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Professional Learning Community Activities Conducted by Secondary School Biology Teachers in Dodoma City, Tanzania

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ABSTRACT

Professional Learning Communities (PLCs) are an essential mechanism for collaborative professional learning of teachers. However, evidence remains limited on the specific activities secondary school Biology teachers engage in within PLCs and their perceived contribution to competence-based teaching in Tanzania. This study investigated the PLC activities conducted by secondary school Biology teachers in Dodoma City and their perceived contribution to competence-based teaching practices. Social Constructivist Theory guided the study. A cross-sectional survey design was adopted, and data were collected through a structured questionnaire from 103 Biology teachers in 60 randomly selected public and private secondary schools and analysed using descriptive statistics. The key findings show that teachers engaged mainly in practice-oriented activities: collaborative lesson planning (83.5% of respondents) and peer observation (52.4%) were the only activities reported by more than half of the teachers, whereas setting and reviewing goals (21.4%) and action research and inquiry-based learning (16.5%) were the least practised. Teachers rated the contribution of PLC activities to competence-based teaching as great on all six indicators ($M = 3.99-4.18$). The strongest contributions were in preparing competence-based lesson plans integrating lessons into real-life situations and involving students in classroom activities, while formative assessment received the lowest, though still high, rating. These findings imply that PLCs benefit learners by helping teachers deliver more learner-centred, contextualised, and participatory lessons, which are the classroom conditions through which competence-based learning and academic performance are improved. The study recommends strengthening inquiry-oriented PLC activities, particularly action research and the collaborative analysis of assessment evidence, so that PLCs can more fully support learners' achievement.

INTRODUCTION

Teachers' professional learning is fundamental to improving the quality of teaching and responding effectively to curriculum reforms (OECD, 2025). In Tanzania, the paradigm of continuing professional development has been changing to approaches that support ongoing, collaborative, school-based learning of teachers. The National Framework for Teachers' Continuous Professional Development recognizes school-based, cluster, and other collaborative approaches as mechanisms through which teachers can improve their professional competences and enhance their classroom practices (Ministry of Education, Science and Technology [MoEST], 2020). This is very relevant in competence-based teaching where teachers are expected to move from transmission of subject content to pedagogical practices that foster participation, problem-solving, communication, critical thinking, and application of knowledge among learners (Komba & Shukia, 2023; MoEST, 2023a, 2023b). PLCs can be one of the ways to ensure that professional learning takes place. Within the PLC framework, teachers may collaborate to solve teaching issues, share experiences and resources, plan their lessons, solve instructional problems, observe each other's teaching practices, and generate new pedagogical knowledge (Dzieciatko-Szendrei *et al.*, 2024; Mwakabenga

& Paine, 2024).

According to studies done in Tanzania, collaborative professional development is capable of developing the knowledge and skills of teachers, whereas school-based professional development has been found to have improved relations among teachers as well as their professionalism (Kajungu, 2024; Mugisha *et al.*, 2024). Nevertheless, the potential of PLCs does not mechanically translate into effective competence-based teaching. According to Mwakabenga and Paine (2024), the PLCs in Tanzanian secondary schools have not been fully exploited and can sometimes promote examination-based methods rather than active learning.

The issue is particularly important to Biology teachers because effective Biology teaching requires the integration of theoretical knowledge with practical, inquiry-oriented, and learner-centred activities. The situation in Tanzania indicates that Biology teachers still face difficulties in the implementation of competence-based education. These difficulties include insufficient training, inadequate knowledge, insufficient teaching and learning materials, and laboratory facilities (Mpate, 2025). Therefore, collaborative learning among Biology teachers might be of great importance to enhance their competence in teaching through competence-based approaches.

While PLCs and teacher professional development

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have received considerable attention in Tanzania, not much has been done empirically on the activities that Biology teachers at the secondary school level engage in during PLCs and how much their participation in these activities leads to competence-based teaching. Previous research has focused on the general area of PLCs and teacher professional development with limited attention to subject-specific issues involving Biology teachers. It was against this background that this study aimed at: (i) identifying the PLC activities carried out by secondary school Biology teachers; and (ii) assessing the extent to which these activities contribute to the implementation of competence-based teaching practices.

LITERATURE REVIEW

Professional learning communities and teacher professional learning

PLCs are defined as collaborative groups of teachers who are involved in reflective and ongoing professional learning for the development of better teaching and learning processes (Hudson, 2024). PLCs are also considered groups established for the improvement of teaching techniques, professional knowledge, and skills of participants, supporting their constant development through practice and collaborative learning (Şensin & Can, 2024). The literature identifies several features that should be considered in developing an effective PLC in order to improve teachers' collaboration and students' achievement. The first is a shared vision focused on the improvement of student learning and the collective responsibility of teachers (Antinluoma *et al.*, 2021; Hudson, 2024). Another important feature is a collaborative culture, in which teachers plan together, use agreed teaching approaches, and resolve educational problems (Antinluoma *et al.*, 2021; Khasawneh *et al.*, 2023).

PLCs have collaborative and supportive leadership, thus giving teachers at all levels an opportunity to take up leadership positions and feel a sense of ownership and empowerment (Antinluoma *et al.*, 2021). Another critical characteristic is reflective inquiry, which enables educators to reflect on their practices, examine student data, and make decisions to improve their teaching methods (Yang *et al.*, 2023). Effective PLCs are also inclusive, involving all educators irrespective of their experience and level of practice, and fostering trust, mutual respect, and support among them. Structural supports such as collaboration time, availability of resources, and supportive communication practices are equally important for PLCs (Antinluoma *et al.*, 2021). Additionally, effective PLCs are networked, as they interact with other organizations and expand their scope and understanding (Yang *et al.*, 2023). PLCs offer a social setting wherein teachers engage in learning through sharing their experiences, analyzing issues encountered during instruction, sharing knowledge, and solving problems collaboratively. This approach is also in line with the views of social constructivists, who posit that professional knowledge is developed through

social interactions and experience sharing (Reños & Pontillas, 2024; Vygotsky, 1978). The empirical literature in Tanzania, for instance, confirms that coaching, teaming, mentoring, and other collaborative school-based approaches build the professional knowledge, relationships, and skills of teachers (Kajungu, 2024; Mugisha *et al.*, 2024). The national framework for teachers' continuous professional development in Tanzania stresses continuous, collaborative, and school- and cluster-based learning (MoEST, 2020).

However, while much of the current literature acknowledges the significance of PLCs in facilitating teacher professional learning, there is not much research into the particular activities that help secondary school Biology teachers engage in collaborative professional learning processes, especially in the Tanzanian setting. Most studies have largely focused on discussing the benefits and features of PLCs but have limited examination of how PLC activities are enacted in teachers' everyday professional practice. This study thus analyses the PLC activities carried out by secondary school Biology teachers in Dodoma city.

PLC activities conducted by teachers

PLCs are effective to some extent based on the type of activities that allow teachers to learn from each other professionally. Some of the activities associated with PLC include collaborative lesson planning, sharing of resources and experience among teachers, mentoring, problem-solving of learners' difficulties, solving of instructional problems, observation of each other's lessons, and discussion of issues in the field (Mthembu *et al.*, 2025; Reños & Pontillas, 2024). In this case, teachers learn from each other by using their classroom experience as common resources, solving their instructional issues, and developing their professional knowledge and practices. Therefore, PLC is not merely about teachers working together, but about specific ways they interact and learn from one another.

There is also some evidence that PLCs take place within subject departments, district subject groups, and learning networks in Tanzanian secondary schools. According to the study carried out by Mwakabenga and Paine (2024), teachers utilized the above-mentioned platforms to solve instructional problems, share information and resources, and also act as informal mentors; WhatsApp groups facilitated professional interactions outside physical interaction. In addition, Mugisha *et al.* (2024) indicate that coaching, teaming, and mentoring are significant collaborative professional learning activities. The above-mentioned professional learning activities are particularly important for teaching Biology, where teachers can collectively address subject-specific difficulties, learners' misconceptions, and practical teaching challenges.

Nevertheless, participation in collaborative activities does not mean that the PLC is working effectively. The obstacles preventing the successful application of the PLC include low awareness, excessive workload, lack

of resources, poor management, and lack of school support (Mwakabenga & Paine, 2024; Peng & Pastor, 2026). Consequently, an analysis of the specific activities carried out by teachers, and not only of the existence of PLCs, is essential for understanding how collaborative professional learning is enacted in practice.

PLCs and competence-based teaching

Competence-based learning focuses on the acquisition and use of knowledge, skills, and attitudes of the learners by actively participating, collaborating, critically thinking, solving problems, and applying their knowledge. In the case of biology learning, competence-based learning is not just about imparting knowledge but doing investigations, experimentation, interpreting evidence, and solving problems (Cabezas *et al.*, 2024; Dah *et al.*, 2024). The curriculum framework in Tanzania focuses on the development of competencies, but biology teachers still have difficulties, including insufficient laboratory facilities, limited resources, and inadequate training (MoEST, 2023a; Mpate, 2025).

The PLCs may become a platform through which teachers can tackle such problems through collaborative learning. By exchanging pedagogical knowledge and resources, discussing teaching problems, reflecting upon classroom experience, and coming up with solutions together, teachers will be able to link professional learning to the requirements of competence-based instruction (Mwakabenga & Paine, 2024; Nguyen *et al.*, 2024). But involvement in a PLC does not necessarily lead to any changes in teaching in the classroom. According to Mwakabenga and Paine (2024), despite the fact that teachers have been able to learn from each other and refine their teaching skills through PLCs, their ability to foster competence-based instruction has been restricted by the examination-oriented nature of the activities and memorisation.

With the social constructivist view, PLCs offer chances for teachers to develop their professional knowledge through interactions and experience sharing among the participating teachers (Vygotsky, 1978). Hence, the effectiveness of PLCs towards competence-based teaching is not only a result of teachers' involvement in PLCs but also depends on the type of activities that they perform. While the use of PLCs as a means for teachers' professional development has received much attention in recent years, there is scarce evidence about the activities carried out by teachers in secondary schools and how they contribute towards the practice of competence-based teaching in Tanzania. In order to address the gap, this study looks at the activities performed by Biology teachers in Dodoma City. It assesses their contribution to the implementation of competence-based teaching practices.

Social Constructivism Theory

Social Constructivism theory has been used in the current study. In particular, the sociocultural theory that was

advanced by Lev S. Vygotsky at the beginning of the twentieth century and has been extensively discussed in educational research through the book 'Mind in Society' (Vygotsky, 1978). According to the theory, learning and the construction of knowledge are a socially mediated process, where the learner creates understanding through social interaction with others and engagement in activity. A critical idea in the theory is the Zone of Proximal Development (ZPD), which highlights how individuals can extend their capabilities through guidance and collaboration with more knowledgeable others (Vygotsky, 1978). With regard to the professional learning of teachers, Social Constructivism implies that professional knowledge can be developed not only individually but also through dialogue, collaboration, mentoring, observing, and solving problems together (Lehtinen *et al.*, 2023). The professional development of teachers within PLCs is quite appropriate from this point of view, since teachers participate in joint actions like collaborative planning, professional discussions, peer learning, and problem-solving during which they share their experiences and develop a common understanding (Khasawneh *et al.*, 2023; Lehtinen *et al.*, 2023).

Social Constructivism theory was used as an analytical tool in the study for examining PLC activities as a social process through which Biology teachers develop their professional knowledge. The theory is aimed at highlighting the ways in which collaboration, discussion, mentoring, resource sharing, and problem-solving can enable teachers to develop and use their knowledge in competence-based instruction. Thus, apart from studying the existence of PLCs, the study will focus on how teachers' participation in specific PLC activities facilitates collective professional learning and informs classroom practice.

MATERIALS AND METHODS

Research design

The study employed a cross-sectional survey research design because it allows data to be collected from a predetermined sample of a population at one point in time, thereby saving cost and time (Creswell & Creswell, 2023). The design also supports the generalisation of findings to the population from which the sample was drawn and, with an adequate and representative sample, increases confidence in the results (Creswell & Creswell, 2023).

Study area

There are many regions in Tanzania, each with a varying number of biology teachers (President's Office – Regional Administration and Local Government [PO-RALG], 2023). Five regions with the largest number of biology teachers were identified, and these are Arusha, Dodoma, Dar es Salaam, Mwanza, and Mbeya; the region of Dodoma was randomly selected among them using a simple lottery method. Within the Dodoma region, Dodoma city was chosen as the location for the study

since it has the greatest number of secondary schools compared to other districts in the region, as presented in Table 1 below.

Target population and sample size

The target population of the research is biology teachers since they initiate PLC activities. Further, they are the

ones responsible for implementing the curriculum, focusing on the biology syllabus.

Regarding sample size, there are 70 secondary schools in Dodoma City, including public and private schools. Among these, there are 46 public schools and 24 private schools. The sample size of 60 secondary schools was determined using Yamane's (1967) formula, $n = N / (1$

Table 1: Number of secondary schools in Dodoma region per district

Name of District	Government Schools	Private Schools	Total
Bahi	24	1	25
Chamwino	39	3	42
Dodoma CC	46	24	70
Kondoa DC	27	0	27
Kondoa TC	29	1	30
Chemba	11	3	14
Kongwa	38	5	43
Mpwapwa	42	2	44
Total	256	39	295

Source: PO-RALG (2023)

+ $N e^2$), where N is the number of schools (70) and e is the margin of error (0.05): $n = 70 / (1 + 70 \times 0.05^2) = 59.57 \approx 60$ schools. The 60 schools were then allocated proportionally to the public and private strata.

Sample size based on the number of schools in each stratum

Public schools: $46/70 \times 60 = 39.43 \approx 39$ schools

Private schools: $24/70 \times 60 = 20.57 \approx 21$ schools

Therefore, 39 public and 21 private secondary schools participated in the study, totalling 60 schools.

Sampling technique and strategy

To obtain the desired sample size and adequate information related to the research questions, a stratified random sampling technique was used to ensure that both public and private schools were fairly represented. Sixty schools were identified as the sample size, 39 being public schools and 21 being private schools. The random sampling of schools within each stratum (public and private) was done through the manual draw technique. The names of all schools within each stratum were written on slips of equal size and placed in separate containers for public and private schools. The slips were then thoroughly mixed, and the desired numbers (39 in the case of public schools and 21 in the case of private schools) were drawn, giving each school an equal chance of being selected. All Biology teachers in each selected school were then included in the survey, giving 123 Biology teachers (81 from public and 42 from private secondary schools).

Data collection instrument

The data collection instrument adopted for the study was a structured questionnaire that evolved out of the

study objectives. The questionnaire had three sections. Section A contained background information about the respondents. Section B evaluated teachers' participation in PLCs, where their involvement in particular kinds of activities was sought. This part also sought the level of engagement in PLC activities and the frequency of involvement in such activities. Section C evaluated the contribution of PLC activities to the promotion of competence-based teaching practices through six five-point Likert scale items. These were measured on a scale of 1 (Not at all) to 5 (To a very great extent). Overall, the data collection instrument aimed at providing quantitative information about the types and frequency of PLC activities carried out by secondary school Biology teachers and how these activities contribute to the promotion of competence-based teaching practices.

Procedure of collecting data

The data were collected in digital form using the Kobo data collection system. Biology teachers from the selected schools were grouped in a WhatsApp Group in which the link to the questionnaire was sent. The participants filled out the questionnaire using their mobile phones. The researcher gave guidance and clarified any difficult concepts where needed. In total, 103 questionnaires were completed and returned (68 from public and 35 from private school teachers), representing a response rate of 83.7%.

Data analysis

The data were cleaned, coded, and verified before being analysed using the Statistical Package for the Social Sciences (SPSS) version 27. The identification of

PLC activities involved selecting activities from the list provided and naming other activities not on the list in an open-ended question. The responses to the open-ended question were examined, categorised, coded into activity types, and then combined with the list responses. Frequencies and percentages were computed to show how often each PLC activity was reported by the Biology teachers, and the results were presented in a clustered bar chart. For the Likert-scale items in Section C, means and standard deviations were computed. Mean scores were interpreted using equal class intervals of 0.80 $[(5 - 1) / 5]$: 1.00–1.80 = not at all; 1.81–2.60 = small extent; 2.61–3.40 = moderate extent; 3.41–4.20 = great extent; and 4.21–5.00 = very great extent.

Validity and reliability

In ensuring both validity and reliability of this study, validity took precedence, as content validity was ensured by making sure that the items in the questionnaire were aligned with the objectives of the research and the theory of social constructivism, which guided the study. An extensive literature review guided the formulation of items with the help of professionals in education and professional development. Moreover, the questionnaire

was drafted in clear and simple language so that all the respondents could understand the questions.

RESULTS AND DISCUSSION

Participants

Table 2 presents the demographic characteristics of the participants and provides an overview of their gender (sex), age, work experience, and education qualifications. Table 2 shows that male teachers constituted 55.3% of the total number of respondents, while females accounted for 44.7%. The collected data showed that 87.4% of the teachers were under the age of 45. Also, 70.9% of the respondents had a bachelor's degree as the highest level of education. Regarding work experience, 82.5% of biology teachers have had 15 years or less than 15 years of experience. The current career stage enables teachers to gain new skills through improvement of teaching practices and application of new approaches through collaboration with peers and participation in PLC activities. The social constructivist approach views such demographics as favorable for PLCs, as teachers apply collaborative learning in order to share their experience and build knowledge collectively, which is the essence of good teaching practice.

Table 2: Demographic characteristics of participants

Characteristics	Biology teachers (n=103)		
	Public(n=68)	Private(n=35)	Total
Gender			
Male	40 (58.8%)	17(48.6%)	57(55.3%)
female	28 (41.2%)	18(51.4%)	46(44.7%)
Age			
20 -24 years	03 (4.4%)	04 (11.4%)	07 (6.8%)
25 – 34 years	28 (41.2%)	13 (37.1%)	41(39.8%)
35 – 44 years	28 (41.2%)	14 (40%)	42(40.8%)
45 and above	09 (13.2%)	04 (11.4%)	13(12.6%)
Work Experience			
0-5 years	12 (17.6%)	07 (20%)	19(18.4%)
6-10 years	21 (30.9%)	11 (31.4%)	32(31.1%)
11-15 years	23 (33.8%)	11 (31.4%)	34(33.0%)
Above 15 years	12 (17.6%)	6 (17.1%)	18(17.5%)
Education Qualification			
Diploma	07 (10.3%)	00 (00%)	07 (6.8%)
Bachelor degree	45 (66.2%)	28 (80%)	73(70.9%)
Master's degree	16 (23.5%)	07 (20%)	23(22.3%)

n=number of respondents

PLC activities conducted by secondary school biology teachers in Dodoma City

Figure 1 presents the frequency distribution of teachers' involvement in the nine PLC activities in public and private schools. The data were analysed using descriptive statistics and are presented as a clustered bar chart.

Figure 1 shows that secondary school Biology teachers

were involved in all nine PLC activities. In raw frequencies, public school teachers reported more involvement than private school teachers in every activity (13–56 against 4–30); however, because the public school subsample was larger ($n = 68$ against $n = 35$) and respondents could select more than one activity, these raw counts should not be read as mutually exclusive categories or as evidence of

greater collaboration in public schools. When expressed as proportions of each subsample, participation was broadly similar across the two sectors: collaborative lesson planning (82.4% public; 85.7% private), peer observation (50.0%; 57.1%), mentoring and coaching (41.2%; 51.4%), analysing student work (39.7%; 45.7%), reflection and dialogue (39.7%; 37.1%), professional development workshops (33.8%; 34.3%), sharing best practices (32.4%; 31.4%), setting and reviewing goals (22.1%; 20.0%), and action research and inquiry-based

learning (19.1%; 11.4%).

The major finding is that participation was highest in activities closely related to day-to-day classroom practice. Collaborative lesson planning was by far the most common activity (83.5% of all respondents), followed by peer observation (52.4%); these were the only two activities reported by at least half of the teachers in both sectors. Moderate participation was reported for mentoring and coaching (44.7%), analysing student work (41.7%), reflection and dialogue (38.8%), professional

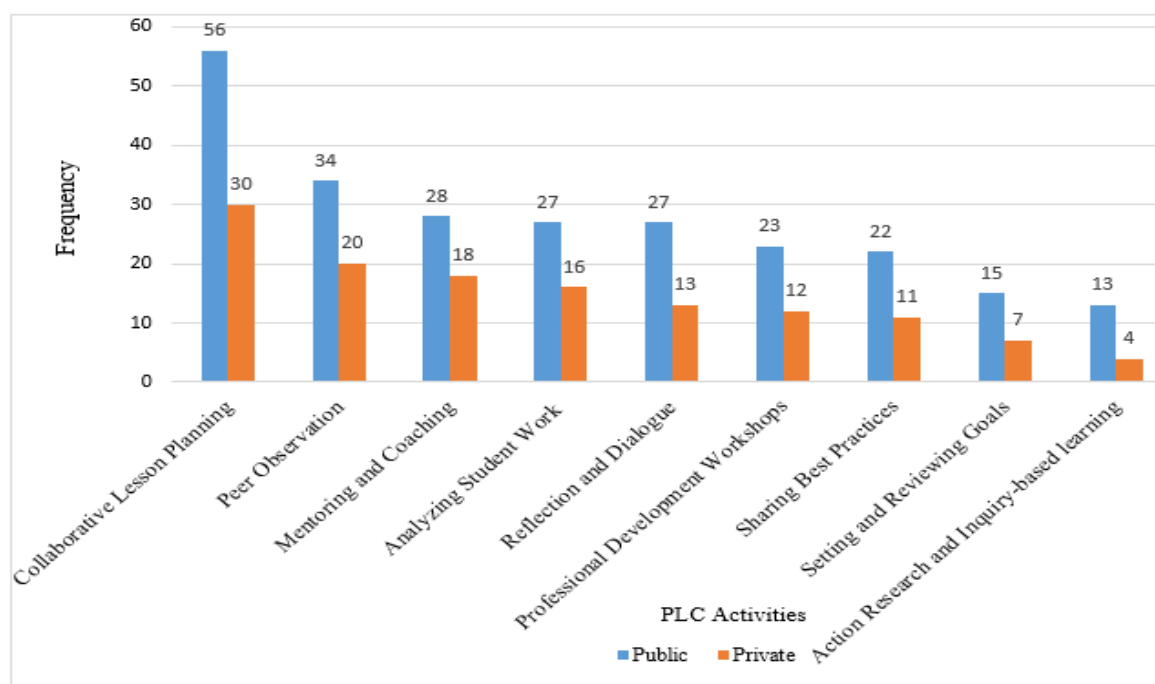


Figure 1: PLC activities

Note: There were multiple responses

development workshops (34.0%), and sharing best practices (32.0%). Setting and reviewing goals (21.4%) and, especially, action research and inquiry-based learning (16.5%) were the least practised activities, indicating low engagement in more structured, goal-oriented, and inquiry-based forms of professional learning. Both sectors therefore share the same limitation: teachers have not moved far beyond collaborative planning towards the reflective inquiry that PLC theory identifies as most transformative for instructional improvement. Taken together, these results show that the PLCs of the surveyed Biology teachers. However, they include various professional development activities, are not yet fully utilised, since fewer than half of the respondents in each sector were engaged in most of the PLC activities. This highlights a clear need to build teachers' capacity in action research and other inquiry-related practices.

Perceived contribution of PLC activities to competence-based teaching

Teachers rated the contribution of PLC activities to competence-based teaching practices on a five-point Likert

scale: NA = Not at all, SE = Small extent, ME = Moderate extent, GE = Great extent, VGE = Very great extent. The results are presented in Table 4.2.

The results in Table 4.2 show that teachers perceived PLC activities as contributing to a great extent to all six aspects of competence-based teaching, with mean scores ranging from 3.99 to 4.18, all within the 3.41–4.20 (great extent) band. Between 77.7% and 86.4% of teachers rated each item at a great or very great extent. The major finding is that PLCs contributed most to preparing competence-based lesson plans ($M = 4.18$, $SD = 0.872$), followed by integrating lessons with real-world situations ($M = 4.13$, $SD = 0.893$), involving students in classroom activities ($M = 4.12$, $SD = 0.953$), designing activities that develop students' key competencies ($M = 4.11$, $SD = 0.885$), and flexibility in meeting students' needs ($M = 4.09$, $SD = 0.864$). Formative assessment had the lowest mean score ($M = 3.99$, $SD = 0.798$), although its contribution was still rated as great. Overall, the pattern suggests that PLC activities were seen as contributing to several aspects of competence-based teaching, most strongly lesson planning and instructional design, and comparatively less to formative assessment.

Table 3: Perceived contribution of PLC activities to competence-based teaching

Statements	NA	SE	ME	GE	VGE	MEAN	SD
PLC discussions help me prepare competence-based lesson plans.	3	1	10	49	40	4.18	0.872
PLC activities help me to integrate lessons into real-world situations.	0	7	14	41	41	4.13	0.893
PLC activities help me involve students in classroom activities.	2	4	17	37	43	4.12	0.953
PLC collaboration helps me design teaching activities that develop students' key competencies.	3	2	11	52	35	4.11	0.885
PLC participation supports flexibility and adaptability in meeting student needs.	2	2	16	48	35	4.09	0.864
PLC activities support my practice of formative student assessment.	1	3	18	55	26	3.99	0.798

Discussion

This study yielded three major findings: (i) Biology teachers' PLC participation is concentrated in practice-oriented activities, notably collaborative lesson planning and peer observation, while inquiry-oriented activities such as action research and goal setting are rarely practised; (ii) teachers perceive PLC activities as contributing to a great extent to competence-based teaching, especially lesson planning, the contextualisation of lessons, and student involvement; and the areas of teaching that teachers perceive as most supported mirror the activities they most often perform, with formative assessment being the least supported. Each finding is discussed below, together with its implications for learners.

PLC activities conducted by biology teachers at secondary schools

From the results presented, it was revealed that biology teachers in Dodoma City engaged in a diverse but uneven range of PLC activities. Collaborative lesson planning and peer observation were the most commonly practiced activities in both private and public secondary schools, while setting and evaluating goals, action research, and inquiry were the least commonly practiced activities. This demonstrates that the involvement of teachers in PLC activities is more towards activities which are directly connected to classroom teaching, as opposed to those which involve a more systematic process of professional learning. Therefore, carrying out PLC activities does not necessarily mean that the teacher is involved in all aspects of PLC activities.

This pattern becomes especially important when analyzed through the lens of Social Constructivism, which is a theoretical framework based on the idea of learning as a socially mediated process of knowledge construction through interaction and dialogue (Lehtinen *et al.*, 2023). Collaborative lesson planning and peer observations offer real chances for Biology teachers to share their classroom experience, negotiate interpretation of curricula requirements, explore other ways of teaching, and learn

from each other. The predominance of such phenomena implies that PLCs function mainly as socially oriented communities of practice. Yet, the limited engagement in action research and inquiry-based learning implies that there are still fewer opportunities for teachers to inquire about the current practices and reconstruct knowledge about their profession.

This result is in agreement with recent studies revealing that the success of PLCs is not only a function of collaboration among teachers but is also related to the type of interactions that take place between them (Hendrickx *et al.*, 2025). It has been found that the processes of collaboration and interaction among teachers within PLCs differ greatly in terms of their nature and may contribute to the degree of teacher learning (Hendrickx *et al.*, 2025).

Also, studies conducted in the Global South demonstrate that collaborative learning and innovation in teaching practices can be the result of engaging in authentic PLCs; however, in this case, the role of leadership, resources, trust, and emphasis on teaching and learning is emphasized (Nguyen *et al.*, 2024). The present findings extend this literature by showing that, among Biology teachers in Dodoma City, PLC participation is weighted towards relatively accessible, classroom-oriented activities rather than sustained inquiry.

The relative rarity of action research and inquiry-based learning is especially important, as these are higher levels of professional learning. Different from the simple exchange of teaching ideas, inquiry-based PLCs engage teachers in the identification of issues in instruction, examination of evidence, experimentation with potential solutions, and collective reflection on their effects (Lehtinen *et al.*, 2023). There is evidence in the literature demonstrating how collaboration through action research can help teachers construct new knowledge and improve practice (Chen, 2022). The fact that such low engagement was found in the current study may indicate a potential difference between collaboration through participation and collaboration through knowledge construction.

The findings also provide an important contextual contribution to research on Tanzanian schools. Existing evidence suggests that PLCs have the potential to support teachers' professional development and competence-based teaching in Tanzania, but their potential is not always fully realised. The present study adds greater specificity by showing which PLC activities are most and least commonly undertaken by secondary-school Biology teachers. The predominance of collaborative planning and peer observation suggests that PLCs have become relevant spaces for practical instructional support. Still, the limited engagement in action research and inquiry indicates that their capacity to support sustained, evidence-informed professional learning remains underdeveloped. As a result, it may be suggested that PLCs in the case of the participating Biology teachers represent an already formed phenomenon but not a perfectly developed one from the standpoint of a professional learning environment. The most valuable role played by PLCs seems to be related to the support of collaborative work of teachers with regard to their practice at the current stage; however, the opportunity to conduct systematic inquiry is still underdeveloped. From a Social Constructivist perspective, strengthening PLCs therefore requires moving beyond opportunities to share experiences towards structured processes of dialogue, critical reflection, collaborative inquiry and reconstruction of practice.

Perceived contribution of PLC activities to competence-based teaching

Further, the findings indicate that teachers viewed PLC activities as consistently contributing highly to competence-based teaching, with the means ranging from 3.99 to 4.18. The PLC activity that contributed most to competence-based teaching was the preparation of competence-based lesson plans, followed by lesson integration into reality. At the same time, formative assessment had the lowest mean among the six indicators, although it still fell within the great extent category. This means that teachers viewed PLC activities as having a special contribution to competence-based curriculum planning and instruction.

The relevance of competence-based lesson planning is aligned with the activities as depicted in Figure 1. The frequent activity within the PLCs, which was collaborative lesson planning, made the high perceived contribution to lesson planning possible; therefore, there seems to be a strong link between what teachers do in their PLCs and the instructional practices they link to the activity. Collaborative lesson planning gives teachers a chance to exchange ideas about curriculum requirements, teaching methods, anticipated needs of learners, and learning activities. From the point of view of Social Constructivism, these allow teachers to build up pedagogical knowledge collaboratively and apply it to classroom practices.

The fact that lessons were rated highly in terms of integration into real-world situations, student

involvement, and competence development also implies that teachers view their involvement in PLC as an avenue for moving from non-contextualised and teacher-centred to contextualised and learner-centred teaching. This aligns with the results obtained by Liu *et al.* (2024), who discovered that PLCs can link professional learning with instructional integration among STEM teachers, as well as Mydin *et al.* (2024), who revealed positive correlations between PLC engagement and teachers' performance. These findings support the interpretation that PLCs can serve as a bridge between professional learning and classroom enactment when teachers collectively engage with instructional problems and practices.

These perceived improvements in teaching have direct implications for learners' academic performance. When PLC collaboration helps teachers prepare competence-based lesson plans, relate Biology content to real-life situations, and involve students actively in lessons, learners are more likely to participate, to understand and apply biological concepts, and to develop the practical, problem-solving, and communication competences that the competence-based curriculum requires (Komba & Shukia, 2023; Mpate, 2025). Collaborative lesson planning and peer observation also allow teachers to share strategies for addressing common learner misconceptions in Biology. At the same time, stronger collective attention to formative assessment would help teachers identify learning difficulties early and adjust instruction before summative assessment. Studies elsewhere have linked structured PLC work with gains in student achievement (Mariani-Petroze, 2023) and with improved instructional integration (Liu *et al.*, 2024). However, direct evidence on PLC effects on student learning in the Global South remains limited (Nguyen *et al.*, 2024), and the present study measured teachers' perceptions rather than learners' outcomes. The benefits to learners' academic performance should therefore be understood as the expected outcome of the improved teaching practices reported here, which future research should test directly.

A low score in relation to formative assessment constitutes an interesting caveat. Even though teachers felt it was highly valuable, formative assessment seems to be a somewhat weaker area in terms of support when compared to lesson planning and instructional design. This could be attributed to the type of PLC activities observed in Figure 1: where PLC engagement is concentrated on collaborative planning and peer observation, there may be fewer opportunities for teachers to systematically examine assessment evidence, interpret students' learning difficulties, and collaboratively adapt instruction.

From a Social Constructivist perspective, this finding reinforces the proposition that collaboration alone does not guarantee equally strong learning across all aspects of practice; the focus and depth of interaction matter. Evidence that PLC interaction varies in its capacity to generate professional learning supports this interpretation (Hendrickx *et al.*, 2025).

Combined, these two sets of results show a clear pattern.

Activities in which teachers engage collaboratively are the ones closest to their practices in class, and in turn they perceive the greatest contribution of the PLC in areas of teacher practices close to these activities. On the other hand, the more systematic activities are not engaged in very often. Formative assessment, which is an activity where teachers have to review student learning and make changes accordingly, is one of the areas where they do not perceive such strong contributions from the PLC. The alignment between the activity profile and perceived contribution provides a useful indication of how the current form of PLC engagement may shape the areas of professional practice that teachers perceive as most supported.

The findings thus contribute a contextually relevant perspective on PLC research. Instead of looking at PLCs as one uniform intervention, the study shows that there is an internal structure to the use of PLCs: teachers find it easier to collaborate on practice-based activities compared to inquiry-based activities, and their contribution to PLC is accordingly greater when it comes to planning and implementation of practices in the classroom. This particular point is especially relevant to the Tanzanian context where the implementation of competence-based curriculum calls for constant translation of the curriculum into classroom practices. PLCs may provide an important mechanism for this translation, but their potential could be expanded by incorporating more systematic collaborative inquiry.

CONCLUSION

This study analysed the PLC activities carried out by secondary school Biology teachers in Dodoma City and their perceived contribution to competence-based teaching. The key findings are that teachers engaged in a wide variety of PLC activities, but participation was concentrated in collaborative lesson planning (83.5%) and peer observation (52.4%), while goal setting and reviewing (21.4%) and action research and inquiry-based learning (16.5%) were rarely practised. Second, teachers perceived PLC activities as contributing to a great extent to competence-based teaching ($M = 3.99-4.18$), most strongly to preparing competence-based lesson plans, integrating lessons into real-life situations, and involving students in classroom activities; formative assessment was the least supported area, reflecting the limited use of evidence-based, inquiry-oriented PLC activities.

These findings have important effects on learners. By helping teachers plan competence-based lessons, connect Biology content with learners' everyday experiences, and engage students actively, PLCs create classroom conditions in which learners participate more, understand and apply biological concepts better, and develop the competences required by the curriculum, all of which are pathways to improved academic performance. Conversely, the limited use of action research and of the collaborative analysis of assessment evidence means that learners' difficulties may not be systematically identified

and addressed, which restricts the potential of PLCs to raise learners' achievement.

From the perspective of Social Constructivism, the results imply that PLCs offer important social settings for teachers to interact, negotiate pedagogical understandings, solve instructional issues, and construct professional knowledge collaboratively. But since inquiry activities are not being undertaken in great number, it implies that the transformative power of PLCs has not been fully tapped. The central implication is therefore that PLC development should move beyond routine collaboration towards deeper forms of collaborative inquiry, reflection, evidence use and action research.

The study's principal contribution lies in demonstrating that the issue is not simply whether PLCs exist, but what teachers actually do within them and how these activities correspond with the areas of teaching they perceive as being supported. In the Tanzanian secondary-school Biology context, PLCs appear to be functioning more strongly as spaces for collaborative practice than as sustained communities of inquiry. Strengthening the latter dimension could enable PLCs to more fully support teachers' continuous professional learning and the implementation of competence-based teaching. The study recommends that schools and educational stakeholders strengthen underutilized but impactful PLC activities, particularly action research and inquiry-based learning, which build critical thinking and support continuous, evidence-based instructional improvement. Implementing these practices will require targeted professional development, access to relevant resources, and leadership support that connects PLC activities to constructivist principles.

Limitations

Two key limitations of this study include, first, that the investigation of PLC activities involved mainly a descriptive approach and an investigation of their occurrence without examining the quality, intensity, duration, or nature of interaction associated with the activities. Therefore, the number of times that an activity is mentioned does not necessarily reflect the degree or quality of professional learning involved. Second, the study was conducted among secondary-school Biology teachers in Dodoma City, which may limit the transferability of the findings to teachers of other subjects, regions, or educational contexts. These limitations suggest that the findings should be interpreted as evidence of reported PLC activity patterns within the study context rather than as direct measures of the quality or effectiveness of PLCs more broadly. Future research could address these limitations through longitudinal designs, classroom observations, qualitative examination of PLC interactions, and comparisons across school sectors and regions.

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