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The role of the professional learning community in the professional development of Madrasah Ibtidaiyah teachers in scientific literacy skills

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Abstract

Lots of empirical studies related to teacher professional development (TPD) so far have been conducted widely and have been implemented on elementary teachers. However, the focus on the TPD programs using professional learning communities (PLC) to develop Madrasah Ibtidaiyah (MI) teacher professionalism in scientific literacy skills has not been carried out massively. The purpose of this empirically current study is to analyze and describe the role of PLC in carrying out the TPD activities for MI teachers in scientific literacy skills. This study employed a grounded theory design to adopt a qualitative approach, involving a total of 20 participants who were MI teachers. To collect the data, some open questions were listed, and a structured interview was administered to participants. Three coding phases, such as open, axial, and selective coding, were applied to analyze the data. Results showed that there were three main roles of PLC in holding TPD programs for MI teachers, such as implementing TPD activities, TPD modelling, and improving teacher competences. All of the PLC roles in holding the TPD programs are projected to develop MI teacher knowledge and skills related to scientific literacy, so they can enhance students' scientific literacy skills in elementary school. This recent study implicates grounding new knowledge or insights regarding the role of PLC in developing MI teacher professionalism in scientific literacy.

Keywords: Madrasah ibtidaiyah, Professional learning community, Scientific literacy, Teacher professional development.

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Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
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1. Introduction

The development of science and technology in the 21st century has grown rapidly, and this situation requires some educational elements, such as students and teachers, to think critically and creatively and analyze and solve complex problems in the educational environment [1-5]. As a consequence, the mastery of scientific literacy is extremely essential for students in the field of science from lower education until higher education because it is an ability that can foster students' 21st century skills such as problem-solving, critical thinking, creativity, collaboration, and communication [6-9]. Particularly, Brodie [10] defined scientific literacy as the ability to understand, think, and adjust the concept and perspective of the sciences on various occasions. Moreover, Doğan and Adams [11] stated that it refers to science-based scientific and technological knowledge so that someone who understands scientific literacy will use science and technology as the foundation to explain the scientific phenomenon and evaluate it, design, assess, and evaluate the identification process with various scientific questions, and then interpret the data and proof with various arguments and conclude it. Additionally, scientific literacy does not only require content knowledge but also procedural and epistemic knowledge [11]. Therefore, scientifically literate students understand concepts and main ideas constructing the foundation of scientific and technological thinking, how the science is passed on, and the extent to which such science is justified by theoretical proof and explanation.

The training and enhancement of students' scientific literacy skills need scientifically literate teachers. Nevertheless, not all teachers have the qualities, such as readiness and ability, to promote the development of students' scientific literacy, and it is hard for them to prepare, implement, and evaluate the learning process. Moreover, Major and Watson [12] revealed that science teachers are only oriented to lesson materials without noticing the learning goals, and they also do not vary in implementing learning methods and models. As a consequence, students become passive learners and feel bored during the learning process. According to Suparman, et al. [13], learning sources such as teachers, lesson books, and other tools that are not interested generate students to experience boredom. Meanwhile, science is one of the core subjects to develop 21st century skills in Madrasah Ibtidaiyah (MI) or elementary school because it is the basic science whose development appears to be applied sciences, whereby one of those is related to various technologies [10]. This shows that the professional development of science teachers is extremely needed to enhance students' scientific literacy skills. According to Townley [14], teachers' professional development (TPD) refers to the effort oriented towards teachers by guiding, instructing, and sharing information to develop their ability and skill in content, pedagogical, and technological knowledge. Effective professional development through structured-professional learning creates a change in teachers' practices and enhances students' academic achievement [15].

The professional development of science teachers can be conducted in various models, such as assessment, open classroom, lesson study, study group, and looking at student work [16]. Moreover, Gracheva, et al. [17] categorized the professional development models of teachers as standardized TPD, site-based TPD, and self-directed TPD. However, the implementation of science teachers' professional development programs using those models has not gone well because there is no relation between professional learning activity, teachers' real activity, and school's enhancement goal [18]. Professional development activities are not based on teachers' needs [19], they are not designed for adult learners, and they are not interested in these activities, which are different from learning practices in the classroom [20]. Additionally, the lack of teachers' innovation and skills in science learning creates barriers in TPD [21]. As a consequence, the TPD becomes less effective, whereas it can promote teacher's scientific literacy skills. Therefore, this study proposes the professional learning community (PLC) as an alternative model for science teachers' professional development in MI. he term "PLC" refers to the professional community that is working to simultaneously improve the way that students learn by working together, conversing, sharing, and reflecting [14]. According to Paulus, et al. [22], PLC consists of characteristics, structural conditions, and human and social resources, and those elements commonly contribute to TPD.

To date, many empirical studies related to TPD have been conducted widely and have been implemented with elementary teachers [12, 19, 23] and middle school teachers [20, 24]. Some TPD studies focus on the use of a multifaceted approach [15] and an inquiry approach [25, 26]. In addition, few TPD studies are carried out to develop the professionalism of mathematics teachers [27] and science teachers [28, 29]. Moreover, previous studies regarding PLC as the TPD model have been conducted widely, in which it is used to develop teachers' professionalism in senior high school [18]. PLC is also much studied in Southeast Asia to promote the TPD in Thailand [21], Malaysia [30], and Singapore [31]. The current studies, however, that focus on the program of TPD using the PLC model to develop the professionalism of science teachers in elementary schools have not been carried out massively. Therefore, the purpose of this recent study is to analyze and describe the role of the PLC model in the professional development program of MI teachers in scientific literacy skills. Particularly, this study is expected to provide accurate scientific information related to the role of the PLC in upgrading teachers' competence and conducting TPD activities, as well as model implementation and categorization in TPD, whereby all of those are projected to enhance students' scientific literacy skills in MI.

2. Literature Review

2.1. Teacher Professional Development

Teacher professional development (TPD) is the process of assisting teachers in developing their technological, pedagogical, and content knowledge (TPACK) skills and abilities through guidance, instruction, and information sharing [14]. Consequently, in the TPD, there are program needs that can be implemented by a variety of learning models centered on teachers and collaborative, active, and participative activities for teachers regarding the most effective program. Sancar, et al. [15] stated that effective TPD requires some characteristics, such as: (1) focusing on the contents, such as literacy, mathematics, and science; (2) merging several active learnings depending on andragogical theory; (3) supporting the collaboration in which there is cooperation between teacher and school in sharing the information; (4) using the practical and effective learning model; (5) providing the training and support from the experts; and (6) giving reinforcement and reflection. Thus, the TPD becomes a sustainable and effective program for teachers to enhance TPACK and self-belief.

The TPD can be implemented in various ways to make the learning process active. Some learning models to implement the TPD can be performed through observations, open classrooms, lesson studies, study groups, and looking at student work [16]. The TPD can also be conducted through various activities, such as courses and workshops, conferences and seminars, observation at school, mentoring, and collaborative research. This shows that the activities involved in implementing the TPD can be carried out in various ways. Moreover, Gracheva, et al. [17] divided the TPD model into three categories, such as standardized TPD, site-based TPD, and self-directed TPD. Standardized TPD refers to a centered approach involving workshops and training, focusing on exploration, and demonstrating some skills. Site-based TPD refers to a learning model that focuses on specific and situational conditions whereby teachers can carry out the new techniques and strategies by training in the classroom. Self-directed TPD refers to a learning model requiring the self-regulated learning of teachers and also needing the computer and internet.

2.2. Scientific Literacy

Literacy can be viewed as the ability to interpret and use information in printing and writing from various contexts to enhance the potency and quality of people's lives so that they can extensively interact in society [18-20]. The development of science and technology influences the extension of literacy, so some literacies, such as scientific literacy, mathematical literacy, digital literacy, financial literacy, economic literacy, and others, are developing in several scientific fields. Moreover, scientific literacy refers to an individual's ability to respond to the sciences and technology implemented in their daily lives. Bates and Morgan [18] stated that, basically, scientific literacy can be categorized into four aspects, such as context, competence, knowledge, and science habits. Additionally, Bozkuş and Bayrak [19] argued that to measure scientific literacy, several indicators can be considered: (1) identifying the valid scientific argument; (2) evaluating the source validity; (3) evaluating the use and fault of scientific information; (4) understanding research design elements and their effect on results and conclusions; (5) making the data representation graphically; (6) reading and interpreting the data representation; (7) understanding and interpreting the basic statistics; (7) solving problems using the quantitative ability; and (8) justifying conclusions and predictions based on the quantitative data.

2.3. Professional Learning Community

A professional learning community (PLC) can be defined as a professional community that conducts efforts to improve the practice of the learning process simultaneously [21-23]. The PLC consists of teacher, assistant, and staff, and it can be performed through collaboration, discussion, sharing, and reflection among teachers to make an effective PLC. The PLC has three elements, such as characteristics (reflective dialogue, collective focus on student learning, deprivation of practice, collaboration, and various values and norms), structural conditions (time to meet and discuss, physical proximity, interdependent teaching roles, teacher empowerment, and communication structures), and human and social resources (openness to improvement, trust and respect, supportive leadership, socialization, and cognitive skills).

3. Methods

3.1. Research Design and Procedure

A qualitative approach using grounded theory was used to conduct this study. According to Creswell and Creswell [32], grounded theory was proposed in a different way from other qualitative research designs in that it was a systematic qualitative procedure in generating the theory that explained a process, interaction, and behaviour regarding substantive topics in the wide concept. So, this design was expected to explain the role of TPD using the PLC model in developing scientific literacy skills in MI. Furthermore, the procedure for conducting this study consisted of three main steps: preparation, implementation, and analysis (See Figure 1).

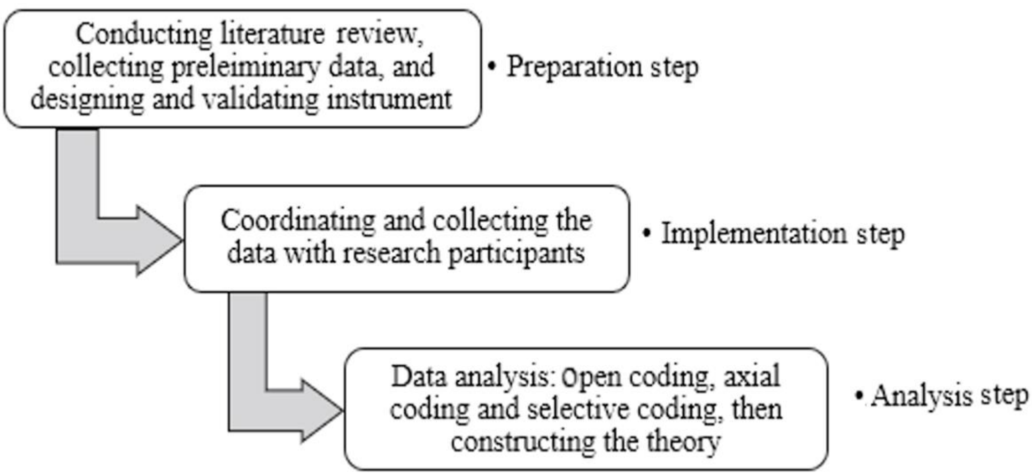

Figure 1.
Research procedure.

3.2. Participant

This study was conducted at all MI institutions in an administrative city located in West Java. As many as 20 MI teachers were involved in this study as participants. The teachers were selected by using purposive sampling in that they were more representative in giving information related to the role of the TPD programme in MI using the PLC model in scientific literacy than other MI teachers who also followed the PLC activities.

3.3. Instrument

Many open questions were listed to collect data regarding the role of PLC on the TPD programme in upgrading teachers' competence, conducting TPD activities, and applying TPD modelling. Subsequently, some questions were directed to explore the enhancement of teachers' competence, consisting of personal, social, pedagogical, and professional competence. Additionally, several questions were projected to explore TPD activities consisting of teacher needs, reflection, and feedback. Moreover, a few questions were directed to explore TPD modelling, consisting of activity models, TPD categorization, and facilitators. Three pedagogical study experts who were lecturers in science education had theoretically validated all of the open questions in the instrument. The aspects of the instrument that were validated consisted of content and language. The validity score for each aspect was 4.2 (content) and 4.7 (language), where Jatic, et al. [33] stated that if the validity score was more than 4.0, it could be stated that it was valid. As a consequence, the instrument of open questions used to conduct the interview was valid.

3.4. Data Collection

Structured and non-structured interviews were conducted to ask the participants. The interview was performed to explore the information regarding MI teachers' perspective, experience, and feelings as the participants who got and followed the TPD programme using the PLC model in scientific literacy skills. Furthermore, the data obtained from the interview, such as audio and video, were written in text format as transcripts.

3.5. Data Analysis

The data in text format was analyzed in terms of the coding, such as words or short phrases that symbolically described, revealed, and explained the essential visual and verbal data. According to Creswell and Creswell [32], coding refers to the transition process between data collection and data analysis. Moreover, Creswell and Creswell [32] stated that there were three phases in conducting the coding: (1) open coding, (2) axial coding, and (3) selective coding, so that these coding phases were applied to analyze the data. NVivo software was utilized to make the labelling process of coding names easier.

4. Results and Discussion

The coding analysis passing through three phases such as open coding, axial coding, and selective coding revealed that there were three main roles of the TPD programme in MI using the PLC in scientific literacy skills (See Figure 2). Firstly, it became the TPD modelling, such as the TPD model, TPD categorization, and facilitator. Secondly, it upgraded teachers' competence, consisting of personal, social, pedagogical, and professional competence. Thirdly, it implemented the TPD activities that contained teacher needs, reflection, and feedback.

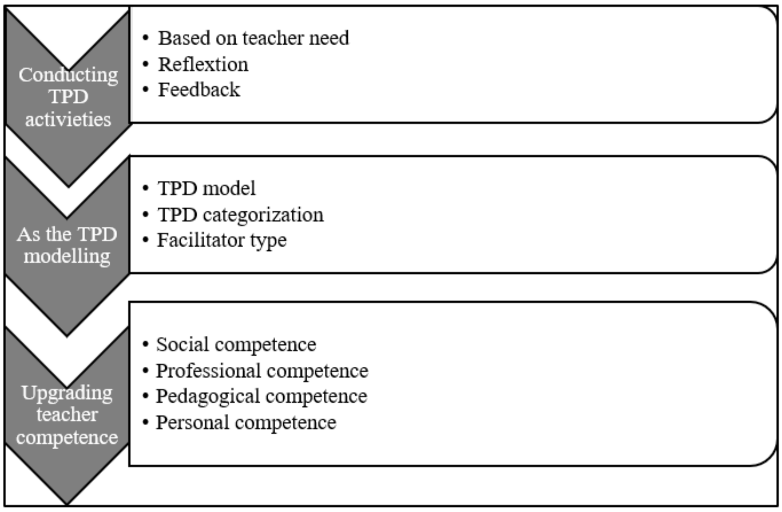

Figure 2.
The main role of PLC on the TPD of MI in scientific literacy skills.

In detail, each of the roles of PLC in the TPD of MI in scientific literacy skills was explained and discussed comprehensively in the following subsection.

4.1. The Role of PLC in Implementing TPD Activities

One of the results of selective coding was the role of PLC in implementing TPD activities. PLC was not only a community for teachers to gather and coordinate but also an organization for them to mutually teach each other in that they have the job and responsibility to do various activities such as training and discussion to enhance their competences. The axial coding results also showed that the role of PLC in implementing TPD activities could be broken down into three main areas: teacher need, reflection, and feedback. Each aspect of those activities was explained in the following subsections:

4.1.1. Teacher Needs

The results of open coding revealed that, at least, there were five main elementary teachers who needed to develop their professionalism in the science subject, specifically in enhancing students' scientific literacy skills (See Figure 3). These requirements arose for them as a result of their inability to follow the training that the training hall was holding.

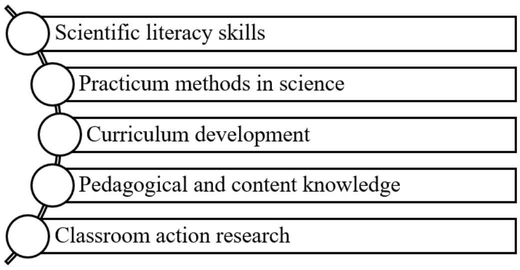

Figure 3.
Elementary teacher needs in every training.

4.1.2. Reflection on TPD Activities

The results of open coding showed that there were four reflection forms for teachers as members of PLC who followed the TPD activities. First, they were active in following each activity, which was essential in that active learning in the learning process created interaction among teachers, sharing ideas or information, and discussion related to problems and solutions in the learning classroom in each school. Second, some teachers did not want to share ideas or information with other teachers, whereas the benefit of TPD activities in various aspects such as competence, experience, and skill was extremely expected of teachers. Third, the training that they got could improve their manner of teaching and help them solve the learning problem. Fourth, there was a punishment for those who did not follow the training, like not getting the certificate proof.

Additionally, other results of open coding revealed that there were several reflections on the implementation of training activities in PLC. First, the implementation of training activities in PLC had not been maximal, and the management structure of PLC had not carried out the training programme that could provide the benefit of developing elementary teachers. Second, the PLC performed the training activities that were not based on teacher needs. Third, the socialization of PLC's activities was still less, and some teachers did not know about the training activities. Fourth, the role of the headmaster in each school in giving permission to follow the training activities in PLC affected the involvement of teachers as participants.

4.1.3. Feedback for TPD Activities

The results of open coding indicated that there were several feedbacks for TPD activities using the PLC, and these feedbacks were needed to improve the TPD program in the future (See Figure 4).

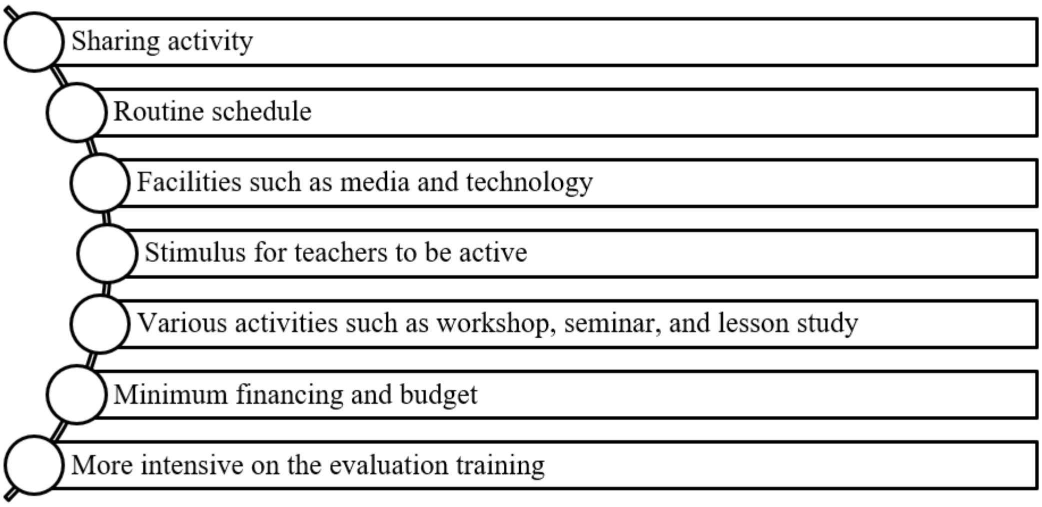

Figure 4.
Feedbacks toward TPD activities.

In common, teachers get the chance to improve and enhance their manner and method of teaching by following the process of TPD activities. It means that the PLC becomes the facilitator for them to learn deeply. According to Merchie, et al. [21], the optimal and effective PLC can provide benefits for teachers in learning. Additionally, Sancar, et al. [15] argued that the TPD programme provides changes for teachers in both knowledge and attitude, all of which are directed towards achieving the best performance in teaching for students. Philipsen, et al. [27] also confirmed that the PLC, with its programmes, generates teachers' sense of self-confidence and skills in implementing the learning process and enhancing students' academic achievement. These show that the TPD is one of the positive solutions to improving teachers' skills and competence by holding the PLC and its various activities. Moreover, Lin, et al. [34] stated that the TPD has a significant positive effect on enhancing teachers' skills and competences.

Some TPD activities, such as reflection and feedback, are extremely needed for the improvement of the training programme in PLC. Few studies revealed that reflection is the activity providing effective TPD [12, 20]. Moreover, Bates and Morgan [18] stated that the feedback process for the PLC's activities is important. Both in the reflection on TPD activities and the feedback for TPD activities, sharing activity is one of the emerging problems in the PLC, whereby there are some teachers who do not want to share their ideas or knowledge with other teachers. Meanwhile, sharing activities in the TPD programme passing through the PLC is a form of teachers' collaboration to cooperate with each other [35]. The effective sharing activity generates a beneficial TPD program. In addition, the TPD will become a continuing programme in that sharing activities create the ongoing communication process. Moreover, Lindl and Hilbert [36] argued that the TPD programme containing sharing activities as one of the optioning activities reveals much new knowledge among teachers.

Another reflection is that the implementation of the PLC programme has not been optimal, as there are few activities in the PLC that are not based on teacher educations. Few empirical studies also reported that the imperfection of TPD implementation becomes the main problem in the PLC [37, 38]. One of the indicators of the imperfection in implementing TPD program is that the TPD programme focusing on scientific literacy skills has not been carried out. As a consequence, teachers do not have more knowledge or ability regarding how to enhance students' scientific literacy skills because it does not only require scientific concepts and theories but also knowledge related to scientific procedures and practice. This becomes one of the skills teachers need to hold in the PLC. In addition to the development of scientific literacy skills, the training related to the utilization of information and communication technology in the learning process is also what teachers need, in that integrating technology into the learning process can help make the delivery of learning materials easier for students[6].

4.2. The Role of PLC in TPD Modelling

The result of another selective coding was the role of PLC in TPD modelling. The TPD modelling provided a variety of TPD implementations in the PLC. Moreover, the results of axial coding showed that the role of PLC in TPD modelling could be classified into three main aspects, such as the TPD model, TPD categorization, and facilitator type. Each aspect of those TPD models was explained in the following subsections.

4.2.1. TPD Model

The results of open coding showed that some models were used in implementing the TPD program in the PLC (See Figure 5).

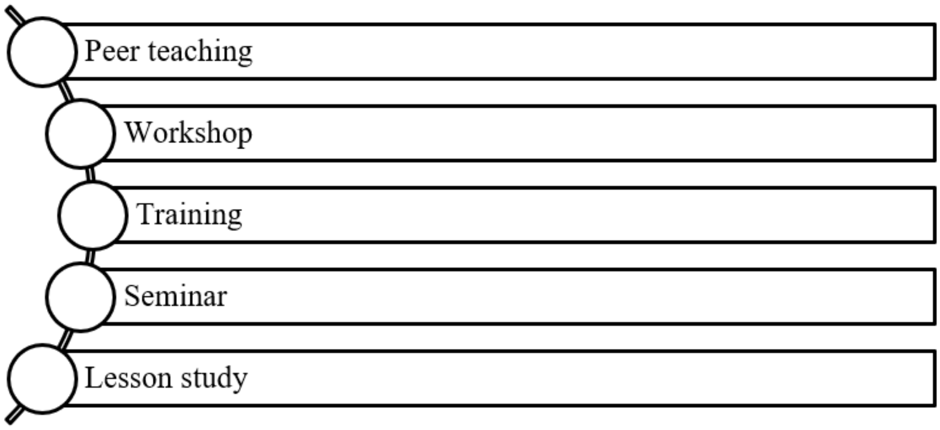

Figure 5.
Model in implementing TPD activities.

The interview results revealed that peer teaching and workshops were the most well-known models used in implementing TPD activities for elementary teachers in the PLC. Peer teaching was implemented in the PLC in that TPD activities usually constructed collaborative learning containing small groups that teachers commonly shared ideas or knowledge in the small groups [39]. Additionally, TPD activities in the PLC usually carried out workshop-based learning, whereby teachers could directly practice the lesson materials that they studied [40]. The next TPD model was training, in which the training was conducted independently and in groups, which enabled teachers to share ideas and knowledge. Other interview results showed that the models rarely used in implementing TPD activities in the PLC were seminar and lesson study. According to Vermunt, et al. [41] and Basma and Savage [39], lesson study has a beneficial effect on the quality of teacher learning and also has the highest impact on improving teachers' meaning-oriented learning. These findings show that some TPD models, such as peer teaching, workshops, training, seminars, and lesson studies, are implemented in conducting activities in the PLC. In their literature, Karsenty and Brodie [42] stated that several TPD activities, such as peer teaching, workshops, training, seminars, and lesson studies, have a significant positive effect on teachers' skills and competences in the PLC.

4.2.2. TPD Categorization

The results of another open coding revealed that there were three categorizations for carrying out TPD activities in the PLC (See Figure 6).

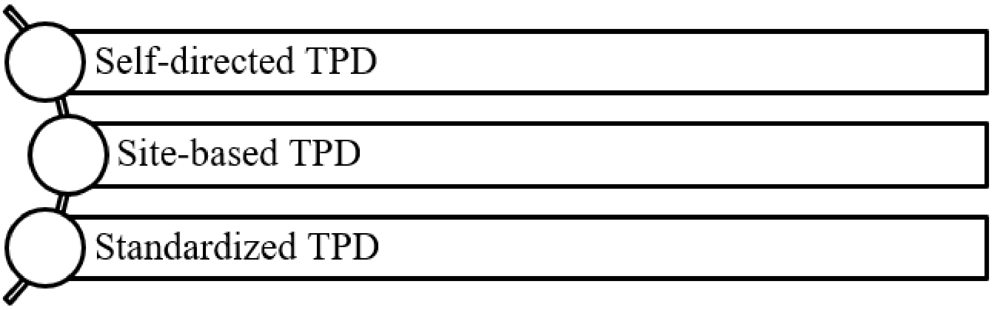

Figure 6.
Categorization in implementing TPD activities.

The interview results showed that the training of elementary TPD was conducted independently (self-directed TPD) by utilizing online media such as YouTube and websites related to teacher needs. After completing the training on deep lesson materials, they implemented this category. In addition, site-based TPD was carried out in each elementary school, using the lesson materials decided by the PLC. Then, the results of another interview revealed that standardized TPD was carried out in the official training halls, like the religion ministry's training hall. Gracheva, et al. [17] also stated that there are three categories for implementing TPD programmes in the PLC: standardized TPD, site-based TPD, and self-directed TPD. Moreover, Huijboom, et al. [43] argued that some categories of implementing TPD activities, such as self-directed TPD, site-based TPD, and standardized TPD, have a significant positive effect on the teachers' skills and competences.

4.2.3. Facilitator Type

Competent facilitators were extremely required to train teacher professionalism in teaching so that they could get lots of new knowledge and experiences from the facilitators. The results of another open coding showed that there were two types of facilitators involved in the TPD program in the PLC (See Figure 7).

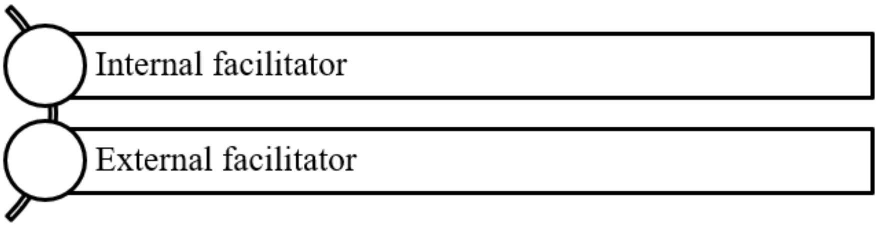

Figure 7.
Facilitator type in implementing TPD program in the PLC.

The interview results showed that the implementation of TPD programs in the PLC involved external facilitators, such as lecturers or experts from higher educational situations. Additionally, internal facilitators such as representative teachers from each elementary school, elementary school supervisors, and exemplary teachers were involved in TPD activities in the PLC, whereby they were selected by the PLC's management in that they mastered the training materials to rehearse elementary teachers in developing their professionalism. According to Dille and Røkenes [44] and Noonan [40], facilitators are one of the essential aspects in the development of teacher professionalism, in which teachers can specifically enhance professional and pedagogical competence by following a series of activities given by the facilitators so that they gain more knowledge and experience.

4.3 The Role of PLC in Upgrading Teacher Competence

The result of another selective coding was the role of PLC in improving teacher competence. The role of PLC in upgrading elementary teacher competence was the main target of TPD programs. Moreover, the results of axial coding showed that the role of PLC in upgrading teacher competence could be categorize into four main aspects, such as social competence, personal competence, professional competence, and pedagogical competence. Each aspect of those teacher competencies was explained in the following subsections.

4.3.1. Social Competence

The results of open coding showed that there were few roles for PLC in improving teacher social competence (See Figure 8). This competence supported them in interacting academically with other teachers.

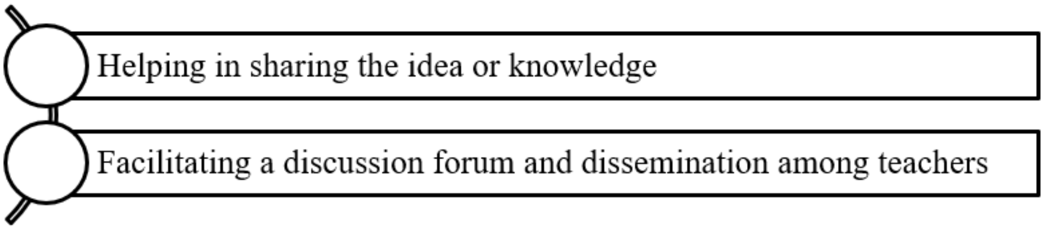

Figure 8.
The role of PLC in improving teacher social competence.

To upgrade teacher social competence, the PLC played a role in helping teachers share their ideas or knowledge. This shows that the existence of PLC creates interactions among teachers to share ideas and reach innovative solutions to learning problems. Moreover, the PLC facilitated teachers in providing a discussion forum and dissemination whereby there were interactions among teachers from each elementary school in the forum.

4.3.2. Personal Competence

The results of another open coding revealed that there were some roles of PLC in improving teacher personal competence (See Figure 9). This competence is promoted by improving their personalities related to their work as teachers.

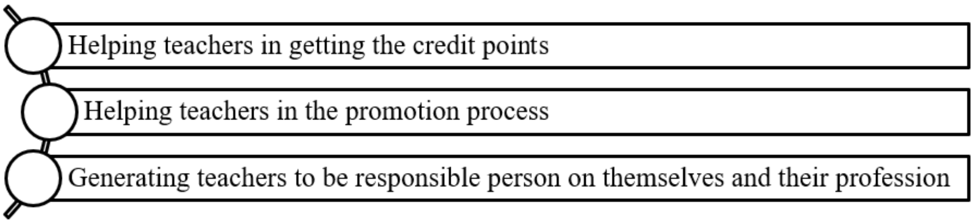

Figure 9.
The role of PLC in improving teacher personal competence.

To improve teacher personal competence, in addition to helping teachers get credit points and the promotion process, the PLC played a role in constructing teachers as people who were responsible for themselves and their profession.

4.3.3. Professional Competence

The results of another open coding showed that there were some roles of PLC in improving teacher professional competence (See Figure 10). This competence supported teachers in enhancing their abilities and skills, especially those related to scientific literacy.

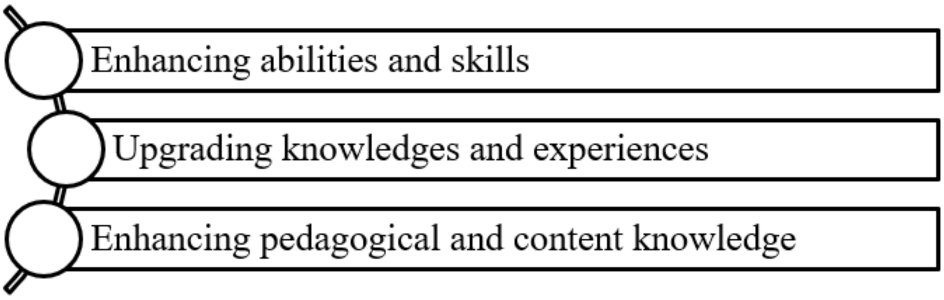

Figure 10.
The role of PLC in improving teacher professional competence.

To upgrade teacher professional competence, the PLC provided a discussion forum regarding thematic science in which it added teacher new knowledge and experiences. It means that the PLC upgrades teacher abilities and skills in teaching and also enhances their pedagogical and content knowledge.

4.3.4. Pedagogical Competence

The results of another open coding revealed that there were few roles of PLC in improving teacher pedagogical competence (See Figure 11). This competence promoted teachers implementation of the learning process in the classroom.

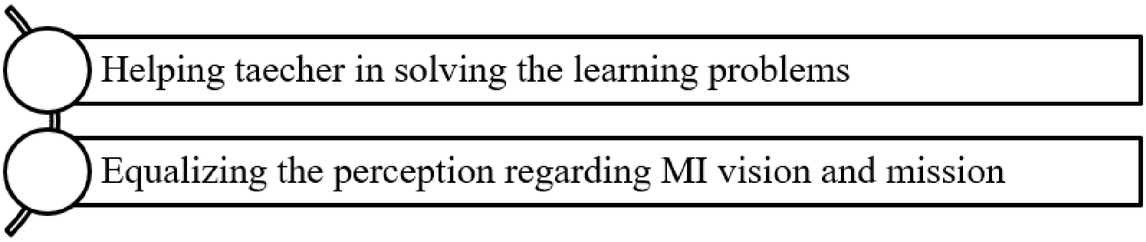

Figure 11.
The role of PLC in improving teacher pedagogical competence.

To improve teacher pedagogical competence, the PLC played a role in reaching effective solutions to solve the learning problems. The problems were related to the learning process and its evaluation. Additionally, the PLC had another role in equalizing and reformulating MI vision and mission, specifically related to tahfidz program.

The implementation of TPD activities in the PLC at least has carried out its role in improving teacher competences such as social, personal, professional, and pedagogical. Particularly, several empirical studies showed that the PLC has a positive effect on the development of teacher competence [11, 37, 45, 46]. Moreover, Prenger, et al. [37] and Admiraal, et al. [35] revealed that networked PLC has a positive impact on the enhancement of attitude, knowledge, and skill in implementing the learning process. The discussion and seminar forum for teachers held by the PLC not only improve teacher social and personal competence but also enhance teacher professional and pedagogical competence. Sharing activities in the discussion and seminar forum greatly enables teachers to mutually share ideas, knowledge, and experiences. This is in line with Johannesson [46] and Karsenty and Brodie [42], who state that sharing activities has a significant effect on developing teacher professionalism in the PLC. Specifically, sharing activities in the PLC promote the improvement of knowledge and experiences and the enhancement of skills and abilities [11]. Moreover, Brodie and Chimhande [45] and Vermunt, et al. [41] revealed that the skills and experiences gained from sharing activities in the PLC encourage and enrich the variety of teacher teaching styles, so it makes the learning environment attractive and not boring for students. It means that sharing activities helps teachers solve the learning problem, whereby usually the learning environment, which is boring and not attractive, becomes the main problem in the learning process. This shows that teacher social competence promotes the development of other teacher competencies, such as personal, professional, and pedagogical. This current study also provides empirical proof that the TPD programme in the PLC was more dominant in improving teacher social competence than other teacher competencies. A few previous reports also showed that teacher social competence encourages other teacher competencies [22, 45, 47]. This indicates that in addition to developing teacher personal, professional, and pedagogical competence, it is extremely important to develop teacher social competence. Moreover, Fan, et al. [48] stated that teachers who have some skills in professional, social, pedagogical, and personal areas greatly enable them to develop their students' skills and abilities, especially scientific literacy.

5. Conclusion

This current empirical study generates new theory related to the role of PLC in the professional development of MI teachers in scientific literacy skills. Generally, the PLC has roles in implementing TPD activities, TPD modelling, and improving teacher competence. Particularly, the role of PLC in implementing TPD activities is to provide reflection and feedback and also accommodate teacher needs. Additionally, the role of PLC in TPD modelling is to dish up a variety of TPD models, TPD categorizations, and facilitator types. Then, the role of PLC in improving teacher competence is to upgrade social, personal, professional, and pedagogical competence. All of the PLC roles in holding the TPD activities are projected to develop teacher knowledge and skills related to scientific literacy so they can enhance students' scientific literacy skills in elementary school. Therefore, this recent study implicates, in presenting new knowledge or insights, the role of PLC in developing teacher professionalism, mainly related to the development of teacher knowledge and skills about scientific literacy.

Some of the open questions used in the instrument have not covered in detail all of the needed information related to the role of PLC in the professional development of MI teachers in scientific literacy skills. Particularly, the information regarding the role of PLC in improving teacher competence only presents that it is only to upgrade teachers' social, personal, professional, and pedagogical competence. Additionally, the process of data collection does not involve triangular activity, whereas this study only involves the process of interviewing. Other data collection techniques, such as observation and documentation, are actually needed to provide strong evidence. Of these limitations, this implies that future relevant studies should involve the triangulation process to strengthen the evidence of results. In addition, the content of some open questions used in the instrument has to be substantially enhanced to complete the required information.

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