

Curriculum reform and teachers' training needs: the case of higher education in Ghana

Marie A. B. Bakah, Joke M. Voogt and
Jules M. Pieters

Professional development is the key to curriculum-based reform, yet there is little empirical evidence upon which to base decisions of design or implementation of training and development programmes. This study examined the training and development needs of Ghana's polytechnic teachers in an existing curriculum reform scenario as they became involved in curriculum design. Forty-four teachers and four heads of mechanical engineering departments and representatives of the leadership of four polytechnics granted comprehensive interviews and responded to questionnaires. Findings revealed that updating subject knowledge through industrial attachments was a major training and development need for teachers. Teachers indicated that they were keen to get more involved in curriculum design and argued for their subject knowledge to be improved to give them the confidence to do so. The results of the study suggest higher education teachers have training and development needs in relation to effective curriculum design and implementation. It is proposed that polytechnic–industry links are strengthened and that teachers should draw on teamwork to plan and undertake industrial attachments.

Introduction

The development of new curricula as means to curriculum reform is a common event in countries across the globe. Commitment to successful curriculum reform, however,

□ Marie A. B. Bakah, Lecturer, Institute for Educational Planning and Administration, Faculty of Education, University of Cape Coast, Cape Coast, Ghana. Email: marieafua@yahoo.com. Joke M. Voogt, Associate Professor, Department of Curriculum Design and Educational Innovation, Faculty of Behavioural Sciences, University of Twente, Enschede, The Netherlands. Email: j.m.voogt@utwente.nl. Jules M. Pieters, Professor and Chair, Department of Curriculum Design and Educational Innovation, Faculty of Behavioural Sciences, University of Twente, Enschede, The Netherlands. Email: j.m.pieters@utwente.nl

requires active involvement of teachers in the design of the new curriculum. Despite good intentions, the attention and energies of policymakers are focused too much on the 'what' (enacting curricular policy/legislation) of desired educational change while neglecting the 'how' (bringing a new curriculum into practice) (Rogan & Aldous, 2005). This study is about assessing the knowledge needs of teachers in Ghana's polytechnics arising out of the process of curriculum reform. To realize successful curriculum reform ('what'), teachers need to be appropriately prepared ('how'), as they are the most influential factor in the change process (Fullan, 2007). Teachers have a crucial role in efforts to enact the new curricula that are being developed. Therefore, it is most important for the polytechnics to have teachers with up-to-date knowledge and skills to design, implement and deliver new curricula. Ingvarson *et al.* (2005) indicate that teacher professional development (PD) is recognized as a vital component of policies to enhance the quality of teaching and learning in our educational institutions. Training and development (T&D) directly linked to curriculum design (CD) is considered to more effectively prepare teachers to deliver curricula than conventional T&D programmes (Penuel *et al.*, 2007). Ongoing curriculum reform in Ghana's polytechnics has underscored the need to focus attention on teachers' PD.

As a result of the upgrade of Ghana's polytechnics to tertiary institutions (Nsiah-Gyabaah, 2005), the polytechnics started to develop and run Bachelor of Technology (B. Tech.) programmes. The Higher National Diploma (HND) programmes, which were already in existence, needed updating to ensure curricular quality and relevance (Owusu-Agyeman & Van den Oosterkamp, 2009). Although the curriculum of the polytechnics has been designed to cater for the needs of industry, there is the need for continuous update and evaluation of content to meet the challenges of industrial growth and expansion. In addition to this, studies have shown that polytechnic teachers in Ghana need to improve their knowledge and skills as they continue to practice their career (Nsiah-Gyabaah, 2005) and get involved in the design of the HND and B. Tech curriculum (Owusu-Agyeman & Van den Oosterkamp, 2009). The success of curriculum reform is dependent on teacher's participation in the reform because content, instruction and curriculum development may largely fall within their control. It is critical, therefore, that management plans and provides consistent and ongoing support for their teachers through T&D. The first step is to determine the specific needs of the teaching population. In order to support polytechnic teachers, it is necessary to proactively include their 'voices' in decision making about how best to support them in the work that they need to do.

The purpose of this study is to investigate polytechnic teachers' T&D needs and challenges as they get involved in CD during the reform process. Furthermore, it examines teachers' perspectives about how they should be involved if innovation is to be effectively implemented.

PD of technical and vocational education and training (TVET) teachers: needs and challenges

Industrial attachment (IA) is seen as an effective T&D activity for TVET teachers. One of the most important features of TVET is its orientation towards the world of work and the inclusion of work-integrated learning in the curriculum (Choy & Haukka, 2009). In an ever-changing industrial environment, IA is a necessary T&D strategy for TVET teachers to ensure that they are equipped with the necessary workforce skills and capabilities for the near future (Choy & Haukka, 2009). There have been ways to develop and maintain TVET teachers' and instructors' professional competence globally through in-service training involving IA (Paleocrassas *et al.*, 2009), exemplars of which are in India (Jain & Saxena, 2002) and Kenya (Kerre, 2009). Cort *et al.* (2004) contend that practical training periods in companies allow teachers to update their skills and knowledge in the subject areas they teach, encourage them to experiment with new teaching methods and materials, give them a realistic and holistic impression of the professions and bring elements of realism into their teaching.

This strategy for applying IA for T&D purposes is a systematic approach to learning and development in authentic environments to improve individual, team and organizational effectiveness (Kraiger & Ford, 2007). Teachers involved in this kind of on-the-job T&D activity increase those competencies critical for a successful teaching performance. This study analyses the T&D needs of a specific group of professionals in the TVET sector in relation to a particular task. Specifically, the analysis investigates the PD needs of polytechnic teachers as they embark on designing new programmes. Putnam and Borko (1997) have indicated that for teachers to be empowered and treated as professionals, they should determine the focus and nature of their PD activities. This study provides an example of determining the needs of educators, the results of which can be used by management to guide their decisions when prioritizing areas for T&D.

Needs analysis in T&D has evolved as a research area that serves a vital role in shaping strategy and enabling organizations to take full advantage of emergent strategies. Inancevich (1992) asserted that a needs assessment should present the following: (1) the analysis of the organization's needs; (2) the knowledge, skill and attitude needed to perform the job and (3) the person or jobholder's needs. Robert (1999) studied the same concept and found that a needs analysis typically had a dual focus: organizational analysis and operational analysis. Both studies found that organizational analysis was used to analyse the needs of the entire organization now and in the future, and operational analysis was used to analyse the needs of a specific group of jobs or positions (Inancevich, 1992; Robert, 1999). In this study, operational analysis is used to identify the needs of polytechnic teachers. We will use the concept of a needs analysis to reveal the needs and challenges of TVET teachers and to justify a common ground for T&D activities. Krishnaveni and Sripirabaa (2008) proposed that perception-based, consensus-oriented assessment is a valuable tool for evaluating and improving T&D activity and that brainstorming sessions led to suggestions for enhancing capacity in identified lag areas. In this context, employees identify their T&D needs to satisfy lifelong employability. Although literature has revealed that a number of studies have focused on employees' reactions to T&D (Arthur *et al.*, 2003), there is lack of empirical evidence about employees' T&D needs in relation to particular task or tasks employees are to perform.

Active involvement of teachers in CD is pertinent to successful implementation. As indicated earlier, teachers' increased level of professional knowledge and skills can create a firm basis for CD and implementation in polytechnics. PD triggers the teacher's awareness of what the curriculum is about and what the former is doing. Teachers' assessments of training needs start a process of reflection, critique and refinement of the teacher's classroom practice. Thus, training needs elicit change through the teacher's awareness, while PD intervenes directly to bring about change. PD is a basic educating strategy with the purpose of achieving change in what the teacher does and why. Whereas the constituents of curriculum development are available through the knowledge and skills of teachers, a focus on the attitudes of teachers and an awareness of their training needs help to create a PD experience that supports curriculum development and helps to achieve change.

TVET teachers in CD and implementation

CD is a process involved with devising, planning and selecting elements, techniques and procedures by which to communicate learning (Hansen, 1995). CD is generally an iterative and lengthy process, carried out by a broad range of participants and influenced by an even wider variety of stakeholders (Van den Akker, 2003). A major stakeholder is the teacher (Marsh & Willis, 2003) who participates from time to time in CD (Ben-Perez, 1990). Teachers' knowledge of subject matter and classroom as well as their concerns need to be the starting point of CD processes (Ben-Perez, 1990). Active involvement of teachers in CD leads to a sense of ownership and contributes to their PD through reflection on concrete experiences (Van den Akker, 2003). Penuel *et al.* (2007) reported from a large-scale survey that PD, which is specific and linked to the curriculum, influenced teachers' knowledge and practice and had a positive impact

upon the implementation of curriculum reform. Teachers' knowledge of content and pedagogy enables them to reveal the weaknesses, shortcomings and conditions of the curriculum. For this reason, teachers need to have a central role in the CD process that starts with locating curricular problems (Ben-Perez, 1990). An important focus of PD, therefore, is in CD. The main research question for the study is: *What training and development needs of teachers exist in a curriculum reform scenario?* Cross-sectional survey (Gray, 2004) was used to acquire substantial data on CD activities and PD challenges and needs from polytechnic teachers and administrators.

Methods

Sample

The mechanical engineering departments of four out of 10 polytechnics in Ghana were engaged in the study. These four polytechnics were selected because they are the oldest and most well established. All mechanical engineering teachers ($N = 44$) in those four polytechnics were involved in the study. Twenty teachers had a master's degree, 19 teachers were bachelor's degree holders and five teachers had HND. Twenty persons in leadership positions were involved. All the teacher respondents were males, while three of the 20 respondents in management position were female.

Instrumentation

Teachers responded to questionnaires and semi-structured interviews. All the 20 persons in leadership positions were interviewed. Questions elicited participants' perceptions about T&D and CD in the polytechnic. Questionnaire items on T&D activities that comprised open- and close-ended items were based on teachers' perceptions of their T&D needs.

Data analysis

Questionnaire data were analysed using descriptive statistics. When appropriate, further analysis was conducted using the paired sample *t*-test to compare the means of teachers in terms of their current status and desired state of involvement in CD. To get an indication of the magnitude of an effect, effect sizes were calculated using Cohen's *d* (Cohen, 1988). Cohen provided tentative benchmarks for the interpretation of effect sizes and considered $d = 0.2$ a small, $d = 0.5$ a medium and $d = 0.8$ a large effect size. All interviews were transcribed and analysed. This process involved segmenting the information (Tesch, 1990) and developing coding categories (Bogdan & Biklen, 1992). Data were categorized into emerging themes and presented through a narrative report (Miles & Huberman, 1994).

Results

Teachers' T&D needs

Teachers had the opportunity to indicate what kind of T&D they needed most. Teachers prioritized their T&D needs (Table 1), and results showed that the majority of them (82%) indicated the most important T&D need as IA to update their practical skills. Only 2.3% of the teachers indicated that on-campus workshops in subject area were the preferred need.

Interview data from teachers and leadership confirm the importance of IA for the T&D of polytechnic teachers. The ensuing comment by a teacher is an example of what the teachers observed about industrial visits.

Here when you talk about staff professional development people are thinking of going abroad. But just within here I can be attached to an industry where I can work for about two to three hours then I come and teach. And that will make me efficient.

Table 1: Priority of training and development needs of teachers

Professional development activities	N	%
Refresher courses organized by professional institutions	3	6.8
Pursuance of further academic studies	4	9.1
On-campus workshops in subject area	1	2.3
Industrial attachment to update practical skills	36	81.8

The above comment affirms the concept of PD of some teachers. They are content with industries as a learning resource. Meanwhile, another teacher was of the view that:

We need to be going to industry and see what is coming on board now because technology is changing very fast so to be abreast with time, we need to be going to industry.

The teacher acknowledges that industries are better equipped with modern technologies that the polytechnics may not have the resources to acquire. Thus, to catch up with innovation, they have to embark on industrial visits. This view is confirmed by a fellow teacher as he indicated that:

In fact since we are producing students to feed industry through hands-on training, the departments will have to liaise with industry for their inputs such as equipping staff with relevant knowledge and skill in order to give of their best.

While only 9.1% of the teachers indicated continuing further academic studies as a priority need for T&D, pursuance of further academic studies in terms of graduate and postgraduate programmes was high on the agenda for leadership in terms of T&D. Comments that follow attest to this. A head of T&D asserts that:

Teachers need to be provided with scholarships to embark on further studies. They need sponsorship as well to attend relevant seminars and training workshops. Yes, I think that is very much needed and has been spelt out in our strategic plan.

Despite documentation to ensure that teachers pursue further academic studies, in practice, scholarships may be limited or unavailable. This is a challenge for the polytechnics. A head of department intimated this:

All is not well with us teachers in this institution in terms of academic qualification, so our desire is to get the encouragement and support from the polytechnic management to get higher degrees, yes.

It is observed from the results that apart from IA, teachers' attainment of high academic knowledge through postgraduate programmes was considered a T & D need only by polytechnic leadership.

Teachers' involvement in CD

Table 2 indicates that 50% or fewer teachers are currently involved in almost all the CD tasks listed except deciding on learning materials and resources (54.5%). As to the curricular tasks that teachers desire to be engaged in, over 50% of them responded in the affirmative to all the CD components. Developing instructional/learning techniques scored the highest positive response from the respondents (68.2%). Deciding on learning venues scored the least (52.3%).

Paired sample *t*-test results (Table 2) reveal an overall significant difference ($p < 0.05$) with a medium effect size of 0.44 between teachers' current and desired involvement in CD tasks. Selecting course periods ($p = 0.083$, $d = 0.28$), deciding on teachers' tasks ($p = 0.445$, $d = 0.14$) and deciding on learning materials ($p = 1.00$, $d = 0.00$) were not significant. The largest effect size ($d = 0.51$) recorded was on the task developing evaluation techniques/procedures.

The teachers were asked if their involvement in CD will empower them as professionals. This was aimed at discovering whether teachers see their performance of CD tasks as part of their professional duties. A total of 97.4% of them (43 of the 44 respondents) agreed to the statement.

Table 2: Teachers' (N = 44) involvement in curriculum design

Curriculum design tasks	Teachers' involvement		p-value	Effect size
	Current	Desired		
Deriving objectives	40.9	61.4	0.005*	0.40
Developing instructional/learning techniques	45.5	68.2	0.003*	0.47
Developing evaluation techniques/procedures	36.4	61.4	0.003*	0.51
Selecting course periods	40.9	54.5	0.083	0.28
Deciding on learning venues	31.8	52.3	0.005*	0.41
Determining student groups	40.9	61.4	0.018*	0.40
Deciding on teachers' tasks	50.0	56.8	0.445	0.14
Deciding on learning materials	54.5	54.5	1.00	0.00
Determining course content	45.5	61.4	0.033*	0.32
Overall	43	60	0.001*	0.44

Note: Cronbach's alpha = 0.89.

* $p < 0.05$.

To acquire detailed information about how teachers are involved in CD, the polytechnic leadership provided responses on the CD activities of teachers. Their comments showed that a CD environment existed in the polytechnics. They gave several examples in their responses to confirm that new programmes were being developed and that teachers were involved in the design process. A statement by a dean explained how teachers were involved in the development of the B. Tech. programmes:

You know let me give you an example. We developed the B. Tech syllabus. What we did was that we got some of the teachers who formed committees for various programmes. We come together and then come up with the curriculum and we pass it over to industry for industry to put in their concerns. So it is more or less teamwork, let me put it that way.

The dean's statement concerning the design of new B. Tech. programmes indicated that the committees are not made up of every teacher in the departments concerned but rather a selected few. In contrast to that, all teachers are involved in the review of an existing programme, which is the HND syllabus. A head of department declared that:

At a departmental meeting where all the teachers are present, we come out with the core competencies in the syllabus for the three year HND curriculum. So based on the core competencies we came up with some modules, or blocks and we spread the competencies based on this block. Basically that is what we do.

These comments from the leadership indicate that teachers form the core of committees that design or review the curriculum, which is a very important and prevalent feature at the polytechnics because of new B. Tech. programmes being mounted and the review of existing HND programmes. Information from the deans and heads of departments indicated that there were usually no guidelines for the selection of teachers who form committees for CD at the department. A dean admitted that:

Yes, I think there doesn't seem to be a coordinated programme, at least with my experiences here, that consciously aims at pulling all teachers on board to design or review that programmes.

The study also sought to find out whether the curriculum components (Van den Akker, 2003) were made manifest in the steps and decisions taken by teachers in designing curriculum at the polytechnics. Probing further in the interviews revealed that all the components were considered as has been captured in the comments of a head of academics below:

Table 3: Teachers' (N = 44) professional development challenges in terms of curriculum design

Challenges in professional development	N	%
Inadequate workshops on subject area	7	15.9
Inadequate exposure to new trends in industry	24	54.5
Inadequate conduct of own research in subject area	2	4.5
Lack of higher academic knowledge in subject area	11	25

The various aspects of the curriculum are taken into consideration when teachers meet to review or design a programme. Attention is paid to selection of content and their objectives, teaching technology to be adopted, delivery methods, teacher evaluation and assessment criteria for students. We also take into consideration teaching and learning materials and timetables among others.

The results revealed teachers' interest in getting more involved in CD activities. Overall, teachers unanimously agreed that getting involved in CD empowered them as professionals. Ways in which teachers in the polytechnics are involved in CD are through the design and review of new and existing programmes, respectively.

PD needs of teachers in relation to CD

The study sought to find out whether teachers had PD challenges in relation to the CD activities in which they participate. Table 3 reveals that the majority (54.5%) of the teachers referred to inadequate exposure to new trends in industry. Only 25% of them were of the view that lack of higher academic knowledge in their subject area was a challenge, while 4.5% referred to their own inability to conduct research in their subject area.

Data in Table 3 are corroborated by interview data captured by the following comments:

We need to undertake industrial visits but it is not working. Even if it is just one day and you come back, you see a lot of things. Before going on a visit to industry teachers can put down those things exactly they want to learn about. So it makes it possible for you to learn a lot even for just for one day but well it's hard to process the visits.

The above comment reiterates teachers' willingness to acquaint themselves with industrial operations and equipment to bridge the industry–teacher knowledge gap. It will be noted from the ensuing comment from another teacher that their desire is to train students who have industry-relevant hands-on skills, thus calling for a balance between theoretical and practical training.

I think we should think of a technical polytechnic producing people that can easily fit into the job market. A polytechnic teacher should not enter the classroom to offer only theoretical information. He should be going to industry to acquaint himself with the modern machinery being used and modern trends of production to impart to students.

The stance of leadership was clear about the need for teachers' knowledge of developments in industry. It will be noted that polytechnics may not purchase some major industrial machines because their operation can only be in industrial settings because of large-scale production. A head of department stated:

As a matter of fact, improving the practical aspect of teacher's knowledge is a major setback which I must confess. Due to the fact that engineering in particular is capital intensive, we need to equip teachers to have strong practical grounding.

A dean as in his comments below stressed that teachers' IA will impact on the curriculum through its regular update by teachers who might encounter current information concerning their subject areas.

In fact, all the polytechnics are practical oriented, and therefore teachers should be attached to industry for regular visits. Then with the change of industrial trends, we

could make the necessary changes in the curriculum quickly. So the IA should not only be for the students but also for the polytechnic teachers.

The results reveal that IA is of prime importance to teachers for the performance of CD because it will keep them abreast with industrial trends and bring new information and skill the industry needs to bear on the curriculum and instructional practice.

Discussion and conclusion

This study aimed at identifying T&D needs of teachers related to their involvement in CD in an era of curriculum reforms in Ghana's polytechnics. However, the authors acknowledge the small sample size and recognize that this may limit their ability to generalize upon the findings. Pursuing postgraduate programmes was the T&D priority of leadership due to the polytechnics' policy of maintaining the master's degree as the minimum qualification for their teachers. IA was mostly deemed by teachers as a very important T&D programme. This confirms the studies of Jain and Saxena (2002) and Kerre (2009), who found IA programmes for TVET teachers were successful as a basis for PD. IA usually refers to the formal placement of persons in the workplace to facilitate the achievement of specific learning outcomes (Choy & Haukka, 2009). IA is a necessary T&D programme for polytechnic teachers to ensure that they are equipped with updated knowledge and skills for CD. Teachers were involved in the design and review of new curriculum and existing curriculum, respectively, through being members of curriculum development committees (cf. Marsh & Willis, 2003). Inadequate exposure to relevant new trends in the engineering industry was a concern for teachers regarding their knowledge base for the performance of curriculum tasks. Ben-Perez (1990) also found that challenges teachers face with curriculum development is related to the subject matter of the curriculum. Teachers' up-to-date experience and knowledge about developments in industry is of utmost importance for an up-to-date curriculum.

Analysing present knowledge requirements is an essential starting point for T&D, just as it is for strategic planning. It appears in this study that the polytechnic teachers were aware of and understood what their needs were regarding curriculum development. This awareness is a precursor to the actual practice of designing and implementing the curriculum. Findings revealed teachers' desire and willingness to undertake IA. This study showed that teachers find it important to incorporate relevant and up-to-date information on developments in industry in their teaching.

Findings from this study concerning IA were consistent with earlier researchers such as Okaka (2003), whose report on the status and needs of TVET teachers in southern African countries such as Botswana, Malawi and Mauritius revealed problems with IA arrangements and therefore recommended its review. Although regular IA is regarded critical for Australian TVET practitioners to keep up to date with changes and technologies, there was no consistent approach or formal coordination of such activities (Holland & Holland, 1998). Teachers in higher TVET education as in countries mentioned above, either developed or developing, recognize that they have T&D needs in updating their knowledge on developments in industry. However, a structured approach to meet these needs seems lacking. Teachers in higher education are assumed to possess high-level knowledge in their subject areas. They are often at the forefronts of designing programmes and courses to expand knowledge and make it more relevant to its consumers. Lessons drawn from this study stimulate thinking about whether higher education teachers need to regularly assess their T&D needs, especially if they want to make a relevant contribution to curriculum reform. We advance knowledge of the effectiveness of self-identified T&D needs of teachers in higher education because it forms the basis for the conduct of systematic and sustained in-service programmes to boost knowledge and skills for curriculum reform.

Implications for practice

One major channel through which polytechnics can achieve successful curriculum reform is to involve academically competent and professionally skilled teaching staff.

Providing opportunities for teachers to pursue postgraduate programmes is a long-term strategy that does not address the current curriculum reform activities. A more feasible measure for teachers is to embark on IA because up-to-date knowledge about practical components of subject matter is relevant for the polytechnic curriculum. Polytechnic departments could develop and sustain polytechnic–industry partnerships, through memoranda of understanding and workshops to address knowledge gaps between polytechnics and industries. Teamwork is a fertile ground to embed T&D among teachers with a view to enhancing their knowledge for curriculum reform. The use of teamwork to enhance T&D could be in the form of design teams, a PD approach that is collaborative in nature and useful for curriculum reform. According to Handelzalts (2009), a design team is a group of at least two teachers working together on a regular basis, with the aim of redesigning and delivering (a part of) their curriculum. In a design team, teachers can plan for and undertake IA as well as other useful PD activities that can meet their learning needs for curriculum reform.

On the basis of findings and recommendations arising from this piece of work, the researchers intend to conduct further studies in the form of an intervention on a pilot scale to mobilize interested teachers to embark on IAs. It is intended that teachers will incorporate current information acquired from industry into their courses.

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