

# Effect of teachers' networks on teachers' professional development and student performance in secondary schools in Tanzania

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## ABSTRACT

The emergence of the knowledge society age calls for innovative forms of teachers' professional development for improving student performance outcomes. Teachers' networks are the innovative forms of teachers' professional development. This survey study focused on assessing the effect of teacher networks on teachers' professional development and student performance outcomes. In addition, the study sought to seek opinions from teachers on how teachers' networks can be improved. Data were collected using questionnaires administered to 318 science teachers purposively selected from ordinary level secondary schools. Analysis was carried out using descriptive and inferential statistics. Findings revealed a significant positive relationship between teacher networks and teachers' professional development ( $r = .36$ ; two tailed  $p < .05$ ). Also, a positive but rather weak statistical significance relationship ( $r = .23$ ; two tailed  $p < .05$ ) between teachers' professional development and student performance was found. Furthermore, 44.65% of the participants proposed meeting frequently as a way to improve teacher networks. Findings are discussed, implications drawn and recommendation made.

**Keywords:** Teachers' professional development, teachers' networks, student performance outcomes.

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## INTRODUCTION

In the past centuries, teachers' professional development followed a traditional form in which experts from outside the school were brought into the school to improve teaching, learning and assessment quality of teachers using a one-size-fits-all solution (Lieberman and Wood, 2005). However, the UNESCO World Report (2005) retaliated that the emergence of the knowledge society fosters the value of exchange, the ethics of discussion and the sharing of knowledge. On the other hand, Little (2006), in her paper titled "Professional Communities and Teachers' Professional Development" argued that the traditional form of teacher professional development is less effective in preparing teachers to improve student performance outcomes, especially in this knowledge age. Lieberman and Wood (2005) asserted that the ineffectiveness of the traditional form of teachers' professional development gave way to innovative forms of teachers' professional development (TPD), which are

effective and more suitable in preparing teachers to improve student performance outcomes. Teacher networks (TNs) between the schools (Lieberman and Wood, 2005) are the innovative forms of teachers' professional development which support teachers as agents for change in education and key players associated with the knowledge society (UNESCO World Report, 2005).

TNs carry all the attributes of quality and effective teachers' professional development needed in this knowledge age such as opportunities of teachers to explore, create and share new knowledge in order to integrate it into their day to day teaching practice (Department of Education and Training, 2005). Moreover, TNs are sustained over time and regard teachers as primary developers of their own profession (Lieberman and Wood, 2005). However, research carried out in the USA by Feger and Arruda (2008) discovered that studies

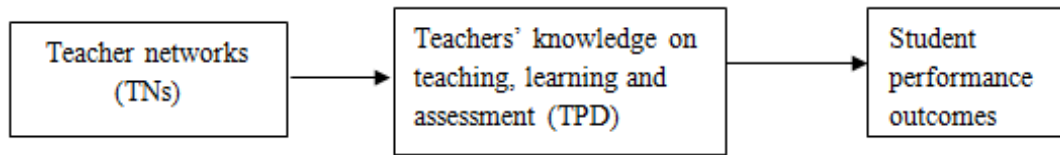


Figure 1. Conceptual framework.

in TNs are central in developed countries like UK and the USA, but not in African countries.

### Statement of the problem

PROGRAM 1 is a TN that was introduced in Tanzania in 2009 soon after the adoption of the Competence Based Curriculum (CBC) in 2008 as a new form of teachers' professional development. The aim of introducing PROGRAM 1 was to improve ordinary level students' performance in science subjects including Mathematics. Ordinary level students are those who have entered their first level of secondary schools after completing primary education. Teachers teaching the same subject get opportunities to meet under the TN (PROGRAM 1) in order to share ideas about teaching, learning and assessment of their respective subjects based on the adopted CBC. However, even though TN exists in Tanzania its effectiveness has not been assessed. Thus, the research presented here seeks to examine that area in order to unveil the truth in the Tanzania context.

### Purpose of the study

The study aimed to assess the effectiveness of TN (PROGRAM 1) in improving teachers' professional development and student performance outcomes. It also aimed to seek opinions from teachers on how TNs can be improved.

### Objectives of the study

The study was conducted to achieve the following objectives:

- (i) To establish the effect of TNs on teachers' professional development.
- (ii) Examine if teachers' knowledge of teaching, learning and assessment contributed by TNs has any effect on student performance outcomes.
- (iii) To seek opinions from teachers on how TNs can be improved.

### Research question

To fulfill the research objectives, three research

questions were developed:

- (i) Is there any relationship between TNs and teachers' professional development?
- (ii) Is there any relationship between teachers' knowledge in teaching, learning and assessment as contributions of TNs with student performance change?
- (iii) What are the teachers' opinions on how to improve TNs?

### Conceptual framework

All the three research questions are centered on science education teachers in Tanzania secondary schools. The relationships presented by the first two research questions are also indicated in the research and the theoretical framework in Figure 1. The theoretical part of the research was based on this model.

From the conceptual framework above, the TN that supported teachers in gaining knowledge on teaching, learning and assessment investigated in this study is PROGRAM 1 in which teachers collaborate in order to improve their knowledge on teaching, learning and assessment for better students' performance outcomes. Teachers of Science are at the centre of this study.

### LITERATURE REVIEW

The related literatures concerning the concept of TNs, which are the innovative form of teachers' professional development for improving student performance outcomes, drawn from various studies conducted in various countries, were reviewed and organized following the conceptual framework.

### Conceptualization of the term TNs

Jackson and Timperley (2006) defined the term TN as a group of schools working together to sustain school-to-school learning for enhancing student performance outcomes. According to Lieberman and Wood (2003) TNs are groups of teachers coming from different schools, aiming at collaborating with one another to improve the quality of school-to-school learning, pupil learning and professional development. Little (2006) described different types of teacher networks such as

school networks, university-school partnerships, and teacher-to-teacher networks with the intention of learning about new possibilities of improving their teaching, learning and assessment practices for better student performance outcomes. However, the TNs referred in this study are those of school-to-school, specifically the science teacher network embodied by PROGRAM 1.

### **Concept of TNs as relate to teachers' professional development**

In TNs, teachers from different schools meet and create a new pool of knowledge about effective teaching, learning and assessment, where individual schools can draw from, in order to develop professionally (Jackson and Timperley, 2006). Thus, different researchers have found that TNs help teachers to:

- a) Share expertise for their professional development, which adds to individual teaching skills and knowledge that single schools cannot offer (Supovitz, 2002).
- b) Gain a sense of empowerment that facilitates continuous professional growth (Smith and Wohlstetter, 2001).
- c) Gain new knowledge and skills, which help to increase their efficacy, which in turn bring changes in teacher teaching practice and finally improve student performance outcomes (Lovett and Gilmore, 2003).

Thus, Jackson and Timperley (2006) concluded that teacher networks act as vehicles for dissemination of good practice to enhance the professional development of teachers. They are especially suitable for this knowledge age (Lieberman and Wood, 2005).

### **Link between teachers' knowledge in teaching, learning and assessment (as contributed by TNs) and student performance outcomes**

Research conducted by Wiley (2001) showed that individual student performance in Mathematics is positively affected by an increase in the amount of learning resulting from teacher networks, but this is only the case in schools where teachers experience good leadership. Furthermore, Lee and Smith (1996) carried out a longitudinal follow-up study of 820 United State high schools, including 9,904 teachers, and found out that performance gains for 8<sup>th</sup> and 10<sup>th</sup> grade students in reading, social studies, science and mathematics were significantly higher in schools where teachers took collective responsibility for students learning. In addition, Visscher and Witziers (2004) carried out a research in the Netherlands to explore the link between teacher networks and Mathematics test scores of a representative sample of 975 students, obtained from junior high and senior high

schools, and concluded that shared responsibilities, shared goals, joint decision making, advice and consultation were important to improve educational practice and, consequently, student performance. In conclusion, Little (2006) asserts that in schools with effective teacher networks student performance was higher.

Therefore, the connection between teacher networks, teacher professional development and student performance outcomes can be established as follows: teachers tend to draw their knowledge from a pool of knowledge created through networks. This knowledge helps teachers to improve their classroom teaching, learning and assessment, which in turn translate into improved student performance outcomes.

### **Forms of teachers' professional development and their effects on student performance outcomes in Tanzania**

Based on the main theoretical and conceptual framework in Figure 1, two main direct interactions, which can be established, include:

- (i) Interaction between TNs and teachers' professional development.
- (ii) Interaction between teacher knowledge in teaching, learning and assessment and student performance outcomes.

Concerning the TN, PROGRAM 1 represents the teacher networks under investigation in Tanzania, where Science (Chemistry, Biology, Physics and Mathematics) teachers from different schools meet at least once a month in each region to discuss matters related to their profession for the betterment of student performance. Also, focusing on professional development in our conceptual framework, Targamadze and Vebra (2008) observed different ways of evaluating professional development, which can support our measurement process, such as:

- (i) Evaluation of participant's reaction to expertise;
- (ii) Change in student learning outcomes; and
- (iii) Participant's use of knowledge and skills.

Thus, evaluation of teacher professional development in this study focuses on both participants use of knowledge and skills that teachers acquire after attending professional development activities and change in student learning outcomes. The knowledge and skills evaluated included knowledge about conducting the lesson in practical terms, preparation of teaching materials, providing student's assignment and giving feedback to student's assignment and use the project method of learning. The extent to which teachers apply this knowledge in their daily classroom teaching practice

and the change in student learning outcomes determined the extent to which they have developed professionally.

Teachers' professional development was evaluated through student performance outcomes because Harris and Sass (2006) observed that recent studies on effect of teachers' professional development on student achievement used a two-year student score gains approach. Therefore, this study used two-year (2012 and 2013) national examination student score gains because these are the two consecutive years of which Form IV students have graduated since the establishment of PROGRAM 1 in 2009. Hence, the fruits of PROGRAM 1 can be assessed.

## METHODOLOGY

### Research design

The study employed both quantitative and qualitative design.

### Population and sampling procedure

The targeted population was all secondary school science teachers in Tanzania. Due to the appraisal nature of this study, that required to evaluate content and instructional changes among teachers who participated in TNs, the most important inclusion criterion was that the teachers involved must have had attended the teacher network (PROGRAM 1) at least twice. Therefore, the researcher purposively chose 11 out of 29 regions in the country with a high population of schools where PROGRAM 1 was conducted. The regions were Arusha, Dar es Salaam, Kilimanjaro and Tanga. It also involved Iringa, Morogoro, Mbeya, Mwanza, Pwani and Ruvuma and Dodoma regions.

The study involved a sample of 318 ordinary level secondary school science teachers in 129 schools obtained by stratified-random sampling. The stratification of the population was necessary so as to include the minority female teachers who would otherwise be unrepresented in the sample if random sampling dictated the procedure. The selected respondents were supposed to fill in the questionnaires as a means of data collection.

### Instrument and variable used

A questionnaire consisting of 27 items including demographic information (DI) items, a teacher network (TN) scale, a teacher professional development (TPD) scale, and a student performance outcome (SPO) scale were used. In addition, one question requiring teachers to give their opinions on how TNs can be improved was included.

The teacher TN items were adopted from Center for Research in the context of teaching (2001) and also possessed high reliability ( $\alpha = .90$ ). However, re-validation to suit the Tanzanian settings was seen as imperative. This was done through piloting using researchers' fellow workers. Piloting aimed at assessing clarity of the information on how to fill the questionnaires and the terminologies used, format, and evaluate readability of the instrument. However, the original language of the questionnaires that is English was maintained. The items used had a new reliability ( $\alpha = .87$ ). The items also required teachers to use a Likert scale (1 = 'Never' to 5 = 'Very often') to indicate the extent to which the network (PROGRAM 1) activities that they had attended expressed the given characters.

The TPD scale items were developed by the researcher based on information from the literature review. Teachers were required to use a Likert scale (1 = 'Never' to 5 = 'Very often') to indicate the extent to which they had developed professionally based on the given characters. Furthermore, measurement of student performance used two-year (2012 and 2013) national examination student score gains. Teachers were asked to use the 2012 and 2013 form IV national examination results and indicate the percentage change in student performance as a result of teachers' attendance in professional activities.

### Data analysis

Data obtained were analyzed using the Statistical Package for Social Sciences (SPSS) program version 19.0. For descriptive purposes, the data obtained were calculated into percentages, means and standard deviations and presented in tables. On the other hand, inferential data were treated by correlation analysis to establish degree of relationship between TNs and TPD, and finally TPD and SPO.

## RESULTS AND DISCUSSION

This part of the paper presents the results obtained in the study and their analysis and discusses the results related to teachers' networks, teachers professional development students' performance outcome and teachers opinions on how TNs can be improved.

### Characteristics of the sample and variables/scales

#### *Gender, age and education level*

The study involved 318 respondents, of whom 227 (71.38%) were male and 91 (28.62%) were female. Furthermore, the respondents were categorized by age and education level, as observed in Table 1.

Data in Table 1 shows that the majority, 175 (55.03%), of respondents were professionally young people, aged between 31 and 43 years old. This implies that there were very few science teachers in schools before the emergence of privately owned higher learning institutions. The young teachers seen now are a part of the recent educational changes in Tanzania. Considering education level, it can be observed that 138 (43.4%) and 139 (43.71%) respondents were diploma and bachelor degree holders, respectively.

#### **Type of subject and attendance of teachers to the professional development activities**

Table 2 shows the different types of subjects taught in schools and the frequency of the teacher attendance in TNs.

Data in Table 2 indicate that 54.71% of the participants are teachers who teach Chemistry and/or Biology. This may be attributed by the fact that most teachers who

**Table 1.** Gender, age, and education level of respondents (N = 318).

Demographic chapters	Frequency (f)	Percentage
<b>Age</b>		
24 - 30 years old	45	14.15
31 - 34 years old	100	31.45
38 - 43 years old	75	23.58
45 - 51 years old	53	16.67
Above 51 years old	45	14.15
<b>Education level</b>		
Diploma	138	43.40
Bachelor	139	43.71
Masters	40	12.58
PhD	1	0.31

**Table 2.** Types of subject taught and frequency of attendance to professional development activities (N = 318).

Demographic characters	Frequency	Percentage
Chemistry and/or Biology	174	54.71
Physics and/or Chemistry	74	23.27
Mathematics and/or Physics	65	20.44
Others	5	1.57
<b>Attendance</b>		
Twice	75	23.58
Three times	80	25.16
More than three times	163	52.26

studied Chemistry and Biology subjects were aspiring to be doctors, but they did not meet the qualification criteria for being doctors. In addition, results indicate that 52.26% have attended professional development activities three or more times.

### Teacher networks

Focusing on teacher network activities that teachers have attended, teachers were asked to rate (using 1 = never, 2 = seldom, 3 = sometimes, 4 = often, 5 = very often) the extent to which those activities fit effective teacher professional development. The results obtained are represented in Table 3.

Results in Table 3 indicate that the type of professional development activities offered in Tanzania under PROGRAM 1 often meet the principle of effective professional development, since five out of six items which measure the quality of the network in Tanzania, carry a mean greater than 3. This indicates that PGRAM 1 is effective. However, some weakness can be observed in the item that asks if the network activities are sustained

overtime. This item carries the lowest mean (M = 2.59, SD = 1.02). This means that the teacher network activities are episodic. This may be due to lack of time, as documented in the literature by Dufour (2004).

### Teacher professional development

Change in classroom teaching practice was used in this study as an indicator of teachers' professional development. To find if teachers were professionally developed as a result of attending TN activities, they were asked to rate the extent to which they had changed their teaching practices after attending professional development activities, using 1 = never, 2 = seldom, 3 = sometimes, 4 = often and 5 = very often. Table 4 summarizes the findings.

Using means and standard deviation (SD) the results in Table 4 reveal that the majority of teachers changed professionally because of attending PLCs and TNs. However, there is some weakness in the 'use of project method for learning more often' as the item carries both the lowest mean and the highest SD (M = 2.92, SD = 2.28). This may be associated with the fact that using the project method of learning demands time, knowledge and financial support.

### Teacher professional development and student performance outcomes

Teachers were asked to use the national examination results and indicate the percentage change in student performance between the year 2012 and 2013 as the result of teachers attending professional development activities.

### Relationship between PLC, TN and TPD

To accept/reject research hypotheses 1 and 2, three scales – that is, teacher networks (TN scale) and teachers' professional development (TPD scale) were developed. Thereafter, Pearson correlations were carried out. The results obtained are summarized in Table 5.

Regarding the first question which inquired if there is any relationship between TN and TPD, correlation results from Table 5 reveal that there is a significant relationship between scale TN and Scale TPD ( $r = .36$ ; two tailed  $p < .01$ ). This means the more teachers participate in TN activities the more they develop professionally. The findings are in line with Supovitz (2002) who found that TN had the ability to change the way teachers think and their teaching practice.

### Effect of TPD (as contributed by and TN) on SPO

To answer question two, Pearson correlation analysis

**Table 3.** Teacher responses to teacher network items (N = 318).

Teacher network item	N	M	Mode	SD
Focus on subject matter and how to teach it	316	3.89	5	0.86
Fits well with what I want in my current teaching assignment	299	3.59	5	0.65
Recognize and built on individual teachers knowledge and experience	318	3.96	5	0.88
Promote collaboration and joint work among teachers	316	3.89	5	1.01
Is sustained overtime with ample participants follow up and support	318	2.59	4	1.02
Improve my skill to meet the instruction of my students	315	3.98	5	0.78

**Table 4.** Teachers response to professional development items (N = 318).

Professional development items	N	M	Mode	SD
Prepare new teaching materials more often	318	4.16	5	1.06
Conduct your lesson more practically more often	318	4.07	4	0.95
Student work in group more often	317	4.37	5	0.85
Provide assignment to student more often	317	4.69	5	0.98
Provide feedback for students assignment more often	316	4.76	4	0.83
Use project method for learning more often	314	2.92	3	1.28

**Table 5.** Correlation between TN and TPD.

	TN scale	TPD scale
TN scale	1	
TPD scale	.36*	1

\*p < .05, \*\*p < .01.

**Table 6.** Correlation between TPD and SPO.

	TPD	SPO
Scale TPD	1	
Scale SPO	.23*	1

\*p < .05.

between TPD and SPO was carried out. The results of correlation analysis are shown in Table 6.

The results from Table 6 reveal a positive but rather weak statistical significant relationship between TPD and SPO ( $r = .23$ ; two tailed  $p < .01$ ). This indicates that the involvement of teachers in both TNs help them grow professionally; this in turn leads to improved student performance outcomes. These results are consistent with Little (2006) who found that the performance of students in schools with effective teacher networks was higher. However, the weak correlation between TPD and SPO can be accounted for by the fact that professional development activities in TN are episodic. This was revealed through descriptive analysis, which was performed on TN scale and also the teachers' opinions on how to improve teacher networks as teachers

proposed they should meet frequently. The weak correlation can also be explained by the fact that teachers rarely use the project method for student learning. This could help students gain more knowledge and hence to better understand the concept taught in the classroom and thus improve their performance.

### Teachers' opinions on how to improve teacher networks

In order to answer research question three, teachers were provided with an open-ended question asking them to propose ways to improve TNs. 312 participants answered this question. Results showed that 139 (44.65%) of the participants proposed that there should be frequent teacher network meetings. However, 115 (33.82%) proposed that teacher networks could be improved by sharing what you have learnt from external schools. Moreover, 58 (14.44%) of the participants proposed that teachers should be given allowance to attend teacher network activities.

The suggestion by teachers that they need to meet frequently can imply that, in Tanzania, TNs activities are episodic. Therefore, it is clear that although TN activities exist in Tanzania they are not earning good fruits as expected, because they are not sustained.

Considering the second suggestion that teachers should share what they have learnt from TPD activities, it is clear that some teachers do not share what they have learnt from TPD activities. However, this may be due to lack of time, since sharing ideas on anything requires time.

The idea of providing allowance was the third

suggestion and is worth to be adopted since Sargent and Hanun (2009) observed that Singapore provided allowance to their teachers for professional activities, a process which led the country to excel in the Trends in International Mathematics and science Study (TIMSS).

### Implication of the findings to the knowledge society

In this knowledge society, which fosters the value of exchange, the ethics of discussion and the sharing of knowledge, effective TNs are needed. The unsustainable TN will not yield the desired fruits for both teachers' professional development and student performance.

### CONCLUSION

In general, the findings from this study show that the innovative form of teachers' professional development that TN is gives a positive contribution to both teachers' professional development and student performance in Tanzania. However, descriptive analysis of mean response for each item in both teacher networks and teachers' professional development revealed some factors that contributed to lower down the magnitude of the relationships. For teacher networks, this was noted by lower mean responses obtained in the item which asked if the teacher network activities are sustained over time with ample follow up and support, while for teachers' professional development this was noted by lower mean responses obtained in the item which asked if teachers use the project method for student learning more often. Therefore, more steps are still required to realize effective and quality teacher professional development through TNs in the Tanzania educational context, if significant student performance change is desired.

### Suggestion for further study

It has been mentioned earlier that the researcher used data from eleven (11) regions out of twenty nine (29) regions. It is suggested that further research will be done on the same study but to include the remaining regions. Also, a comparative study between urban and rural about the effect of teachers' networks on teachers' professional development and student performance can be conducted to reveal the reality since it is believed that teachers in urban area get more opportunity to meet frequently and therefore develop more professionally and hence good performance of their students compared to rural area.

### RECOMMENDATIONS

The researcher recommends that the government and external supporting agencies should continue to sponsor

TNs meetings to make sure that they are sustained so as to produce the desired student performance outcomes.

Secondary schools located in rural areas should establish projects, like chicken rearing which can help raise funds for running TNs and make them sustainable.

For the secondary schools located in urban areas, parents may contribute with some amount of money for running TNs meetings in order to sustain them.

Teachers who are knowledgeable about projects, for example those with Masters Degrees or PhDs, should share their knowledge with others who lack it. Courses on project work should be strengthened in colleges and universities so as to enable graduates to acquire knowledge on project work.

Teachers should be financially supported and encouraged to use project methods in the teaching-learning process to improve student performance outcomes.

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