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AKADÉMIAI KIADÓ

Content and effectiveness of TVET teacher CPD in Kenya

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RESEARCH ARTICLE

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ABSTRACT

Continuing Professional Development (CPD) for teachers can improve teaching and wider school practices. However, within developing country contexts, research on the CPD practices of vocational teachers remains limited. This study therefore investigated the CPD practices of Technical and Vocational Education and Training (TVET) teachers in Kenya, focusing on the content, outcomes and effectiveness of their CPD practices. Adopting a questionnaire survey approach, data was collected from 170 TVET teachers drawn from six TVET institutes in Kenya's Nairobi Metropolitan Area.

TVET teachers in Kenya were found to more frequently focus their CPD on subject content knowledge and less frequently on pedagogical knowledge. Their CPD activities are not always effective as the CPD activities often do not involve active learning and collaboration, and are not always of sufficient duration. Cluster analysis showed that for some teachers, CPD activities are rarely effective and result in limited impact on practice. However, Initial Teacher Education was found to encourage teachers to focus on broader content and to adopt more effective CPD practices.

To improve the effectiveness of TVET teacher CPD practices in Kenya, it is recommended that TVET teachers in Kenya are supported to adopt active and collaborative learning activities that are spread over extended time durations.

KEYWORDS

continuing professional development, initial teacher education, vocational education and training, TVET, teachers, Kenya

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INTRODUCTION

To teach effectively, vocational teachers need a wide range of competencies which include technical knowledge in their vocations and well-developed teaching skills. Rapid scientific and technological changes demand that vocational teachers update and improve their competencies and in particular their knowledge of modern technology, emerging industrial practices as well as relevant teaching methodologies (Antera, 2021; Axmann, Rhoades, Nordstrum, La Rue, & Byusa, 2015; Rawkins, 2018). The quality and relevance of Technical and Vocational Education and Training (TVET) therefore depends on the professional development of TVET teachers (Cedefop, 2016; Gamble, 2013).

However, despite its importance in supporting quality and relevant TVET, it is not always clear what content TVET teachers learn in their Continuing Professional Development (CPD), or how effective such content is in developing desired TVET teacher competencies, or the impact of TVET teacher CPD on teaching practices (Stanley, 2021). This lack of insight into the content, effectiveness and impact of TVET teacher CPD is more common in developing country contexts where research on TVET remains limited. Haßler et al. (2020) thus note that the CPD of TVET teachers in Sub-Saharan Africa should be further researched and developed in evidence-based ways.

Kenya is one such country in Sub-Saharan Africa where, due to limited research into the CPD practices of TVET teachers in Kenya, it remains unclear how TVET teachers in Kenya improve their professional competencies, and in particular, the content they learn, the effectiveness of their CPD practices and the outcomes of their CPD practices. To address the existing research gap into the CPD practices of teachers in Kenya, and as part of a larger study investigating the CPD practices of TVET teachers in Kenya, this study investigated the content, outcomes and effectiveness of TVET teacher CPD practices in Kenya. To guide the study, three research questions were posed:

a. What content do TVET teachers in Kenya learn in their CPD?
b. What are the outcomes of TVET teacher CPD in Kenya?
c. How effective are the CPD practices of TVET teachers in Kenya?

In reporting the findings of the study, this article starts with a brief overview of the content, outcomes and effectiveness of teacher CPD followed by a description of the context of the study, its design and findings. The article concludes with a discussion of the findings and conclusions drawn from the study.

TVET teacher CPD

Teacher CPD refers to the ongoing learning activities that improve teachers' professional competencies -that is, the knowledge, skills and values teachers need to be effective in their work (Kennedy, 2014; Richter, Kunter, Klusmann, Lüdtke, & Baumert, 2011). Njenga (2022b) notes that teacher CPD is characterized by multiple aims, diverse content and a broad range of learning methods. Aims relate to the motives and reasons teachers have for participating in teacher CPD, while content refers to the knowledge, skills and values teachers seek to develop. Learning methods relate to the formal, informal and non-formal learning methods teachers use to learn and develop their competencies (Njenga, 2022b). Past research on teacher CPD has

endeavoured elucidate on the aims, content and learning methods that constitute teacher CPD, as well as identify the factors that influence teacher CPD and its outcomes (Fischer et al., 2018).

With respect to the content teachers learn in their professional development, Shulman (1986) identified the triad of Subject Content Knowledge (SCK), Pedagogical Content Knowledge (PCK) and General Pedagogical Knowledge (GPK). Subject Content Knowledge refers to the discipline-specific knowledge that a teacher is expected to teach, while Pedagogical Content Knowledge refers to the knowledge of subject-specific teaching methods that a teacher uses to teach effectively, i.e., knowledge and skills of teaching a specific subject. General Pedagogical Knowledge, refers to knowledge about the aims and context of education and student learning. Examples of general pedagogical knowledge include curricular knowledge, knowledge of learners and their characteristics, and principles and strategies of classroom management and organisation.

With respect to the professional development of vocational teachers, scholars have relied on Shulman's classification, with minor modifications to account for the vocational education context (Gamble, 2013; Hoekstra, Kuntz, & Newton, 2018). For example, Gamble (2013) observes that in addition to subject matter knowledge and pedagogical knowledge, vocational teachers are also required to possess practical workplace experience. Antera's (2021) review of empirical literature on the professional competencies of vocational teachers supported these assertions when she found that the professional competencies of vocational teachers are taken to relate to vocational teachers' participation in practice (both in teaching and in their trade areas) and vocational teachers' possession of up-to-date knowledge of the legal and practical aspects of their vocations. Other aspects of the professional competencies of vocational teachers relate to the teaching skills teachers should have, a self-development attitude, humanistic values, responsibility and accountability. In their systematic review of literature on vocational teacher CPD, Zhou, Tigelaar, and Admiraal (2022) identified similar categories of the professional competencies that vocational teachers are expected to develop.

With respect to the outcomes of teacher CPD, a wide range of outcomes have been associated with participation in teacher CPD. These include updating content taught in class, using a wider set of teaching methods, providing demonstrations, and adopting better classroom management practices. Other outcomes include adopting better student assessment practices and collaborating more effectively with other teachers (Desimone, 2009; Fischer et al., 2018; OECD, 2019; Sancar, Atal, & Deryakulu, 2021).

Zhou et al. (2022) reviewed past empirical research on the CPD of vocational teachers. They used Harland and Kinder's (2014) model of the outcomes of In-service Teacher Training (INSET), and identified that the learning outcomes vocational teachers get from their CPD are similar to those general education teachers get. These outcomes included improvements in their knowledge and skills, changes in teaching practices, and development of new insights including shifts in assumptions about teaching practices and the curriculum.

Other than identifying the outcomes of teacher CPD, researchers have also focused on evaluating the effectiveness of teacher CPD and have developed different approaches to assess the effectiveness of teacher CPD (Agrati, 2021; Desimone, 2009; Fischer et al., 2018). Noting the wide range learning activities that teachers may engage in Desimone (2009) suggested that a fruitful way evaluating the effectiveness of different teacher CPD program is to assess if a given CPD program possesses those attributes which are associated with effective teacher CPD (i.e., teacher CPD that leads to improved teaching practices and ultimately to improved student learning outcomes).

From her review of theoretical and empirical research on effective teacher CPD, Desimone identified five attributes associated with effective teacher CPD. These attributes have come to be referred as the criteria for effective teacher CPD. The first two attributes relate to the content learnt, whereby teacher CPD focuses on content that is relevant to the needs of teachers and content that is well organized and coherent. The next two attributes relate to how teachers learn, whereby teachers use active learning methods and learn collaboratively with other teachers. The fifth attribute relates to time, whereby teacher learning takes place over an extended and sufficient duration of time. Other studies have identified similar attributes of effective teacher CPD (Halász, Looney, Michel, & Sliwka, 2018; Hassler, Hennessy, & Hofmann, 2018; OECD, 2013, 2019; Olofson & Garnett, 2018). Desimone's (2009) approach has been used to empirically assess the effectiveness teacher CPD in different settings, e.g., in TALIS 2013, 2018; OECD, 2013, 2019), while Stanley (2021) used the TALIS questionnaire to assess TVET teacher CPD practices.

The preceding literature demonstrates that TVET teacher CPD is largely similar to the CPD of general education teachers with respect to content covered, outcomes and effectiveness of teacher CPD. The literature also shows that despite the difficulties involved in assessing the effectiveness of teacher CPD activities, a viable approach involves asking teachers to evaluate how well their past CPD activities featured the characteristics or attributes associated with effective teacher CPD. This study therefore investigated TVET teacher CPD practices in Kenya based on the content areas, outcomes, and criteria of effectiveness identified above.

Context of the study

Kenya has a large and expanding TVET sector that features both formal and informal training systems (Akala & Changilwa, 2018; TVETA, 2020). Formal TVET is characterized by registered training institutions that follow a pre-defined curricular delivered by trainers. The learning institutions may be private or public. Informal TVET lacks such formality and usually takes place in the informal sector of the economy, where skilled workers offer training to apprentices on the basis of informal training agreements. Formal TVET programs are diverse and include engineering, business and commercial studies, ICT etc. Formal TVET programs typically lead to the award of artisan, craft or diploma certificates. The artisan certificate programs, usually offered in Vocational Training Centres (VTCs), take six months of study and are offered to students unable to join secondary education. As non-university training institutions, Technical and Vocational Colleges (TVCs) offer two-year craft certificate programs or three-year diploma certificate programs to students who have completed secondary education (UNESCO-UNEVOC, 2018). This study focused on TVET teachers in public Technical and Vocational Colleges.

TVET teachers in Kenya, often referred to as trainers, are expected to have received some form of teacher training before being assigned teaching duties. Vocational teachers may receive teacher training at the Kenya School of TVET (previously Kenya Technical Teachers College) or at any of the universities where a bachelor of education program is available. However, there is no requirement for technical work experience to work as a vocational teacher or to join a vocational teacher training program (UNESCO-UNEVOC, 2018). Vocational teachers have therefore been described as lacking in the practical and technical competencies they need to teach effectively (Akala & Changilwa, 2018; Sifuna, 2020). In addition, pre-service teacher education for both general education teachers and TVET teachers in Kenya has been criticised as

overly focused on subject content knowledge with limited focus on professional practice and especially classroom practice and teaching methods (Bunyi, Wangai, Magoma, & Limboro, 2013; Ferej, Kitainge, & Ooko, 2012; Kitainge, 2004; Ronoh, Okinyi, & Wanyonyi, 2013). These conditions have resulted in a large number of TVET teachers lacking adequate professional competencies and expressing a strong need for TVET teacher CPD. Indeed (Njenga, 2022a), found that TVET teachers in Kenya express a relatively high need for professional development.

Although the government and donor agencies sometimes provide short in-service training programs, systematic and large-scale provision of TVET teacher CPD lacks in Kenya. TVET teachers are therefore largely responsible for their own professional development and some teachers pro-actively participate in continuing professional development in the hope of better placement (Bett, 2016; Lowe & Prout, 2018; UNESCO-UNEVOC, 2018). However, the exact nature of such CPD practices remains unclear. In particular, it remains unclear what content TVET teachers learn in their CPD, the effectiveness of their CPD practices and the outcomes of their CPD practices with respect to teaching practices. This study therefore sought to identify the content, outcomes and effectiveness of TVET teacher CPD practices in Kenya.

METHODS

Following the approach used by similar studies in the past (e.g. Stanley, 2021), the study adopted a questionnaire survey approach. The questionnaire items were adapted from those used in the 2013 and 2018 Teachers and Learning International Survey (TALIS, 2013; TALIS, 2018) to explore the CPD practices of teachers (OECD, 2014, 2018). Specifically, participants were asked to identify if they had covered specific content areas in their past CPD activities. Using Likert type scales, participants were further requested to identify perceived changes in their teaching practices due to CPD, perceived benefits from their CPD, impact due to different content areas, and how well past CPD activities met the criteria for effectiveness. To assess the influence of teacher characteristics on their CPD practices, the questionnaire collected basic data about the participants such as age, gender, educational qualifications and career stage.

The study population consisted of TVET teachers in public Technical and Vocational Colleges (TVCs) in Kenya. Six TVCs were selected by convenience from the Nairobi Metropolitan Area. The area was chosen owing to its size and representativeness. At the institute level, participants were selected by simple random sampling. It was acceptable to use simple random sampling because there was no reason to assume that teachers in the TVCs are not homogenous. In addition, data to develop a more sophisticated sampling plan was not available. The sample size set was 200 teachers.

The study commenced after ethical permission was obtained from the Ethical Committee of the Faculty of Pedagogy and Psychology at Eötvös Loránd University and research licencing by Kenya's National Council for Science and Technology. Data collection for the study took place between January and February 2021. The survey data was then analysed through descriptive and inferential statistical analysis. Descriptive analysis focused on an aggregate description of the participants, the content their past CPD activities had focused on, perceived impact from participating in CPD, and a mean rating of effectiveness. In line with the study's view that multiple factors, including teacher characteristics, influence teacher CPD practices (Njenga, 2022b), inferential analysis focused on relating CPD practices to the characteristics of teachers.

Further analysis focused on relating content areas to perceived impact, and assessing how effectiveness and impact relate to each other and the characteristics of teachers.

Description of the participants

From the issued questionnaires, 178 questionnaires were returned, of which 170 were validly filled. By gender, 116 (68%) respondents were male and 54 (32%) were female, which closely matched the national distribution of TVET teachers in Kenya as reported in August 2020 by the Directorate of Technical Education: 65.36% male and 34.61% female (Ministry of Education - Directorate of Technical Education, 2020). With respect to age, 26.5% were below 30 years of age, 35.3% were between 31 and 40 years of age, while 23.5% were between 41 and 50 years of age. The rest, 14.7%, were above 50 years of age. With respect to educational qualifications, majority of the respondents had a Bachelor's degree (57.6%), while 24.7% had a Master's degree, and 1.2% had a PhD degree. The rest, 16.5%, had a Diploma Certificate issued by a non-university tertiary educational institution. Two thirds of the respondents received Initial Teacher Education (ITE) before they were employed to work as teachers, 14% received teacher training after they started working as teachers, and a fifth have not received formal teacher training.

FINDINGS

TVET teacher CPD content

When asked what content areas their past CPD activities had focused on, subject content knowledge was the most common. ICT skills for teaching and content related to student evaluation were the second and third most popular content areas. Content related to school management and administration, curriculum development and knowledge about learners and their characteristics were the least popular. Results are indicated in Table 1.

When the content areas were put into the categories of Subject Content Knowledge (SCK), Pedagogical Content Knowledge (PCK) and General Pedagogical Knowledge (GPK), it was found that Subject Content Knowledge was the most popular content area with more than 80 per cent of the respondents indicating that their prior CPD activities had focused on SCK. However, 30 per cent of the respondents indicated that their prior CPD activities had not focused on General Pedagogical Knowledge, while 23 per cent indicated that their CPD activities had not focused on Pedagogical Content Knowledge.

To assess if teacher characteristics influence the content teachers focus their CPD on, the choice of content was compared against different teacher characteristics such as gender, career stage, teaching area, and non-teaching responsibilities held. Chi-square tests conducted were not significant, and it can therefore not be said that the above teacher characteristics influence the content teachers focus their CPD on. However, statistically significant differences were found with respect to Initial Teacher Education (ITE). Compared to teachers who had not received ITE, teachers who had received ITE were more likely to focus their CPD on all content areas apart from subject-content knowledge and content related to new technologies in the work-place. Results are shown in Table 2 with p-values less than 0.01 italicized.

Table 1. Prior CPD Content areas covered

Content areas covered in past CPD activities	No (%)	Yes (%)
Subject-content knowledge i.e., knowledge and skills specific to my field	14.8	85.2
ICT skills for teaching	15.4	84.6
Student evaluation and assessment	17.8	82.2
New technologies in the work place	23.1	76.9
Knowledge of educational goals, purposes and values	24.3	75.7
Pedagogical-content knowledge i.e., teaching methods specific to my subjects	26.6	73.4
Guidance and Counselling	26.6	73.4
Knowledge of learners and their characteristics	29.6	70.4
Curriculum theory and development	29.6	70.4
School management and administration	39.1	60.9

Table 2. Content choice and Initial Teacher Education

If content covered in past CPD activities		ITE received or not				
		Has ITE	No ITE	Chi-square	df	Sig.
Subject-content knowledge (knowledge and skills specific to my field)	No	19	6	0.374	1	0.541
	Yes	117	27			
New technologies in the work place	No	28	11	2.430	1	0.119
	Yes	108	22			
Pedagogical-content knowledge (teaching methods specific to my field)	No	24	21	28.749	1	*0.001*
	Yes	112	12			
ICT skills for teaching	No	16	10	7.011	1	*0.008*
	Yes	120	23			
Knowledge of learners and their characteristics	No	34	16	7.031	1	*0.008*
	Yes	102	17			
Student evaluation and assessment	No	18	12	9.730	1	*0.002*
	Yes	118	21			
Knowledge of educational goals, purposes and values	No	25	16	13.096	1	*0.001*
	Yes	111	17			
Curriculum theory and development	No	32	18	12.263	1	*0.001*
	Yes	104	15			
Guidance and Counselling	No	29	16	10.028	1	*0.002*
	Yes	107	17			
School management and administration	No	45	21	10.412	1	*0.001*
	Yes	91	12			

Impact and outcomes of TVET teacher CPD

To assess the effects of teacher CPD on teaching practices, participants were asked to evaluate the extent to which teacher CPD activities influence their teaching practices on a five-point Likert type scale. The most common effects were updating teaching content and providing demonstrations in class. The least common effect was being able to collaborate with other teachers. Results are captured in Table 3.

When asked to identify the outcomes of their past CPD activities, teachers felt that participating in CPD had led to improved confidence, improved teaching skills and improved student performance. In contrast, less than one per cent of the respondents felt that CPD does not lead to improved teaching skills or improved confidence in oneself as a teacher. However, many participants felt their CPD had not resulted in career progress, appointment to managerial positions, or respect from colleagues. Results are captured in Table 4.

To assess the impact of different content areas on teaching practices, participants were asked to rate the impact of different content areas on their teaching practices on a five-point Likert scale. Subject-content knowledge was reported to have the largest perceived impact on teaching and professional practice. Content related to ICT skills for teaching and content related to student evaluation were also reported to have strong impact on teaching practices. On the other

Table 3. Change in practice due to CPD

Change in practice due to CPD	Rarely (%)	Sometimes (%)	Frequently (%)	Mean
I update the content I teach in class	1.8	18.3	79.9	4.02
I provide demonstrations during practical lessons	4.7	16.0	79.3	4.03
I use different teaching methods	3.0	18.3	78.7	4.09
I deal with classroom challenges more effectively	5.9	18.3	75.7	3.96
I use more effective student assessment methods	4.7	23.1	72.2	3.93
I am able to collaborate with other teachers	7.1	21.9	71.0	3.88

Table 4. Perceived benefits

Perceived Benefits	None/Limited (%)	Moderate (%)	Large/V. Large (%)	Mean
Improved student performance in national examinations	3.6	16.1	80.4	4.05
Improved teaching skills	0.6	15.4	84.0	4.16
Improved confidence in myself as a teacher	1.0	11.2	87.0	4.27
Career progress i.e., promotion	18.9	23.1	58.0	3.5
Appointment to managerial position	39.6	25.4	34.9	2.86
Improved respect from colleagues	20.7	23.7	55.6	3.42

hand, more than a quarter of the respondents felt that content related to school management has little or no impact. Interestingly, more than a fifth of the respondents felt that content related to knowledge of learners and their characteristics and knowledge related to the curriculum have little or no impact on their teaching and professional practice. Table 5 summarizes the findings.

Summarized by content areas, TVET teachers in Kenya find subject content knowledge to be the most impactful content with 88 per cent of the respondents rating Subject Content Knowledge as having moderate to high impact. Pedagogical Content Knowledge and General Pedagogical Knowledge were rated as having moderate to high impact by 84% and 78% of the respondents respectively.

The patterns with respect to the impact of different content areas closely matched the patterns in how frequently teachers covered the content areas. To assess if the perceived impact of a given content area influences the choice to focus learning on that content area, the perceived impact of the different content areas was compared to responses of whether the content area had been covered in the past. An apparent correlation was found between having covered a given content area and how impactful the content area was perceived to be. This is graphically demonstrated in Fig. 1. As can be seen, teachers who felt that a given content area had high to moderate impact also stated that that they had focused their learning on that content area. On the other hand, teachers who felt that a given content area had little or no impact stated that their past CPD activities did not focus on that content area.

Effectiveness of TVET teacher CPD

To assess how effective past CPD activities were, participants were asked to assess the extent to which the CPD activities they had participated in met the criteria for effectiveness identified by Desimone (2009). To make the assessment, participants used a five-point Likert type scale to rate how frequently past CPD activities could be characterized as relevant, coherent, collaborative, active, and of sufficient duration.

Table 5. Perceived impact of CPD content

Content Area	Perceived impact of content		
	Moderate to high (%)	None to small (%)	Mean Impact
Subject-content knowledge	89.9	10.1	3.77
New technologies in the work place	85.8	14.2	3.74
Pedagogical-content knowledge	81.7	18.3	3.63
ICT skills for teaching	89.3	10.7	3.84
Knowledge of learners and their characteristics	76.8	23.2	3.61
Student evaluation and assessment	87.6	12.4	3.71
Knowledge of educational goals, purposes and values	82.1	17.9	3.60
Curriculum theory and development	76.8	23.2	3.46
Guidance and Counselling	79.9	20.1	3.47
School management and administration	73.7	26.3	3.40

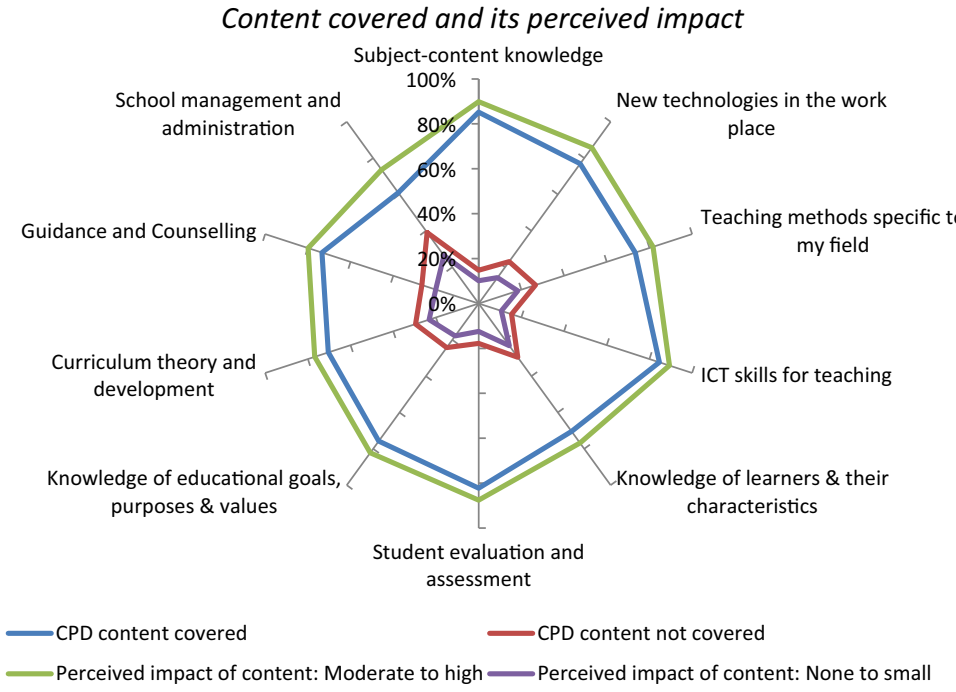


Fig. 1. Content covered and its perceived impact

The results are indicated in Table 6. As can be seen from the results, majority of the teachers felt that their CPD activities had covered content that was relevant to their work and that the covered content was coherent and well organized. However, a large percentage of the

Table 6. Effectiveness of prior CPD activities

Core features of CPD	Rarely (%)	In some activities (%)	In most activities (%)	Mean
Content that was relevant to my work as a teacher	11.3	23.2	65.5	3.61
Content that was coherent and well organized	16.1	26.2	57.7	3.45
We were a group of teachers	19.0	32.1	48.8	3.27
Learning was active and interactive (i.e., not just lectures)	21.0	26.9	52.1	3.31
Collaborative learning activities with other teachers	20.8	35.7	43.5	3.23
Sufficient duration (several occasions spread over weeks or months)	34.5	31.5	33.9	2.99

participants also found that their CPD activities were not of sufficient duration and that the activities were rarely collaborative, or were only collaborative in some activities.

The six attributes were combined into a single measure of the effectiveness of past CPD activities. The combined mean rating was 3.31, implying that TVET teacher CPD in Kenya is not very effective, and that the criteria for effective CPD is only met in some activities.

To assess if different teacher characteristics influenced the likelihood that a teacher's past CPD activities were effective, the mean values of the effectiveness of past CPD activities were compared for different categories of teachers (e.g., by age, gender, career stage etc.). The mean values were only significant for teachers who had received initial teacher education ($M = 3.40$, $SD = 0.82$) and those who were yet to receive Initial Teacher Education ($M = 2.96$, $SD = 0.86$), $t\ (166) = 2.708$, $p < 0.05$. It is therefore likely that teachers who have received initial teacher education participate in more effective CPD activities.

Simple linear regression was used to test if effectiveness of past CPD activities predicted the perceived impact of the CPD activities. The results showed that an increase in the perceived effectiveness of past CPD activities resulted in increased perceived impact, and that average effectiveness explained 33.1% of the variance in perceived impact ($R^2 = 0.335$, $F\ (1,166) = 83.78$, $p < 0.001$). It was found that average effectiveness significantly predicted perceived impact ($\beta = 0\ .58$, $p < 0.001$). Results are shown in Table 7.

To further assess the variables on effectiveness and outcomes of TVET teacher CPD in Kenya, cluster analysis was carried out on both sets of variables. As recommend by Gore (2000) hierarchical cluster analysis was first carried out to identify the most likely number of clusters after which K-means clustering was conducted. After running the hierarchical cluster analysis in SPSS, the resulting dendrogram and agglomeration schedule were analysed to identify the number of clusters that best explained the observed variability in the variables. The agglomeration schedule was analysed for large shifts in the coefficients since large shifts in the coefficients reflect a joining of dissimilar clusters. The dendrogram provides a visual summary of the clustering. Fig. 2 shows the dendrogram obtained using hierarchical clustering of the outcomes of past teacher CPD activities using the Ward Method with Euclidian distances on SPSS version 24.

At the rescaled distance value of approximately 15, three clusters were identified, which are highlighted for clarity. As recommended by Gore, to ensure that the results were not a dependent on the method adopted, hierarchical clustering was repeated using the average method and Pearson's similarity matrix. Since the resulting dendrogram and cluster solution was similar, the three-cluster solution was selected. Based on this result, K-means clustering was done, setting the desired number of clusters to three. The *F*-Tests for the clusters showed that collaborating with other teachers had the highest F-value (147.015) showing that it contributed most to the formation of the clusters.

Table 7. Regression analysis summary for CPD effectiveness predicting CPD impact

Variable	B	95% CI	β	t	p
(Constant)	1.409	[0.98, 1.8]		6.335	<0.001
Avg. Effectiveness	0.596	[0.47, 0.72]	0.579	9.153	<0.001

Note: R^2adjusted = 0.331. CI = Confidence interval for B

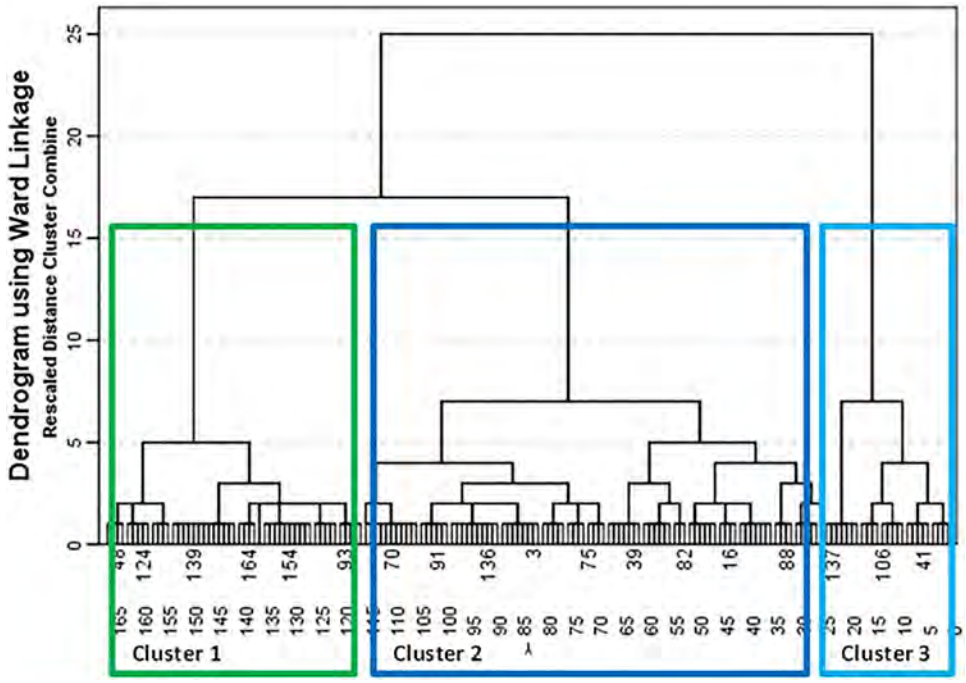
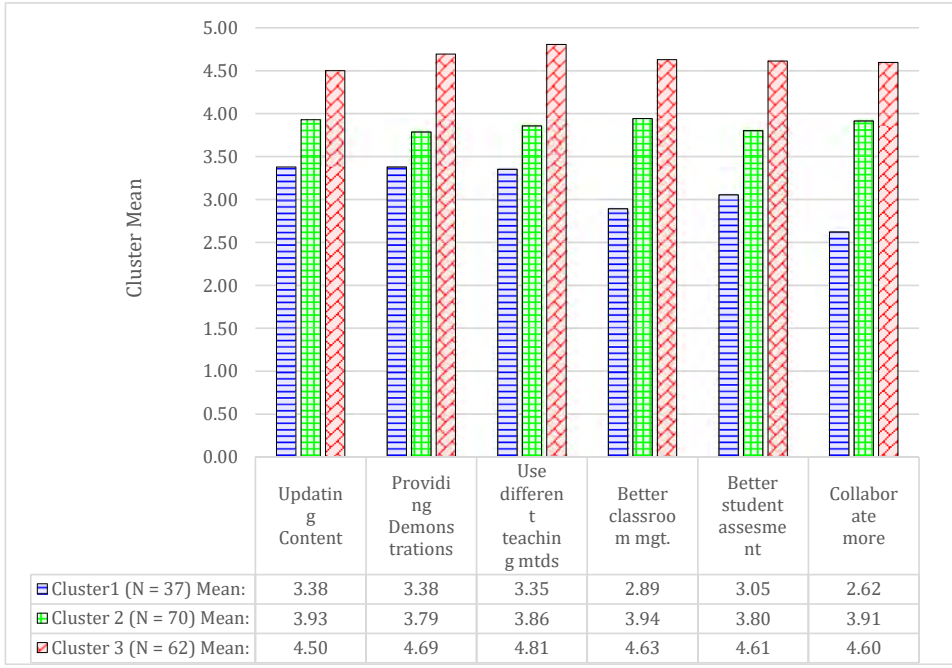


Fig. 2. Outcomes clusters dendrogram

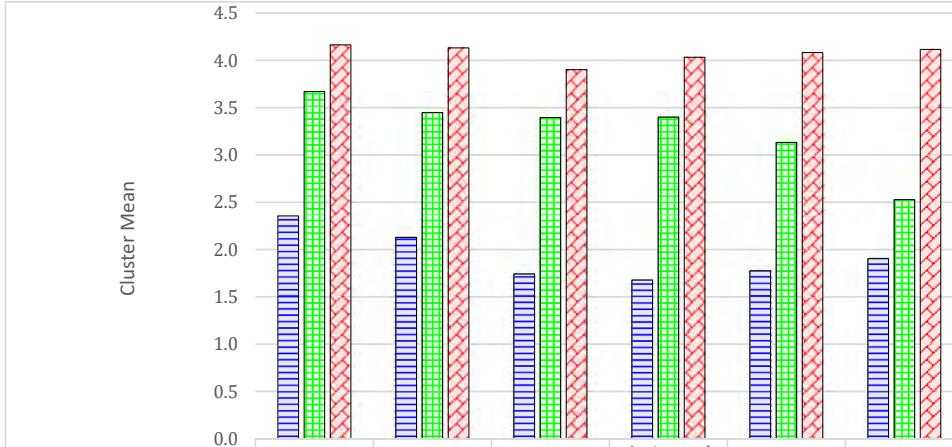
The means of the three clusters obtained CPD are shown in Fig. 3. The first cluster has relatively low means and consists of teachers whose past CPD activities have not had strong impact on teaching practices. The second cluster consists of teachers whose past CPD activities have had average impact. The third cluster has relatively high means for all the outcomes, and therefore consists of teachers whose CPD activities lead to relatively strong impact on teaching activities. Analysis of the clusters based on different teacher characteristics (e.g., prior educational qualifications, career stage etc) did not reveal distinct profiles of the teachers in the categories.

Similar results were obtained from the analysis of the effectiveness of past CPD activities. From the hierarchical and K-means cluster analysis of the effectiveness of past teacher CPD activities, three clusters were identified, whose means are shown in Fig. 4 (for brevity the dendrogram was omitted). The first cluster has relatively low means and consists of teachers whose past CPD activities rarely featured the characteristics of effective teacher CPD. The second cluster consists of teachers whose past CPD activities had some of the characteristics that suggest effectiveness. The third cluster has relatively high means for all the activities, and therefore consists of teachers whose CPD activities could be characterized as relatively effective. Analysis of the categories based on different teacher characteristics (e.g., prior educational qualifications, career stage etc) did not reveal distinct profiles of the teachers in the categories.



	Updating Content	Providing Demonstrations	Use different teaching mtds	Better classroom mgt.	Better student assesment	Collaborate more
Cluster1 (N = 37) Mean:	3.38	3.38	3.35	2.89	3.05	2.62
Cluster 2 (N = 70) Mean:	3.93	3.79	3.86	3.94	3.80	3.91
Cluster 3 (N = 62) Mean:	4.50	4.69	4.81	4.63	4.61	4.60

Fig. 3. Teacher CPD outcomes cluster means



	Relevant Content	Coherent content	Group of teachers	Active and interactive learning	Collaborative learning	Sufficient duration
Cluster 1 (N=31) Mean:	2.4	2.1	1.7	1.7	1.8	1.9
Cluster 2 (N =78) Mean:	3.7	3.4	3.4	3.4	3.1	2.5
Cluster 3 (N = 61) Mean:	4.2	4.1	3.9	4.0	4.1	4.1

Fig. 4. Effectiveness of past CPD activities cluster means

DISCUSSION

The key aim of this study was to investigate the content, effectiveness and outcomes of TVET teacher CPD in Kenya. Using a questionnaire, a sample of 170 TVET teachers drawn from TVET institutes in Kenya's Nairobi Metropolitan Area provided the data on the content that their past CPD activities had focused on, the outcomes of their CPD practices with respect to teaching practices, and how well their past CPD activities met the criteria for effective CPD.

Content most frequently covered was found to relate to subject content knowledge, which mirrors findings from other studies. For example, in TALIS 2018 more than 70% of the surveyed teachers reported that they had attended CPD focused on building knowledge (OECD, 2019). In the survey on vocational teachers by Stanley (2021), vocational teachers were found to frequently focus their CPD on content aimed at improving their subject area knowledge.

The data from this study did not provide a clear-cut explanation as to why TVET teachers put more focus on subject-content knowledge. It is possible that vocational teachers focus less frequently on PCK simply because they face difficulties in accessing PCK related content. It has been observed that owing to the highly technical nature of TVET content, vocational education teachers often lack access to materials focusing on teaching methods specific to their trades (Hoekstra et al., 2018; Lucas, Spencer, & Claxton, 2012).

With respect to the factors influencing the choice of content, teachers who had received Initial Teacher Education (ITE) were found to be more likely to focus their CPD on pedagogical content knowledge and general pedagogical knowledge compared to teachers who had not received ITE. This led to the conclusion that pre-service teacher education has a positive effect in sensitizing teachers on the value and importance of pedagogical content knowledge and general pedagogical knowledge. The choice of content was also found to depend on how helpful the content was perceived to be: teachers who identified a given content area as helpful and positively impacting on their practice were found be cover the content area more frequently.

The most frequently reported change in practice due to CPD relates to updating the content presented in class and providing demonstrations. The reported changes in practice due to CPD agree with findings on the choice of content reported above. The strong focus on subject content knowledge aligns well with updating the content taught in class and providing demonstrations. The study findings mirror findings by Stanley (2021) who in a survey on the CPD practices of vocational teachers in Eastern Europe found that vocational teachers reported differences in impact across different content areas. Content focused on the teachers' subject areas, modern practices in the workplace, and ICT skills for teaching were reported to be the most impactful, while content focusing on teaching in multilingual setting was reported as the least impactful. In Serbia, VET teachers, rated as most impactful, content related to subject-content knowledge and knowledge of the curriculum. Other content areas rated as impactful were ICT skills for teaching and new technologies in the work place. Content areas perceived to have the least impact focused on individualized learning and development of cross-occupational skills (Maksimovic, 2016).

In TALIS 2018 impactful teacher CPD was found to be characterized by content focus, active learning and collaboration, school embedded training, and taking place over extended time periods (OECD, 2019). In the present study, it was found that majority of the teachers felt that their CPD activities were content focused and coherent in most cases. However, more than a third of the respondents felt that their CPD activities were rarely collaborative and sustained for

a sufficient duration of time, suggesting that present CPD practices are not fully effective. Moreover, analysis of the data revealed categories of teachers who report relatively low impact from their CPD activities and who engage in relatively ineffective CPD activities. The findings highlight the need to support TVET teachers in Kenya adopt more effective and impactful CPD practices.

SUMMARY AND CONCLUSIONS

Using Shulman's (1986) classification of teacher knowledge and competencies to categorize teacher CPD content and Desimone's (2009) criteria for effective teacher CPD, this study sought to investigate the content, outcomes and effectiveness of TVET teacher CPD practices in Kenya.

A key finding was that TVET teachers in Kenya are more likely to focus their CPD on Subject Content Knowledge. In addition, TVET teachers in Kenya appear to find CPD as more impactful if it relates to subject-content knowledge. Unfortunately, limited focus on PCK risks leaving TVET teachers in Kenya with only a limited set of teaching methods and blind to the many useful techniques of teaching the technical content they teach. Since past research has shown that teachers require a diverse set of skills and knowledge, TVET teachers in Kenya should be supported to expand the focus their CPD practices on all domains of TVET teachers' professional knowledge.

Another finding was that TVET teacher CPD practices do not fully meet the criteria for effectiveness. It is therefore important that teachers are supported to engage in CPD activities that are spread over longer durations of time and CPD activities that are more collaborative. Moreover, CPD activities should adopt a broader interpretation of content focus, i.e., beyond a focus on subject-matter content, content focus should also focus strongly on how students learn, and on the basis of this, how to teach effectively (Desimone, 2009). TVET teachers should also be supported to engage in embedded CPD activities and on-site CPD programmes which tend to be context bound and therefore more relevant, active and collaborative (Hassler et al., 2018). This will ensure that CPD programmes fully meet the criteria for effectiveness. The study also revealed a notable portion of teachers whose CPD activities are relatively ineffective and result in low impact. This suggests strong need for targeted intervention to support teachers engaging in low effectiveness and low impact CPD. Further research to develop a clear profile of teachers in each category is called for.

Another finding was on the positive role that ITE plays in supporting teachers to engage in impactful and effective TVET teacher CPD. ITE for TVET teachers should therefore be leveraged to enhance the breadth and effectiveness of TVET teacher CPD in Kenya. This may be achieved by updating the ITE curriculum to support the development of pedagogical content knowledge, and in particular, awareness of viable methods of developing pedagogical content knowledge.

LIMITATIONS

The survey findings should be interpreted taking several limitations into account. First, questionnaire based self-reports of past CPD activities may not be exhaustive. Moreover, it is not possible to make conclusions with respect to the accumulation of effects or changes in practice

over time from a single survey. However, the present results likely represent general patterns and a useful indication of the extent to which teachers find their CPD activities as effective and impactful. A further limitation relates to the limited scope to the study. The fact that the study participants were drawn from one region of the country limits the generalizability of the findings. Accordingly, further research using other methods of data collection (e.g., a combination of interviews and surveys repeated over time) and focusing on TVET teachers in other regions of the country is called for.

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