Sustainable ecosystem for professional teachers in Indonesia: The role of teacher professional education programs in achieving the SDGs

Fathur Rokhman[1*], *Arif* Purnomo[2], *Agus* Yuwono[3], *Iwan Hardi* Saputro[4], *Boonrat* Plangsorn[5], and *Ahmad* Fajar Habibi[6]

[1]Universitas Negeri Semarang (Postgraduate School), Semarang, Indonesia
[2]Universitas Negeri Semarang (Faculty of Social and Political Sciences), Semarang, Indonesia
[3]Universitas Negeri Semarang (Postgraduate School), Semarang, Indonesia
[4]Universitas Negeri Semarang (Faculty of Social and Political Sciences), Semarang, Indonesia
[5]Chulalongkorn University, Bankok, Thailand
[6]Universitas Negeri Semarang (Postgraduate School), Semarang, Indonesia

Abstract. This research explores the role of Teacher Professional Education (PPG) in supporting the achievement of the Sustainable Development Goals (SDGs) in Indonesia, especially SDG 4 which emphasizes quality and inclusive education. Adapting Bronfenbrenner's ecological systems theory, this research analyzes four indicators of professional teacher development: adaptive development indicator ecosystem analysis, field development ecosystem, network development ecosystem, and leadership development ecosystem. This research uses a mixed method research design, data is taken from respondents with PPG alumni backgrounds in 2018-2022. This research shows significant progress in active learning innovation and teacher academic qualifications. In addition, there are still challenges in active participation in classroom action research indicators and teacher professional collaboration. The results of this research provide important insights for policymakers to strengthen the PPG program to achieve SDG goals, support a sustainable education ecosystem, and improve the quality of education in Indonesia.

1 Introduction

The education is one of the main pillars in implementing Sustainable Development Goals (SDGs) in Indonesia. The goal of Sustainable Development Goal points 4 and its derivative target 4.7, is inclusive and quality education that is linear with the concept of a sustainable ecosystem for professional teachers. The professional teacher ecosystem has now been realized sustainably in the Teacher Professional Education Program in Indonesia. According to Bronfenbrenner's Ecological Systems theory [1], a sustainable ecosystem for the realization of professional teachers is always supported by aspects of the educational environment. This is supported by the United Nations [2] which believes that environmental,

* Corresponding author: fathurrokhman@mail.unnes.ac.id

social, and economic aspects influence the development of the quality of professional teachers in education. Therefore, teachers must be able to adapt the changes and developments in the world of education to provide knowledge that is relevant and meaningful to all students.

The Professional Teacher Program continuously forms a synergistic educational ecosystem in actualizing the achievement of the goals of inclusive and quality education. The achievement of educational goals for Professional Teachers can be specifically analyzed through indicators of adaptive development, field development, network development, and leadership development. Indicators of sustainable professional teacher development can make a major contribution to the achievement of the SDGs program in the education sector. The first relevance in the development of Teacher Education Program (PPG) adaptation is realized in three activity variable capacity points (1) science and technology capacity building training, (2) active involvement innovation in the classroom, and (3) adaptive research innovation in classroom action. Continuous adaptive development of professional teachers adapts the learning environment to form a flexible and innovative ecosystem with various trends in learning styles and student backgrounds [3]

The second relevance is in the sustainable ecosystem of "Field Development" of professional teachers towards increasing the achievement of education quality targets in Indonesia by 2030. The realization of the implementation variables studied are (1) teacher communication, (2) academic qualifications, and (3) additional qualifications outside the academic field. Teacher activity items in the field development category were chosen to improve and strengthen the quality of effective and meaningful learning and can make a real contribution to the development of science and technology [3].

The third relevance of increasing the achievement of education quality targets in the SDGs commitment in Indonesia is the "Network Development" of professional teachers. The teacher's ability to build and maintain relationships through communication is one of the main provisions for achieving quality education goals. Through the provision of communication, collaboration to strengthen the quality of educational support is getting better. The collaboration creates an expansion of scientific resources from various linear and non-linear fields. Variations in scientific fields add to students' field of insight in looking at the reality of world developments. Through network development, access to training support and partnerships from collaborative processes of various parties can support the goals of declaring SDGs in Indonesia. The network development aspect is focused on variable focus (1) scientific collaboration of teacher organizations throughout Indonesia, (2) scientific field network collaboration, and (3) field collaboration with the educational supporting environment.

The final relevance lies in the "Leadership Development" of teachers by the commitment to SDGs targets in Indonesia. Professional teachers have a role in the realization of leadership in learning, the environment, and other support systems. Apart that achieving the quality of education in SDGs 4, SDG 16 regarding the concepts of peace, justice, and strong institutions, can be formed through the concept of educational relevance in "Leadership Development" for all groups who contribute to support the educational environment. Leadership development in learning can be analyzed through the teacher's contribution to the variables (1) relationship management, (2) performance motivation management, and (3) service management. Leadership development of professional teachers in various fields can create a more supportive and inclusive learning environment and quality education.

This research aims to explore data on four indicators of professional teacher development in the PPG program toward achieving SDGs in Indonesia. The global significance of the research contributes to the literature on professional teacher ecosystem development and sustainable education. Locally significant, the results of this research can serve as input and evaluation for policymakers to improve and strengthen the SDGs program in Indonesia.

2 Methodology

This research uses a mixed-method research design to explore information on the experiences of Teacher Professional Education alumni between 2018 and 2022 throughout Indonesia broadly and randomly. Information data collected using in-depth interview instruments and participant observation in 2023, was transcribed with a brief description of the percentage of indicators achieved from low to high levels. The indicators in the instrument are determined based on the concept of linearity of teacher experience and the policies implemented in the SDGs education quality strengthening program. The data that has been transcribed on certain variables for each indicator is analyzed in such a way as to obtain information on the actual state of the level of educational participation in achieving the goals of declaring the SDGs in Indonesia.

3 Results and Discussion

The analysis of the sustainable ecosystem of professional teachers in the PPG program in Indonesia has obtained quite significant results. In Table 1, the indicators and instrument-derived variables capture data variations with a fairly low level of gap. Adaptive development indicators generally refer to teachers' ability to adapt the various conditions, needs, and learning environments that are inclusive and responsive to change. The first activity variable is training to increase science and technology capacity. Only 48.5% of the total data ecosystem fully participates and always actively take part in training to increase science and technology capacity. Based on the percentage of frequency the activity of professional PPG teachers graduating from 2018-2022, is still below 50%, illustrating that professional involvement still needs to be increased since the launch of the SDGs in Indonesia [4]. Based on the theory of motivation and performance by Ryan. R.M [5], emphasizes the role of intrinsic motivation in the work environment supported by a technology application system so that the achievement of a professional teacher ecosystem can be achieved by mastering learning-supporting technology media.

In the active involvement innovation variable in the classroom, the frequency of learning innovation achieved is above 60%. The active involvement of teachers and students in the process of teaching and learning activities is in the very good category for creating quality education. This is supported by Freeman [6] who states that teachers' activeness in innovating using active learning methods can encourage student participation in increasing understanding and retention. In this variable, almost the majority of teachers and students' active participation in learning is very good, but on the other hand, there are 2% of respondents from among teachers who do not play an active role in classroom learning at all. This is of course influenced by various factors such as the age of the teacher who is no longer young, so the method used in learning is limited to lectures without involving and providing participation opportunities for students to explore learning. Kraft and Blazar [7] researched that the dominant use of the lecture method in learning is often ineffective in increasing students' cognitive and emotional involvement. Therefore, in this case study it is necessary to have a solution that can be applied, such as collaborating learning in the subject area, so that the contribution of younger and innovative partner teachers can help the process of delivering material in the collaborative subject area.

In the adaptive class action research innovation variable, the highest results were only in the category of having done it. As many as 46.5% of respondents carried out innovative classroom action adaptive research only as an administrative and formality requirement, the

rest as a requirement for academic research. In the very active implementation category, the percentage was 14.9%, which shows that there are still many obstacles to implement this activity. Some of the obstacles found were bureaucratic demands, lack of support from the school, and a lack of intensive work to carry out further research [8] [9]. Apart from this, professional development programs organized by the government are often not well integrated according to real needs in the field. The allocation of this program should be able to increase teacher motivation and contribute to improving the quality of education in Indonesia [8].

Table 1. Ecosystem Adaptive Development

Activity	1	2	3	4	5
Training to increase science and technology capacity	0%	3%	9.9%	38.6%	48.5%
Active engagement innovation in the classroom	2%	0%	2%	35.6%	60.4%
Classroom action adaptive research innovation	1%	8.9%	46.5%	28.7%	14.9%

Table 1 presents the percentage indicators of the relevance of educational achievements to the SDGs program in the context of the professional teacher "Field Development" ecosystem. Field development in the professional teacher ecosystem is one of the realistic steps for teachers in learning that is prepared and carried out to meet the modern education system. According to sources from the Cambridge Professional Development Qualification and Ontario College of Teachers, the qualifications of the teacher development ecosystem can be seen from three indicators such as teacher communication, academic qualifications, and additional qualifications [10]. The first qualification indicator in the form of teacher communication skills in learning and outside of learning has been achieved very well, namely 59.4% in the very good category. The teacher communication in this indicator supports the synergy of the education implementation system with the learning environment such as students, parents, and colleagues. Developing teacher communication skills can certainly improve the quality of education in Indonesia because it can create a positive learning environment. The lowest achievement in the teacher communication indicator is at 4% in the quite good category, meaning that the teacher has only created formal learning environment conditions, but has not yet led to learning environment conditions that were very attractive to students.

The next indicator is the academic qualifications of professional teachers which reached 80.2% in the very suitable category. This achievement certainly encourages teachers specifically in their field to master and update their field skills. The qualifications in this indicator are linear with the ecosystem in Table 1 regarding the adaptive development of teachers in their subject areas. This is supported by Blomeke [11] and Harris & Sass [12] who shows a positive relationship between professional development fields in increasing content focus and teacher teaching effectiveness. The development of qualifications in the academic field of professional teachers needs to be integrated and continuously ongoing because the development of research in the field of education will always develop with the times. By developing academic qualifications, teachers can significantly increase learning effectiveness.

In the ecosystem, the development of additional qualification fields outside the field of subject teachers allows teachers to expand their expertise and carry out more interesting learning variations. At the Ontario College of Teachers, there is a program that offers Additional Qualification (AQ) courses for teachers [13]. This certainly allows teachers to be more varied in facing more diverse class challenges as educational times change. Table 2

presents the results of indicators for this field, namely 45.5% in the category of strongly agreeing and participating very actively in additional development outside the field of teacher qualifications. 27.7% are in the category of agreeing and actively participating in developer programs outside the field. The lowest achievement of 4% is in the category of strongly disagree and have never developed qualifications outside their field of learning. This still happens in Indonesia due to several factors such as teacher age bills which no longer allow development outside their field and access factors which are not yet available in several regions of Indonesia in the 3T category: Frontier, Outermost, and Underdeveloped. This area is like several regions in Papua, Maluku, East Nusa Tenggara, and several regions in Kalimantan [14].

Table 2. Ecosystem Field Development

Activity	1	2	3	4	5
Teacher communication	0%	0%	4%	36.6%	59.4%
Academic qualifications	0%	0%	5%	14.9%	80.2%
Additional qualifications outside the academic field	4%	4%	18.8%	27.7%	45.5%

In the further table regarding the ecosystem, development of professional teacher networks, the achievements have not been very significant. In the first indicator of the ecosystem for developing scientific collaboration networks, Indonesian teacher organizations are highest in the formal participation category at 36.6%. Most teachers in Indonesia have officially joined the Republic of Indonesia Teachers Association forum, but only 28.7% actively participate in using this network to improve the quality of learning in their classes. According to Darling-Hammond, L [15] states that teacher involvement in professional networks is still low, and this is largely due to a lack of available time and resources. Teachers are often isolated in the classroom and do not have the same opportunities to collaborate actively with colleagues in a large-scale collaboration forum. In the first indicator, there are still 4% of teachers who are inactive or have never participated at all with this national level focus, even though apart from SDG 4 achievements, the indicator regarding teacher collaboration in national forums is also linear with SDG 17 regarding partnership programs to achieve goals. According to the United Nations [2], the development of scientific collaboration networks functions as a platform to increase scientific resources and support collective efforts to achieve sustainable development goals.

In the second indicator in Table 3 regarding the network development ecosystem, collaboration in the scientific field network has a higher percentage of being very active. 39.6% of respondents were very active in developing networks in their scientific fields, followed by the active category at 27.7%, the moderately active category at 23.8%, and there were still 8.9% of teachers who were inactive and had never participated at all. a collaborative network of teachers' scientific fields. According to research by Ohayon [16], collaboration between teachers in professional learning communities has been proven to improve students' learning skills, planning, and achievement. Teacher-scientific network collaboration is one of the key factors in improving the quality of education in Indonesia because it is related to the development of sustainable education and the regeneration of knowledge in a scientific community.

The third indicator is teacher collaboration with the community sector in the learning environment. The highest achievement was in the moderately active role category at 43.6%, with the community directly or indirectly taking part in the provision of education in Indonesia. In general, some teachers are still not aware that collaboration between teachers and communities can not only improve the quality of education but also support the

achievement of sustainable development goals. This is supported the research Liang Yu [17] which states that the integration of academic knowledge and local experience can produce social interventions that are more effective and contextually relevant. The local experience in question comes from the community environment which directly or indirectly influences the learning that students experience, so that in the application of knowledge students can be in harmony with the conditions of the community around their environment.

Table 3. Ecosystem Network Development

Activity	1	2	3	4	5
Scientific collaboration of teacher organizations throughout Indonesia	4%	9.9%	36.6%	20.8%	28.7%
Scientific field network collaboration	2%	6.9%	23.8%	27.7%	39.6%
Field collaboration with educational supporting environmental communities.	4%	10.9%	43.6%	22.8%	18.8%

Table 4 presents the "Leadership Development" of teachers by the commitment to SDGs targets in Indonesia which is divided into 3 indicators: relationship management between teachers and students, performance motivation management, and relationship service management between teachers and students. Professional teachers have a role in the realization of leadership in learning, the environment, and other support systems. The first indicator regarding the management of relationships between teachers and students in this context shows good bonds and patterns of cultivating relationships. The largest percentage is in the category of strongly agreeing and it is very often realized in the learning process in class at 47.5% and all teachers are aware that student responses in learning are a form of ongoing constructive learning. According to Robinson [18], teachers who can manage good relationships with students tend to have more orderly and productive classes.

The second indicator in the teacher leadership development ecosystem is work motivation management. Performance motivation management indicators are good and tend to be very good, respectively at 44.6%. The achievement of work motivation management has been consciously implemented by teachers because the education system that schools have integrated into the SDGs concept, such as recognition of achievements, can motivate teachers' work, such as recognition of results, working time, teacher wages, and various other elements of achievement and discipline. According to research conducted by Lee [19], appropriate recognition and a good balance between work and personal life can increase teacher work motivation.

In the final indicator in the leadership development ecosystem, namely teacher service management towards students, the highest percentage achieved was 48.5% for the category of strongly agree and very often provide the best service to their students. The rest are in the categories of agree (often) and quite agree (formal service) in providing the best service for students. Teacher service management is supported by the servant leadership theory introduced by Robert Greenleaf [20]. This theory shows the linearity of its application in the world of education in the form of teachers' focus on empowering and listening to students' needs to achieve the students' full potential. This is supported by the results of research conducted by Lemoine, GJ, [21] in exploring the forms of servant leadership principles applied in education to increase the productivity of learning outcomes. The level of student productivity certainly influences the achievement of the quality of education of SDGs 4 and in addition SDG 16 regarding the concepts of peace, justice, and strong institutions, which can be formed through the concept of educational relevance in "Leadership Development" for all groups who contribute to supporting the educational environment. Leadership development in learning can be analyzed through teacher contributions to variables.

Leadership development of professional teachers in various fields can create a more supportive and inclusive learning environment and quality education.

Table 4. Ecosystem Leadership Development

Activity	1	2	3	4	5
Relationship management management	0%	0%	13.9%	38.6%	47.5%
Performance motivation management	0%	0%	10.9%	44.6%	44.6%
Service management	0%	0%	7.9%	43.6%	48.5%

4 Conclusion

In a sustainable ecosystem for professional teachers in Indonesia the Professional Education Program, teachers make a real contribution to achieve the Sustainable Development Goals (SDG 4: Quality Education) in Indonesia. Based on the data in the discussion item on the adaptive development ecosystem, the results in the very good category and in the Innovation indicator, very active involvement in the classroom at 60.4%, in the field development ecosystem, the best indicator reaches 80.2% in the academic qualifications of teachers, in the achievement network development ecosystem. The best result was in the scientific field network collaboration category at 39.6%, and in the leadership development ecosystem, the best result was in the service management indicator at 48.5%.

This data shows that the quality of education in Indonesia is significantly and well monitored. Even though it does not provide instant change, through a continuous learning system it is hoped that it will always provide developments in the quality of education that are in line with the direction of education in Indonesia. These results are in line with SDG target 4, which emphasizes the importance of quality education that is inclusive, fair, and can always encourage lifelong learning for all people in Indonesia.

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