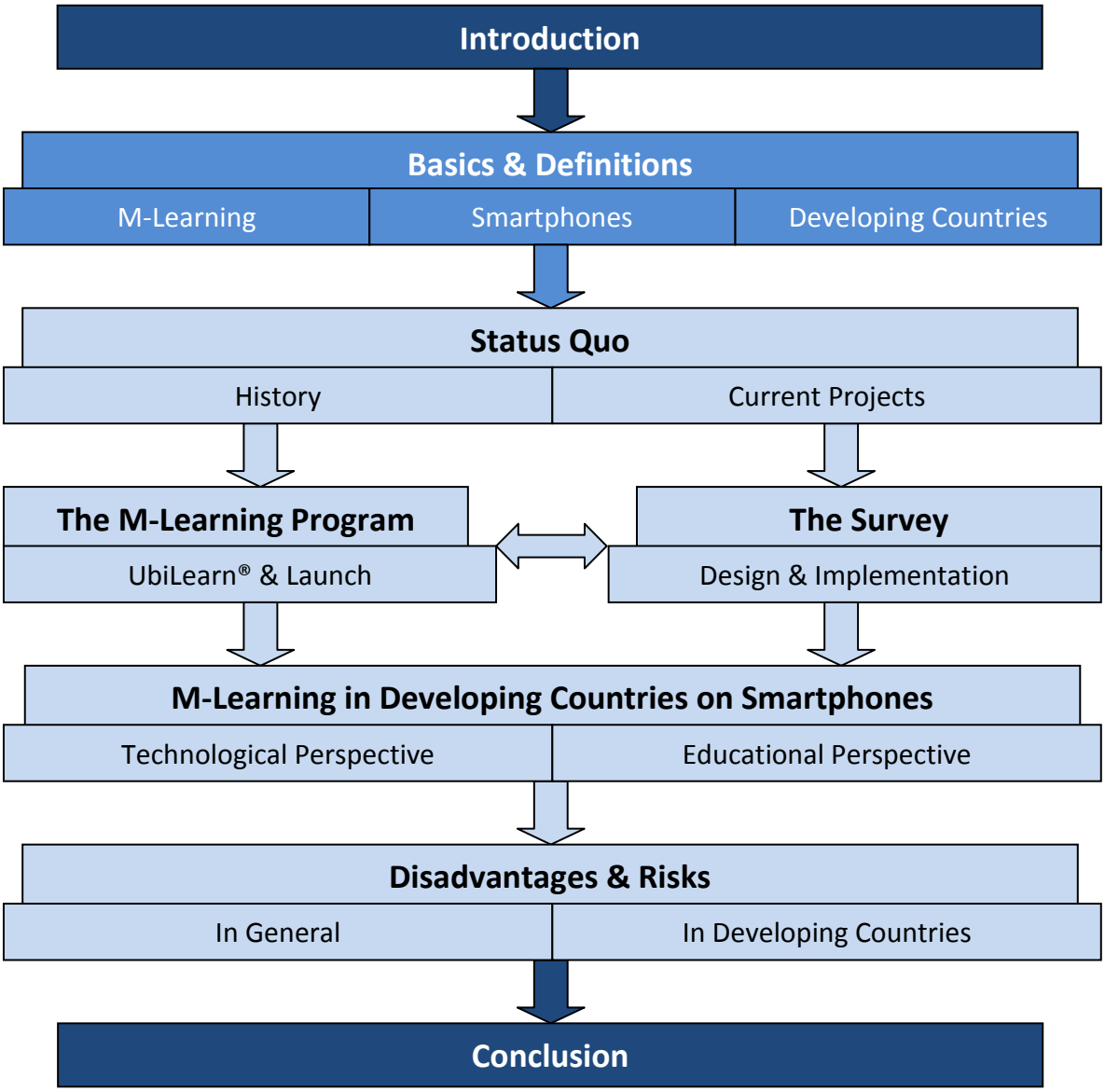

Figure 2: Structure of the Thesis
Reference: Self-constructed

use of ICT, but users of ICT are the ones realizing a positive or negative impact.[336] An increase in Internet user numbers in Africa is often restricted by supply of local content, which induces people to access the Internet more often or for the first time. Therefore, this content has to be locally relevant and also in the local language, which is a very challenging task because in African countries usually many different indigenous languages are existing.[337]

Besides the human aspect of ICT implementation in education the second big issue are the costs of accessing mobile Internet and achieving required handheld technologies. Of course, it is possible to access Internet on a smartphone for some teachers in this case. Nevertheless, costs for mobile Internet access are high for an average income in Kenya, Tanzania and Uganda. Therefore, it makes sense to use micro-learning in combination with offline possibilities of m-learning to not stress the user´s budget too much. An offline version of mobile learning is also important due to often intermitted Internet connections and lower battery exposure since Internet use demands more battery power.[338] Another option in financial regard would be cost absorption by Ministries of Education in each country for teachers that want to access Internet on their smartphone, for example, to download an m-learning app. The financing could be done through aid agencies or bilateral donors to give teachers an incentive to use new learning concepts and improve themselves. This attempt could as well be used to equip teachers with required hardware or at least contribute if a teacher is interested in purchasing a smartphone.

The critical factors of energy and availability of needed technologies are already addressed in section 6.

8. Conclusion

8.1. Summary

Mobile learning is the most current trend in educational terms, in relation to distance and electronic learning, due to owing the increased significance of mobile telecommunication, powerful small handheld devices and faster mobile Internet connections.

[336] cf. Trevor Sehoole, Moja (2004), p.149.
[337] cf. International Telecommunication Union (2007), p.13.
[338] cf. Muyinda (2010), p.42.

The paper presented links between ICT, mobile telecommunication and economic development, which demonstrate the major role, these technologies play in developing countries. It is often the only source of communication, as the ratio of mobile subscribers towards fixed landline subscribers illustrated. However, ICT and mobile telecommunication is also important for information gathering, for example, to reduce travel costs or for farmers, to be informed about crop prices on the world market. Furthermore, these technologies are able to overcome infrastructural problems, which most developing countries are facing.

The required infrastructure for mobile Internet, particular 3G, exists in Kenya, Tanzania and Uganda although not in all parts a basis is established. In the future these networks can be extended or alternatives like the BoulSat project could bring Internet to more people. Progress is also presented by rising numbers of data package subscribers in the three countries. Even though the providers are seen as one major critical success factor for diffusion of 3G and smartphones due to limited supply of well designed data package fee plans.

The introduction asked for the potential of smartphones in developing countries and part of the answer is given by the text above. Since infrastructure and technology are already used no general restrictions from the technological view point are given. In addition, the overall trend reflects well for smartphones because their share of mobile device shipments will be already 37% by 2012. Most interesting for developing countries, however, is the introduction of cheaper models, especially from Chinese and Indian manufacturers. This issue is confirmed by the survey which figured out that the price of smartphones has to be less than $100 or even below $50. Another important factor for the implementation of smartphones is their capacity to serve as mini computers, and probably leapfrog the PC age in these infrastructural poor countries. Altogether the potential for smartphones in developing countries is given because the costs for purchase and maintenance are much lower compared to desktop technologies.

Moreover, the paper shows that smartphones are already used in Kenya, Tanzania and Uganda, and customers are willing to purchase this type of phones, too. In terms of mobile learning it is encouraging because people want to buy smartphones also in

order to use mobile learning. Thus, m-learning is content capable to serve as mobile added value.

One important issue is the cultural adjustment of mobile learning to the educational system of countries including local languages to ensure the efficiency of its use. The paper points out, that possibilities with m-learning are diverse; thus, m-learning should be adjustable to different contexts. This is true for underlying pedagogical concepts and different approaches that can be realized with mobile learning.

In addition, the level of computer literacy is a critical success factor in the implementation of mobile learning in developing countries. Whereas many teachers have sufficient levels of computer literacy, it might be necessary in the first place to train teachers ICT skills before introducing them to m-learning.

The described gaps in the educational system can be addressed in various ways. Mobile learning is particularly appropriate for in-service teacher training due to unimportance of time and place, which raises the overall quality of education immediately. For trainees, who cannot afford residential courses, m-learning gives opportunities to become teachers by blended learning approaches with few residential sessions. Other problems like poor equipment in schools could be tackled with delivery of materials to teacher´s smartphones, too.

From the technological perspective challenges of m-learning are more or less similar in industrialized and developing countries. Hardware limitations due to small screen sizes or small keyboards and questions regarding software, for example, due to decisions about programming native or web applications, are nearly the same.

However, in general mobile learning for industrialized and developing countries shows a significant difference. The trend in industrialized countries is towards micro-learning while the situation in developing countries is different. On basis of poor infrastructure and poor equipped schools mobile learning offers potentials to deliver education and educational materials also to rural and remote learners without affordance of costly infrastructure for landlines or distribution, for example, of books. Therefore, mobile learning has potential to educate teachers in connection with smartphones in many developing countries. Otherwise meaningful realizations are difficult and problems of educational systems might not be properly addressed. It is

possible to come closer to the second Millennium Development Goal of providing education for all through many different approaches, and one should be mobile learning.

8.2. Recommendations & Outlook

A centrally organized but decentralized performed ICT introduction should be mandatory to ensure a minimum level of computer literacy for teachers getting further or initial training through mobile learning. One way to realize this consists of mobile units from the Ministry of Education which would visit different schools to give m-learning and smartphone courses for interested or all teachers.

In terms of financing mobile learning projects or purchase smartphones it is probably necessary to include international donors and create national education programs supported by the IMF or World Bank. The creation of meaningful mobile learning programs should be realized in the relevant country. In case national universities or Ministries of Education do not have enough resources or knowledge for creation it is possible to install partnerships with institutions from other countries. Therefore, a local adapted and sophisticated tool is more likely to emerge.

Many developing countries including Kenya, Tanzania and Uganda, have understood the importance of ICT for their future success. And this progress to educate children in IT and train teachers using IT already leads to higher computer literacy for young people compared to their parental generation.

Connecting higher computer literacy with the growth rates for mobile broadband subscribers and smartphone sales the mobile revolution will not steel clear from developing countries. However, it might take another five to ten years until spread of smartphones and use of mobile Internet will reach levels where mobile learning would be one of the main sources of education for teachers and other interested people in developing countries. Mobile learning by then should be one of the most important contents used on these phones, depending probably on supply of mobile learning adapted to needs of local learners. Therefore, institutions in developing countries need to create this content because they are aware of local circumstances, but perhaps with help of foreign experts in the beginning.

For developing countries it is important to help themselves to become less dependent of development aid and bilateral donors. This is only possible through stronger economies and higher shares in world trade but trade nowadays often consists of online activities and e- or m- commerce.[339] Therefore, Africa needs to develop ICT infrastructure and tackle computer illiteracy if stable economic development should be reached.

A country that understood the role of ICT and is a positive example for others is Rwanda. 17 years after the Rwandan Genocide the country is moving towards an information society and skipping the Industrial Age. For this reason the government in Kigali installs fiber optic cables for miles, to provide mobile broadband Internet to the population.[340] Rwanda serves as an example for many developing countries, showing how modern technologies and education could lead the way to future development.

Nevertheless, many aspects are still unclear and further research needs to be done, especially in the field of local and language adapted content, and price reduction of smartphones. In the end developing countries need to stand on their own feet someday and education is an important factor to support this goal.

[339] cf. International Telecommunication Union (2007), p.2.
[340] cf. Zeppenfeld (2011).