Blended Learning Approach to Integrating Research Competency in Undergraduate Teacher Education Programme for Mathematics Students at Maseno University

By Dr. Mildred Atieno Ayere
mayere@maseno.ac.ke
Maseno University
Kenya

Background to the Study

Prince, Felder & Brent (2007) posits that research has a clear potential to make significant contributions to the quality of undergraduate education. In their opinion, the question is, how best to do it? University research plays a vitally important role in its own right. Therefore, rather than lamenting the rising expectations for research, it is more productive to seek ways to improve undergraduate education that work with the prevailing trends. The strategies for improving undergraduate research differ from institution to institution, but the need for integrating it in teacher education has far reaching effects. Using a scholarly approach to test potential integration strategies in teaching and learning can only increase the synergy between teaching and research to be realized in practice. Schools exist in all communities in Kenya and great potential exist when teachers become researchers. Undergraduate teachers on teaching practice are still under guidance of lecturers at the university and as such hold great potential as researchers when introduced to the skill.

Mather (2011) explains that research enhanced learning and teaching is a complex notion, and consequently is based on different understandings and practices across disciplines, institutions and countries. He further explains that in its basic meaning, it is the bringing together of research and teaching with the aim of enhancing student engagement and learning. Specific ways in which it improves personal skills for participating teachers and enhances classroom instructional processes include: Positive student perceptions of the teaching and learning process; Deeper student engagement: coursework is more stimulating and interesting; Positive experiences with problem-based learning; Development of research skills: bibliographical searching, framing a research question, organisation of data, experimental skills, interpretation and analysis of data, use and understanding of primary and secondary sources; Opportunity to learn in a collaborative group setting; Improvement of self-regulated and self-directed learning as students become more familiar and comfortable with research processes; Fostering of deeper approaches to learning; Opportunity to collaborate with academics; Contribution to building on existing knowledge and participation in a community of practice; Personal and professional gains: graduate capability development, self-confidence, critical thinking, a commitment to lifelong learning, experience with teamwork, communication skills, and better understanding of how knowledge is constructed, conveyed and contested (Evans et al 2008). If all these competencies can be improved in engaging teachers in research, then integrating research in undergraduate education is worth the effort. Jenkins (2001) makes a befitting conclusion on benefits of integrating research in undergraduate teaching by saying that “Indeed, over the last five or so years, it has moved from a strong questioning of the value of (staff) research to undergraduates to advocacy of coupling teaching and research. Darden (2003) explains that learning needs to be an active process at all times. The faculty’s role is to facilitate, guide, and motivate the learning process—training students to be lifelong learners and critical thinkers. Because information in the world is constantly changing, there is need to learn how to evaluate, integrate, and apply information, not

simply memorize accepted facts and theories. It is for these reasons that this study piloted a programme of teacher driven but university guided research initiative that was to improve classroom instructional processes.

As Kenya seeks to be an industrial Nation through its Vision 2030 and Second Medium Term Plan 2017-2030, research in education is a must. Research integration in education is an economic driver as it is the catalyst that ensures societal problems are investigated scientifically, solutions arrived at and forwarded for implementation by relevant government agencies after results are disseminated. In this regard, integrating research in undergraduate training would create a link between the university and the community. Giller (2011) explains that National policies and strategies can play key roles in promoting the integration of research into teaching. Kenya subscribes to a number of such policies in place that are implied in a number of policy documents that guide its socio-economic development. These are policy documents such as Agenda 2063, Continental Education Strategy for Africa 2016-2025 (CESA 16-25) and its own Vision 2030 and MTP II and the STI Sector policy. In the social Pillar of Vision 2030 under Education, Kenya hopes to provide a globally competitive and quality education, training and research. Five key issues stand out in this policy that relate directly to this research: reforming secondary school curricula; modernising teacher training; strengthening partnerships with the private sector; revising the curriculum for university and technical institutes to include more science and technology; and increasing government funding to allow for this transformation.

It has been noted by many scholars that Kenya needs a link that would connect training to industry in order to make its tertiary education relevant. In fact, Giller (2011) proposes that higher education students of the future should have an excellent teaching and learning experience, informed by up-to-date research; every student should learn in an environment that is informed by research, scholarship and up-to date practice and knowledge; both undergraduate and taught postgraduate programmes should develop generic skills needed for effective engagement in society and in the workplace. To him, this bottom up approach, serves to make university programmes relevant to industry that their graduates seek to serve in future. As a matter of fact, putting greater emphasis on actively engaging students with Putting greater emphasis on actively engaging students with research, suitably adapted to recognise variation and complexity of constructing knowledge in different disciplines, is one way of re-linking teaching and research in the 21st century. These sentiments are supported by outcome from institutions that have boldly integrated research in their teacher education programmes and the result (Chetty & Lubben, 2010; Deem & Lucas, 2007).

Statement of the Problem

Kenya as a country has undertaken several reforms and curricula review of its education system to try and make it more practical and relevant to its national needs. Each reform has failed to yield the desired results. This has led to a number of problems, chief among them are high unemployment rates among the youth, disillusionment, soaring crime rates, heightened ethnicity, and mass production of unproductive graduates. Unemployment in Kenya relates closely to under skilling of learners and arising especially from teachers whose research potential has not been well harnessed through the present education system. A number of government policies have been put in place to combat these ills in the education system. These include Agenda 2063, CESA 16 - 25, Vision 2030, MTP II and the STI Sector policy document. The key issues raised in these documents are aligning education system to meet the SDG goals, making education

relevant to the job market and preparing a human resource that would contribute to socio-economic development of the country.

This research proposes the integration of research in undergraduate teacher education programme as one of the measures that can be used to re-align the curriculum specifically in the teacher education to make it more scholastic and the recipients becoming lifelong learners. The fringe benefits of continued research would improve the entire education curriculum starting with the university programmes. This is because research findings are a powerful information source that would continuous provide feedback from stake holders to the university. This feedback would be used to improve pedagogy, classroom delivery processes and relevance of teaching and learning to societal needs.

Purpose and Objectives of the Project

The purpose of this research was to integrate research component in undergraduate Teacher Education. Specifically this project intended to:

1. Inculcate research capabilities among prospective teachers
2. Provide feedback from research findings to improve the undergraduate Teacher Education Programmes in Kenya
3. Use research findings to improve classroom instructional processes
4. Create a link between teacher training and industry through research

Methodology

This project used the quasi-experimental design, with one experimental cohort of students and a control group. Specifically, it used the comparison Group Pre-test/Post-test Design. This design is more of an experimental design but lacks the key ingredient of random assignment of participants into experimental and control groups. However it made up for this lack by controlling for threats to external validity (Borg, 2007). Internal validity threats were controlled for through the control group.

The population for this project was drawn from 100 Bachelor of Education (B Ed) students of Maseno University taking Mathematics and another 100 B Ed students from Kenyatta University taking Mathematics but taking their teaching practice in Western Kenya region, 55 lecturer from Maseno, 60 lecturers from the Kenyatta University's school of Education, 200 principals of participating schools and 10 lecturers from the school of Education from Linnaeus University.

A sample of 60 students and 35 lecturers from both Kenyatta and Maseno University was drawn through the stratified random method. Stratification will be based on the University of each Participant's Origin and speed of returns of the research results. Saturated sampling was applied for the Linnaeus lecturers since all of them took part in the project. All the 200 school principals of the participating schools will form part of the respondents in tracking impact after research.

Data was collected through questionnaires to all participants, observation of online interactions among student researchers with supervisors, online focus group discussion with students and documentary analysis of the project reports and learner performance. All instruments were subjected to validity and reliability measures after piloting and a reliability index of 0.7 was

accepted (Borg, 2007). The paired sample T-test was used to analyse the quantitative data because there was need to look at the pre-test and post-test scores for the control and experimental groups as it reduces the initial differences between groups respectively. Qualitative data from focus groups, observed online interactions were coded according to emerging themes and reported within relevant research objectives.

Conceptual Frame Work

This research was guided by Wuetherick and Turner model (Spronken-Smith et al, 2013).This model guided this project by explaining both the process and the inherent benefits. It showed the need for university teacher education to move from teacher centred pedagogies to learner centred transmission modes and practices. And what a better way of doing this than having the trainees engage in actual knowledge search. This was likely to inculcate in them not only the pedagogic practice but also train them in actual search for information. It clearly explained the need to move from research outcome being transmitted by the lecturer to the trainees as is the common practice in most universities' teacher education programmes to a point where the trainees are used as researchers. To get here, the learner needed to be taken through the research process (by introducing the course at undergraduate level), to being used not just as research assistants without necessarily being taken through the process, to a point where they become the researchers. When this process is internalized by the teacher, their pedagogic orientation and practices also changes to the use of learner centred approaches (inquiry, problem solving, project based learning) that fully engage learners. The end result is that these trainees will become teachers that continuously churn out project dissertations, publications and eager to share their findings with colleagues in seminar presentations. Spronken-Smith et al (2013) aptly summarizes what needs to be done by stating that "Teaching has suffered from imbalance between R&T in status and rewards and in an age of 'super complexity' and given the increased significance of the knowledge economy and the growth of interdisciplinary, "teaching and research that are becoming ever more intimately related … (and) all students – certainly all graduates – have to be researchers".

Analysis and Discussion of Results

This section presents the data in both in words and with the help of tables, charts and graphs to make the narrative clear and easy to understand. Presentations in this section are guided by the objectives of the project.

Inculcating research capabilities among prospective teachers

This objective involved the designing of a research methodology course suitable for use with undergraduate Bachelor of Education (B Ed) students at Maseno University and capacity building for lecturers not only to teach the course but also to supervise the students when doing the actual research. The course was adapted from Linnaeus University in Sweden that had already integrated research in its Bachelor of Education programme for many years. Lecturers from Linnaeus school of Mathematics Education acted as mentors for the lecturers in Maseno University. A seminar, facilitated by experts from Linnaeus University was hosted in Maseno University for its lecturers and the key facilitator from Kenyatta University to discuss how integration is done. This seminar provided a chance for knowledge exchange and experience sharing. Key highlights of the seminar included the following topics: The Linnaeus Experience

in Undergraduate Research; Best Practice in F2F Student Supervision; Overview of the Project – The Linnaeus Approach among others.

Furthermore, there was online orientation of 10 lecturers selected to supervise students in cohorts of 10 each. Orientation of lecturers was followed with orientation of the 100 student who volunteered to take part in the project. The students successfully completed orientation and were enrolled in the research methods course mounted on the university Learning Management System (LMS). The course involved training of the B Ed Mathematics students in the basics of research methods; development of proposals for the research; and actual research in the field during the teaching practice by the students as lecturers continued with research supervision. Supervision of students continued until after a research report with analysed results was written and submitted. The 100 students from Kenyatta University we however instructed to carry out research after going through a face to face course on "Introduction to research methods" taken by all Bachelor of Education students in all universities in Kenya. These students were also supported by lecturers to develop proposals before collecting and analyzing data and finally writing a research report which was presented to the department at Kenyatta University.

As can be seen from Figure 1, 65% of the respondents submitted a proposal in Maseno as compared to only 35% in Kenyatta University thus pointing to the importance of the online research course that the Maseno University students were taken through as well as the online community that interacted with students on the LMS. However, only 35% of students from Maseno University submitted the final project report as compared to 20% from Kenyatta University. Analysis emerging from the Focus group discussion with students pointed to the fact that the online platform afforded Maseno University students more attention as compared to their colleagues from Kenyatta University since a pool of lecturers was available online to respond to their issue. It is noted however that the overall completion rates was still below average at 35% and 20% respectively. Lecturers from both institutions when contacted pointed to work overload as a possible cause of the low returns since it was not possible to give students individual attention.

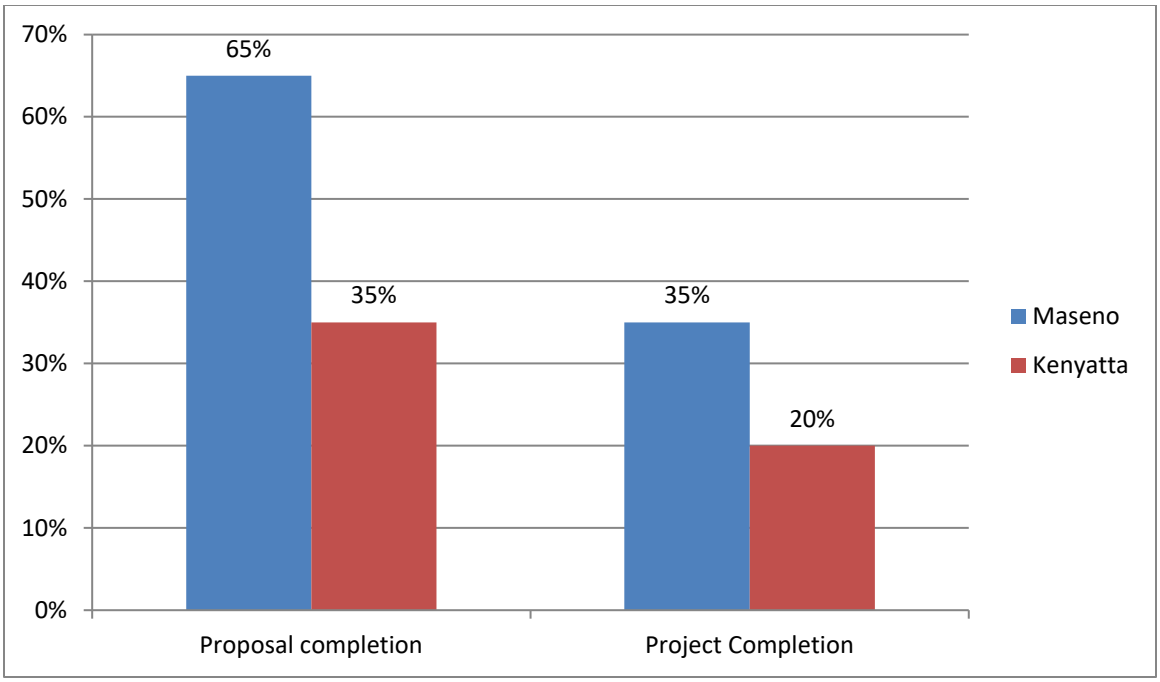

Figure1. Students' Completion Rates

The implication of these findings is that though most Kenyan Universities rely on the Introduction to research methods course, it does not adequately prepare students to handle research in the field. There is need therefore to have a more intentional course on research methods and guided supervision for trainee teachers for them to have a grasp of basic research that can allow them to investigate instructional issues as they arise in the course of their work.

Descriptive statistics in Figure 1 clearly brought the fact that students who undertook a full course on research methods had better completion rates. Further analysis was carried out using the a two tailed t-test to find out if the difference in outcome was significant. The results are presented below.
The results from Maseno (M = 2.59, SD = 0.59) and Kenyatta (M = 1.82, SD = 0.41) final rating scale indicate that the impact of a taught research methods course in Maseno university resulted in an improvement in the rating of the students' research projects.

The results further indicated that there was a significant increase in the performance of students from Maseno compared to those from Kenyatta at the end of the project:
$t = (M1 - M2)/\sqrt{(s2M1 + s2M2)} = -0.77/\sqrt{0.09} = -2.56$
The t-value is -2.55704. The p-value is .01879 and this result is significant at $p < .05$.

The results confirm the hypothesis that integrating research in under-graduate teacher education programme has a significant impact on the teachers' research output at the classroom level. By extension this means that teachers who undertake a supported research course are better field researchers than those who fail to carry out a research project course.

Providing feedback from research findings to improve the undergraduate Teacher Education Programmes in Kenya

Kenyatta University held a face to face seminar with students who took part in the project immediately after the teaching practice session together with their supervisors and other faculty members in the department to disseminate findings. The summary from the presentations were collated and shared with other faculty members in the School of Education web portal.

Maseno University on the other hand relied on its LMS to engage with learners throughout the project phases for purposes of receiving and giving feedback. To further complement the LMS, Maseno University used a group WhatsApp Forum to allow for free flow of feedback into the institution from both students and lecturers. The feedback was then disseminated to the rest of the faculty during the school of Education Faculty board meeting.

The interesting outcome from the dissemination processes was that the thematic areas covered by both group of students was the same. The most common thematic areas emerging from the students' research projects are presented in the table that follows:

Table 1. Thematic Areas of Research

Thematic Area	**Number**	**Percentage**
Learner attitude in Math and its influence on performance	10	19
Role of learning resources in teaching and learning of Math	8	15
Impact of learning environment on Math performance	8	15
Curriculum and its influence on performance	6	11
Influence of assistive resource on special needs learner performance	6	11
Influence of Math on performance of other science subjects	5	9
Gender differences in math performance	4	7
Practical skill area influences on mathematics outcomes	3	5
Influence of learning habits in Math performance	3	5
Factors contributing to common errors in math exams	2	4
Total	55	100

In interpreting Table 1, we take note of the fact that only projects presented with final project were considered. The themes ran around10 different areas ranging from attitude, resources, learning environment, curriculum content, gender, learning habits and to common errors in Math. The impact of this information is that content areas in training of Mathematics teachers should place emphasis around these thematic areas because they were picked out as potential problem areas in the teaching of mathematics at the school level. The most important fact to note therefore is that carrying out research at school level is a very good way of collecting feedback that can be used to improve the teacher education training curriculum at the University level.

Using research findings to improve classroom instructional processes

All the research projects have a literature review section where the teacher searches both global literatures on a concept being investigated. This self-study habit allows the researcher to gain rich and firsthand knowledge that automatically transform their classroom instructional processes.

Secondly formulating a problem statement forces the teacher turned researcher to reflect deeply on their own individual instructional processes and the outcomes. Therefore identifying a problem and a solution to the problem naturally transforms classroom practices with home grown solutions.

Lastly, the recommendations section, targets specific stakeholders from the classroom teachers, teacher trainers, curriculum developers, pedagogy specialists' right to policy makers at the ministry of Education level who are all interested improving instructions. A few of these recommendations are highlighted in the sections that follow:

'Performance of students in mathematics is improved by providing students with the enough course books and revision materials for studying mathematics.'

'Motivating learners involve: Use well-designed learning methods; Provide immediate feedback on learner's performance; Appreciate learners attempt to improve in the subject by reinforcements; Guide the learners to motivate their progress in the studies.'

'School environmental factors should ensure that learners of both gender receive the same learning conditions in classrooms so as to avoid gender differences in learning and performance in mathematics.'

Creating a link between teacher training and industry through research

The following are some direct outcomes from the research project:

i. At least 2% of MU students are directly benefitting from the research training received as undergraduate students as they are training others in basic research and earning an income from this skill.
ii. At least 5 students from both universities were able to register immediately for post-graduate studies because of the interest they gained through the research project.
iii. One school from Maseno University school of Education adopted materials from the course developed under the project to improve their course.
iv. Both Maseno and Kenyatta University were able to use results and linkages from this programme to apply for further funding for students' and lecturer exchange programmes where more exposure to knowledge and industry players are taking place.

Conclusion

Generally, the evaluation team for this project made the following observation and the issues make good concluding remarks.

- Student had well defined research questions capturing the essence of the study which allowed for suggesting relevant and interesting recommendations
- Based on the titles, it was noted that the investigations were often well directed: e.g. on students and teachers' attitudes, understanding of content and not just quantitative relationships that are to be confirmed.

- As much as there were issues with the use of conceptual framework, the ambition to include the same in the theses is laudable – in a number of cases the conceptual framework was even manifest and reflected in the analysis.
- The use of previous research is normally problematic when students use older references – while these might be a problem where access to literature is limited, it was however noted that at one university there were “considerable recent references”.

Issues that we might need to considered going forward might include giving consideration to elements of qualitative research that investigate actual classroom interactions and practices .