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## Research Paper

# EFL Teachers' Technological Pedagogical Knowledge (TPK) and Ecological Agency in Responding to the Differentiated Learning Policy in Indonesia

Bambang Yudi Cahyono<sup>1</sup>, Priyatno Ardi<sup>2</sup>, Yohanis Nurak Siwa<sup>3</sup>, Rina Sari<sup>4</sup>, & Rohfin Andria Gestanti<sup>5</sup>

<sup>1</sup>Department of English, Universitas Negeri Malang, Malang, Indonesia; [bambang.yudi.fs@um.ac.id](mailto:bambang.yudi.fs@um.ac.id)

<sup>2</sup>Corresponding author; English Language Education Study Program, Universitas Sanata Dharma, Yogyakarta, Indonesia; Department of English, Universitas Negeri Malang, Malang, Indonesia; [priyatnoardi@usd.ac.id](mailto:priyatnoardi@usd.ac.id)

<sup>3</sup>English Language Education Study Program, Universitas Katolik Widya Mandira, Kupang, Indonesia; Department of English, Universitas Negeri Malang, Malang, Indonesia; [yohanis.nurak.2202219@students.um.ac.id](mailto:yohanis.nurak.2202219@students.um.ac.id)

<sup>4</sup>English Literature Study Program, Universitas Islam Negeri Maulana Malik Ibrahim, Malang, Indonesia; Department of English, Universitas Negeri Malang, Malang, Indonesia; [rinasari@bsi.uin-malang.ac.id](mailto:rinasari@bsi.uin-malang.ac.id)

<sup>5</sup>Communication Science Department, Universitas Muhammadiyah Ponorogo, Ponorogo, Indonesia; Department of English, Universitas Negeri Malang, Malang, Indonesia; [rohfinigestanti@umpo.ac.id](mailto:rohfinigestanti@umpo.ac.id)

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## Abstract

This study aimed to examine the relationship between EFL teachers' technological pedagogical knowledge (TPK) and ecological agency in responding to the differentiated learning policy in Indonesian high schools. A quantitative research design was employed, using a survey of EFL teachers in Indonesian high schools. A questionnaire gauging EFL teachers' TPK, ecological agency, and differentiated instruction practice was distributed online to 83 teacher participants. Results showed that the teachers possessed high levels of TPK, ecological agency, and differentiated learning implementation. Furthermore, TPK and ecological agency were strongly correlated with differentiated learning implementation, with teachers' ecological agency having a more significant impact on promoting differentiated instruction. Findings suggest that EFL teachers in Indonesia need to continue improving their professional development to enhance the quality of the implementation of differentiated learning in EFL teaching and learning.

**Keywords:** Differentiated Learning; Ecological Agency; EFL Teachers' Professional Development; Technological Pedagogical Knowledge (TPK).

## 1. Introduction

Students of English as a foreign language (EFL) come from diverse social and cultural backgrounds, speak different languages, practice various religions, and have varying economic circumstances due to the country's abundant natural and cultural resources. This diversity is a valuable resource that can be utilized to develop the future generation to their fullest potential (Hasanah et al., 2022). In Indonesia, in particular, the government has enacted a new policy related to differentiated instruction in response to learners' characteristics and diversity. Indonesian students need to meet the criteria of the "Pancasila student profiles" (*Profil Pelajar Pancasila*). These profiles bear the Pancasila (The Five Principles) national ideology which becomes the foundation of the country. One of the profiles is global diversity. It entails that Indonesian students uphold their noble culture, locality, and identity and maintain an open mind when interacting with other cultures to foster a sense of respect for one another and the potential for the development of a noble culture that is constructive and does not conflict with the nation's noble culture (Indawati, 2022; Subiyantoro et al., 2023). The knowledge and appreciation for culture, intercultural communicative abilities, and reflection on and accountability for the experience of diversity are all components and keys to global diversity (Batunan et al., 2023; Iswandari & Ardi,



2022). In Indonesia, differentiated instruction is particularly relevant in EFL classrooms as English is learned as a foreign language by students with varying levels of competency, learning styles, and cultural backgrounds.

Differentiated instruction has gained popularity since teachers have realized that not all students can benefit from a standardized approach to instruction. As the notion refers to the instructional strategies that teachers employ to address students' diverse needs and unique differences (Kahmann et al., 2022; Reis & Renzulli, 2018), teachers have increasingly embraced differentiated instruction as a more effective teaching method, allowing them to modify their teaching methods and materials to meet students' individual learning needs and preferences. By implementing differentiated instruction, teachers can help students achieve better academic success (Ismail, 2019; Rafi & Pourdana, 2023). This approach involves modifying what is taught and how it is taught to match students' diverse learning needs (Tomlinson, 2003). Moreover, Tomlinson (2014) argues that differentiated instruction can promote student involvement and motivation, which can further enhance academic performance and achievement. Despite the effectiveness of differentiated instruction, numerous researchers have identified barriers that impede its implementation in the classroom. Some of these barriers include an unsupportive school administration and a lack of necessary resources (Gibbs, 2023; Holloway, 2000; Jager, 2016), and a highly standardized curriculum that often forces teachers to focus on the curriculum rather than on students' individual needs (Grecu, 2023; Tomlinson, 2000). Moreover, teachers' personal teaching beliefs, as well as a lack of knowledge and expertise or training in differentiated instruction, also hinder its adoption (Page, 2000; Suprayogi et al., 2017; Wan, 2016). Tomlinson (2005) has acknowledged the apprehensions that teachers have about the feasibility of integrating differentiated instruction in their classrooms. Indeed, it is undeniable that the successful implementation of differentiated instruction cannot be separated from teacher-related issues.

The issues of EFL teachers' technological pedagogical knowledge (TPK) and ecological agency are paramount in the practices of differentiated instruction in English classes. It is obvious that the proliferation of technologies accelerates the success of the implementation of differentiated instruction as they can help students to learn based on their individual characteristics and differences. However, the success of using technology in EFL classrooms depends much on EFL teachers' TPK, that is, teachers' understanding of how teaching and learning change due to the use of technologies in certain ways (Koehler & Mishra, 2009), and EFL teachers' agency, referring to teachers' willingness and ability to adapt their teaching approaches by using available technological tools as a response to the new educational policy (Gao & Tao, 2020; Kayi-Aydar, 2019; Sang, 2020). Hence, the teachers who possess TPK know how to make use of technology to facilitate learning, whereas teachers with the agency are empowered to experiment with new technologies to meet student's individual needs and differences. Without these essential competencies, teachers may struggle to use technological tools effectively and fail to provide their students with the personalized instruction they need to succeed. Therefore, EFL teachers play a crucial role in the implementation of differentiated instruction as they are agentic and active in making informed decisions in their professional context, enacting the interplay between their beliefs, previous experiences, and future goals, and the development of TPK and agency to enhance the practice of differentiated instruction and improve student learning outcomes (Priestley et al., 2015; Tao & Gao, 2021).

Numerous studies on the development of teachers' TPK and agency have been conducted (Mashhadi et al., 2023; Peng, 2023; Raygan & Moradkhani, 2022; Tan et al., 2019; Valtonen et al., 2010). However, the studies only focused on teachers' TPK and agency individually and were mainly related to teaching knowledge in general educational settings. The exploration of TPK and the agency that complies with the differentiated learning policy has not received adequate attention. Molla and Nolan (2020) argue that teachers' professionalism in seeking learning opportunities, including developing the knowledge of using technology and addressing educational disadvantages, are among several professional facets of teachers' agency. This indicates that assessing teachers' TPK and agency is demanding and of current importance. Underpinned by this background, this study intends to examine how EFL teachers perceive their TPK and also ecological agency in responding to the differentiated learning policy in Indonesia. Moreover, it seeks to determine the extent to which EFL teachers' TPK and ecological agency enable them to facilitate and promote the practice of differentiated learning in EFL classrooms. The research questions are as follows:

- How do EFL teachers perceive their TPK, ecological agency, and differentiated learning?
- To what extent do EFL teachers' TPK and ecological agency assist them in promoting differentiated learning?

## 2. Literature Review

### 2.1. Differentiated Learning

Because in any given classroom students display a diverse range of skills and learning needs, teachers have to be ready for these differences and provide differentiated instruction to accommodate the needs of each student. Differentiation refers to the attempt of teachers to deal with learner variations in the classroom through multiple approaches that match the individual needs of students (Reis & Renzulli, 2018). In a differentiated instruction setting, teachers provide students with specific choices, enabling them to learn as deeply and quickly as possible, without the assumption that every student follows the same learning trajectory (Tomlinson, 2014). Notably, studies have indicated that implementing differentiated instruction positively impacts students' academic achievement (Smale-Jacobse et al., 2019; Valiandes, 2015).

Modifying Tomlinson's (2005) model, Santangelo and Tomlinson (2012) propose a model of differentiated instruction. The modified model provides four key components of differentiated instruction, namely learning environment, content, process, and product. The first component, the learning environment, has to do with the physical, social, and emotional setting in which learning takes place. In this vein, teachers differentiate the learning environment by establishing a classroom setting that accommodates the various requirements and preferences of every student. The second one, content, refers to the materials that students learn as well as ways students access the learning materials. Most of the time in differentiated classrooms, what is taught remains the same for all students, with variances focusing on how students acquire the materials based on their unique needs. The third component, process, encompasses how students learn and comprehend the material. In this respect, teachers diversify instruction by offering a variety of learning activities that let their students interact with the information in different ways. The last component, product, relates to the ultimate result that students produce to show that they understand the subject matter. In this regard, teachers differentiate their students' work by giving them a variety of ways to show what they have learned.

Santangelo and Tomlinson (2012) also advocate that teachers should consider students' readiness, interests, and learning profiles when planning differentiated lessons. First, readiness deals with a student's preparedness or capacity to participate in a specific learning activity. The readiness differentiation aims to ensure that all students receive learning experiences that are properly challenging, based on each student's unique readiness demands. Next, interest refers to students' personal curiosity and passion. Considering students' interest in the instruction can promote their engagement and motivation, which can lead to deeper learning. Last, the learning profile relates to students' learning styles. To address various learning profiles, teachers might vary instruction by offering a variety of instructional modalities, such as visual aids, group work, or independent study.

Differentiated learning is a key indicator of effective teaching (Kahmann et al., 2022), which involves teachers adjusting the curriculum objectives, teaching strategies, resources, learning activities, and student outcomes to ensure that every student in a classroom receives the optimal opportunity for learning (Tomlinson et al., 2003). Given that the implementation of differentiated instruction is greatly influenced by teachers' pedagogical skills, willingness, and capacity to employ contemporary teaching technologies (Kara, 2020; Tao & Gao, 2022), it is crucial for teachers to actively engage in professional development programs centered on differentiated learning in order to foster their TPK and agency (Hinojosa, 2022; Shareefa, 2023).

### 2.2. Technological Pedagogical Knowledge (TPK)

Teacher professional development (TPD) is a broad issue that is still receiving great attention from researchers and practitioners. Conceptually, TPD refers to the ongoing process of learning and improving teachers' knowledge, skills, and practices to boost their teaching effectiveness in the classroom through formal or informal learning communities among teachers (Ardi et al., 2023; Ardi, Sari et al., 2023; Desimone, 2009; Guskey, 2002). TPD is basically conducted as an attempt to promote teachers' knowledge and competencies by encompassing a wide range of areas covering the subject matter, teaching methods, the use of teaching aids, and the like, with particular characteristics of its effectiveness that teachers need to comply with (Hunzicker, 2011; Sims & Fletcher-Wood, 2021). Formerly, it is assumed that teachers' professionalism in teaching is represented by the ability to deliver the lessons and the commitment to provide comprehensive learning experiences. Thus, TPD usually focuses on content and pedagogical knowledge (Driel & Berry, 2012; Mohammed & Gutema, 2023). However, as the TPACK concept is widely utilized and language learning is

becoming more digital, technological knowledge is essential to consider. Some scholars argue that rather than concentrating on content that teachers have mastered and chosen to specialize in since their preservice period, it is more pressing to delve into the enhancement of TPK (Paidican & Arredondo, 2022).

Teachers' pedagogy and their ability to use technology can change due to various factors, including educational policies and rapid advancements in technological development (Valtonen et al., 2010). Given that teachers' TPK enhances students' learning (Lin et al., 2022), it is vital to closely examine this aspect of their expertise. As society becomes increasingly digital, teachers must possess the skills to seamlessly integrate technology into their classrooms. This integration hinges on their TPK, a core component of the TPACK framework. TPK is defined by Koehler and Mishra (2009, p. 65) as:

Knowledge of how teaching and learning might change when specific technologies are employed in specific ways. In order to do this, one must be aware of the pedagogical benefits and limitations of a variety of technological instruments in relation to discipline and developmentally appropriate educational designs and tactics.

Mishra and Koehler (2006) believe that technological knowledge (TK) and general pedagogical knowledge (PK) are essential for comprehending TPK. The knowledge of learning and instruction, classroom structure and management, and learner characteristics refers to the domain-general knowledge of teaching that researchers refer to as PK (e.g., Voss et al., 2011). TK is labeled by Mishra and Koehler (2006) as "knowledge about both conventional technologies, [...], and more cutting-edge technologies, such as the Internet and digital video" (p. 1027).

As information and communication technology (ICT) utilization is driven by teachers' pedagogical approaches to instruction and learning, not by the ICT equipment itself (Tondeur et al., 2017), teachers must be able to link the instructional techniques they employ to the technology they wish to implement (Hew & Brush, 2007; Saputra & Margana, 2023). Using their academic reasoning, teachers draw this relationship. To successfully achieve particular learning objectives, their pedagogical practices and professional judgment must coincide (Heitink et al., 2016; Koehler & Mishra, 2008; Koehler et al., 2007). The instructional methods are influenced by regional contextual factors (Phillips & Phillips, 2016), such as ICT infrastructure, time, curricular needs, and students' socioeconomic circumstances.

Schmidt et al. (2009) propose a framework that could be employed to examine TPK. The model comprehensively covers all seven aspects of TPACK, namely TK, content knowledge (CK), PK, pedagogical content knowledge (PCK), technological content knowledge (TCK), TPK, and technological pedagogical content knowledge (TPACK). Such specification enables teachers and researchers to examine particular aspects of the framework more deeply. In line with the goal of this study, that is, examining teachers' perceptions of their knowledge related to technology use and their ability to respond to differentiated learning policies, the TPK aspect of Schmidt et al.'s (2009) TPACK framework is adopted as foundational. Additionally, the framework sheds light on the intricacies of technological and pedagogical judgments, offering insights into their practical implementation and resulting implications. Such judgments significantly influence teachers' instructional decisions, which in turn shape the pedagogical methods employed in classrooms. While the role of TPK in facilitating the use of various strategies for differentiated learning has been underexplored, some studies have leveraged the TPACK framework to advocate for differentiated instruction (Graham et al., 2012). This framework offers a practical solution to challenges teachers face when integrating technological tools into their classrooms (Kurt, 2018).

### 2.3. Language Teacher Agency: An Ecological Perspective

The notion of language teacher agency has been a prominent topic in TPD. It encapsulates that language teachers adapt to challenging teaching situations and adjust their teaching approaches and methods to meet the changes in teaching requirements and educational settings (Gao & Tao, 2020; Kayi-Aydar, 2019; Sang, 2020). It also emphasizes that teachers are critical agents in enacting educational policies, who apply them in their teaching practices and provide the students with ample learning opportunities (Ghamoushi et al., 2022; Priestley & Drew, 2019). In recent years, there has been growing research that investigates the topic of language teacher agency (e.g., Davis & Howlett, 2022; Kayi-Aydar et al., 2019; Miller et al., 2018; Tao & Gao, 2021). Generally, teacher agency is conceptualized as the power to act due to sociocultural influences (Ahearn, 2001), reflecting teachers' efforts to adapt their pedagogical practices due to the changing educational policy. Thus, it stems from the dynamic interaction between the individual teachers and their

environment. In this regard, teachers' personal beliefs, past experiences, and future goals interact with their environment, and they are accumulated in the manifestation of their agency (Priestley et al., 2015; Tao & Gao, 2021).

Language teacher agency is heavily influenced by the interplay between individuals and environments. As teacher agency is seen from the broad environment of teachers' lives, an ecological approach to language teacher agency has been used to frame teacher agency research (Li & De Costa, 2019; Tao & Gao, 2021; Vitanova, 2018). The ecological approach to teacher agency differs from other approaches in that it emphasizes the interplay between teachers' individual capacities and the sociostructural and material conditions in which they act (Leijen et al., 2020; Priestley et al., 2015). The perspective highlights that the affordances and restrictions that teachers face in their profession have an impact on their agency and the interaction of teacher selves and environment fosters their agentic ways of being and doing (Davis & Howlett, 2022). Moreover, an ecological approach to language teacher agency recognizes that teachers are not passive actors but active agents who make choices and decisions within their context. The approach considers the complex relationships between teachers, learners, curriculum, materials, assessment, institutional policies, and social and cultural norms. This perspective suggests that the development of language teacher agency is not an individualistic endeavor, but rather a socially and culturally mediated process.

To accommodate the ecological approach to language teacher agency, Priestley et al. (2015) propose three ecological dimensions of teacher agency, namely iterative, projective dimensions, and practical-evaluative. The three dimensions are crucial in understanding teacher agency in the school context. First, the iterative dimension involves teachers reflecting on their life and professional histories, including their beliefs, capacities, and values. Second, the projective dimension focuses on teachers' short- and long-term goals related to their beliefs, capacities, and values. Lastly, the practical-evaluative dimension refers to evaluating different contextual factors affecting teacher agency, including the cultural, structural, and material conditions and resources in the school that lead to the enactment of the agency. Hence, the three dimensions of ecological teacher agency highlight the complexity of teacher agency and how the interconnectedness between individual and contextual factors shapes it. By taking an ecological perspective, it is possible to understand how teachers exercise agency and how it can be fostered and supported in different contexts. Figure 1 visually illustrates the triadic relationship among the three dimensions in the enactment of teacher agency. Drawing on Priestley et al. (2015), Ghamoushi et al. (2022) further develop an inventory to gauge EFL teachers' ecological agency:

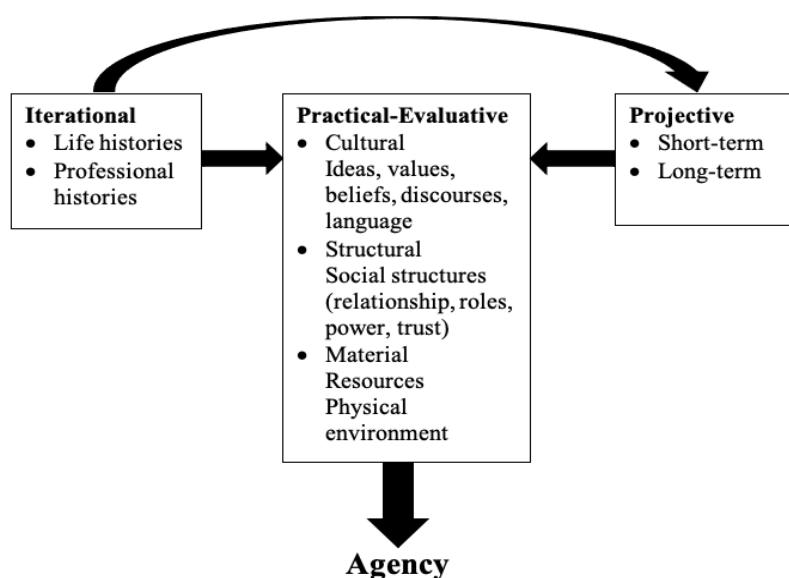


Figure 1. Teachers' Ecological Agency Model (Priestley et al., 2015, p. 30)

Accordingly, the agency that the teachers exercise in the school has a significant role in facilitating differentiated learning for their students. Through their agency, teachers can create and implement lesson plans that cater to the diverse learning needs of their students. The teachers can create a variety of activities, materials, and assessments to provide students with personalized learning experiences since differentiated learning recognizes that each student has unique

learning needs (Tomlinson, 2014). In this regard, they adapt their teaching strategies to meet the individual learning styles of their students, which can lead to improved learning outcomes. Overall, teachers' agency is critical in facilitating differentiated learning and creating an inclusive learning environment that promotes academic success for all students (Smale-Jacobse et al., 2019).

### 3. Methodology

#### 3.1. Research Design

To address our research objectives, we surveyed EFL teachers' perceptions of their TPK and ecological agency in responding to the differentiated learning policy in Indonesia. Thus, the study used a cross-sectional design. According to Cohen et al. (2007), a cross-sectional design creates a "snapshot" of a population at a specific period. This design entails acquiring data from research participants within a single timeframe or a short period and typically involves collecting data from categories or groups of individuals. It was used to investigate how the EFL teachers perceive their pedagogical knowledge, ecological agency, and differentiated learning, and to what extent their TPK and agency assist them in promoting differentiated learning.

#### 3.2. Context and Participants

This study was situated in the Indonesian EFL context, in which the differentiated learning policy has been established in the educational system. The participants were 83 EFL teachers from 81 Indonesian senior or vocational high schools, who have implemented differentiated instruction in their classes. They included 17 males and 66 females, whose teaching experiences ranged from 4 to 24 years. The majority of the participants were between the ages of 25-59 with an average of 40 years. We employed convenience sampling to choose the participants through WhatsApp groups. An online questionnaire was distributed to the participants and the first 83 participants who responded to the questionnaire within an allocated time were included as the participants. Detailed information about the participants is shown in Table 1:

Table 1. *Teachers' Demographic Information*

	Age		Years of Teaching				School Levels				Gender	
	<i>N</i>	%	<i>N</i>	%		<i>N</i>	%		<i>N</i>	%		
25-35 years	24	28.92	Less than 5 years	9	10.8	SMP	47	56.6	Female	66	79.5	
36-45 years	36	43.37	5-10 years	13	15.7	SMA	14	16.9	Male	17	20.5	
46-55 years	17	20.48	More than 10 years	61	73.5	SMK	22	26.5				
56-58 years	6	7.23										

Notes: SMP: Junior High School; SMA: Senior High School; SMK: Vocational High School

#### 3.3. Instruments

We employed an online questionnaire to collect the data from the participants. The items of the questionnaire were adapted from Schmidt et al. (2009), Ghamoushi et al. (2022), and Santangelo and Tomlinson (2012). The instrument contains 39 items on the Likert scale, consisting of 5 TPK items, 18 TEA items, and 17 DL items. The answer to each item is based on a 5-level Likert Scale: (1) Strongly disagree; (2) Disagree; (3) Neutral; (4) Agree; and (5) Strongly agree. Moreover, some questions for gaining respondents' demographic information are also included in the instrument. The items of the questionnaire are displayed in the Appendix.

#### 3.4. Data Collection and Analysis

The participants were asked to fill in the adapted Likert-scale questionnaire distributed online. The Likert-scale questionnaire is used to measure teachers' perceptions of their TPK and ecological agency and its correlation to their perceived implementation of differentiated learning. The participants responded to the questionnaire by indicating the option on the 5-point scale.

The gathered data were statistically analyzed. The validity and reliability of the questionnaire were statistically measured through item analysis using Cronbach's alpha and Pearson correlation. All-composite validity coefficients were

.975, indicating that all the items were valid and reliable. Therefore, descriptive statistics including frequencies, percentages, average scores, and inferential statistics were next performed to investigate the participants' perception of TPK and ecological agency towards differentiated learning. The interpretation of the quantitative data analysis was also performed to provide additional elaboration on what perceptions the teachers had regarding their TPK and ecological agency when it deals with differentiated instruction.

## 4. Results

### 4.1. Levels of Teachers' TPK, Ecological Agency, and Differentiated Learning Implementation

The first research question investigated how the EFL teachers perceived their TPK, ecological agency, and differentiated learning implementation. We administered five items to gauge the teachers' TPK. The results of the descriptive analysis of the teachers' TPK revealed that the mean value of the teachers' TPK was 4.23. It indicates that the average score on this scale was above the midpoint of the scale. In other words, the teachers' TPK had a value above the average. The *SD* of the construct was .71, which means that the score values of the construct were tightly clustered around the mean and there was less variability in the score values. The findings are presented in Table 2:

Table 2. *Teachers' TPK Levels*

Scale	Aspect	Mean	<i>SD</i>
Total	TPK	4.23	.71

To assess the teachers' ecological agency, we employed 18 items in the questionnaire, which were categorized into iterational, projective, and practical-evaluative aspects. Table 3 presents the results of the descriptive analysis of the teachers' ecological agency levels. It was found that the overall ecological agency levels of the teachers were generally high. The overall mean score of the construct (4.15) indicates that the teachers' ecological agency was above the average level. It suggests that the teachers were likely to be proactive in making decisions and changes that have a beneficial influence on the learning environment. The *SD* of .62 showed that there was less variability in the score values. Furthermore, we computed descriptive statistics for each aspect of ecological agency. The analysis revealed that the mean scores of iterational, projective, and practical-evaluative aspects were 4.14, 4.20, and 4.09, respectively. The scores suggest that the aspects held values above the average:

Table 3. *Teachers' Ecological Agency Level*

Level of Ecological Agency			
Scale	Aspects	Mean	<i>SD</i>
	Iterational (6 items)	4.14	.13
	Projective (6 items)	4.20	.18
	Practical (6 items)	4.09	.18
Total		4.15	.62

We used 16 items in the questionnaire to assess the EFL teachers' levels of differentiated learning implementation in their classes. The questionnaire covers four aspects of differentiated learning, namely readiness with 5 items, learning profile with 3 items, learning environment with 3 items, and process/product with 5 items. The results of the descriptive analysis show that the level of the teachers' differentiated learning implementation was high, indicated by the high mean (4.14). It entails that the teachers had implemented the differentiated learning policy in their EFL classes. Besides, the *SD* of .68 showed that there was less variability in the score values. In addition, the analysis revealed that the means of each aspect were high with readiness being 4.22, learning profile being 4.18, the learning environment being 4.06, and process/product being 4.09:

Table 4. *Teachers' Levels of Differentiated Learning Implementation*

Levels of the Differentiated Learning Implementation			
Scale	Aspects	Mean	<i>SD</i>
	Readiness (5 items)	4.22	.09
	Learning Profile (3 items)	4.18	.09
	Learning Environment (3 items)	4.06	.09
	Process/Product (5 items)	4.09	.12
Total		4.14	.68

#### 4.2. Correlation Between Teachers' TPK and Ecological Agency in Responding to the Differentiated Learning Policy

The second research question investigated to what extent the teachers' TPK and ecological agency could relate to the differentiated learning policy. To further examine whether the EFL teachers' TPK and ecological agency were correlated to differentiated learning and had a significant correlation, Pearson correlation analysis was employed. The statistical analysis revealed that a positive correlation was found between the teachers' TPK and ecological agency toward the differentiated learning policy. Whereas TPK and differentiated learning had a significant coefficient of .695, ecological agency and differentiated learning had a significant coefficient of .877. As the coefficient was close to 1, the correlation between the teachers' TPK and ecological agency towards differentiated learning was strong. Besides, the statistical analysis revealed that the significant value for TPK and the ecological agency was at  $p < 0.05$ , indicating that there was a significant correlation between TPK and differentiated learning as well as between agency and differentiated learning, as displayed in Table 5:

Table 5. Correlation Analysis for Teachers' TPK and Ecological Agency in Responding to Differentiated Learning

Scales	Differentiated learning Total	TPK Total	Agency Total
Differentiated Learning Total	1.00	.695**	.877**
TPK Total	.695**	1.00	
Agency Total	.877**		1.00

In Table 5, the positive significant coefficient of TPK and agency represented the linear correlation of those two variables with differentiated learning. This means that when the teachers' perception of TPK increased, their perception of differentiated learning also increased. This also applies to the correlation between agency and differentiated learning. Moreover, the significant coefficient of the EFL teachers' ecological agency (.877) was higher than that of TPK (.695). This indicates that the teachers' agency had a higher correlation and bigger contribution in assisting students' learning in differentiated learning.

The differences in  $t$  values of the TPK, agency, and differentiated learning across gender and teaching experiences are shown in Table 6:

Table 6. Differences in TPK and Ecological Agency in Responding to Differentiated Learning Across Gender and Teaching Experiences

Demographic Characteristics	TPK			Agency			Differentiated Learning		
	$M$	$t$	$Sig.$	$M$	$t$	$Sig.$	$M$	$t$	$Sig.$
Gender									
Male	4.40			4.15			4.12		
Female	4.18	1.989	.269	4.4	1.989	.962	4.14	1.989	.938
Teaching Experience									
< 5 years	4.20			4.00			4.14		
5-10 years	4.36	0.293	.746	4.15	0.284	.752	4.32	1.439	.243
> 10 years	4.20			4.16			3.82		

Table 6 displays the differences in TPK, agency, and differentiated learning across gender and teaching experiences. The results revealed that the TPK of the participants was not significantly different across gender ( $p = .269$ ) and teaching experiences ( $p = .746$ ). However, higher TPK were noted in the males ( $M = 4.40$ ) and the participants whose teaching experiences were between 5-10 years ( $M = 4.36$ ).

Similar to TPK, the results disclosed that the ecological agency of the participants was not significantly different across gender ( $p = .962$ ) and teaching experiences ( $p = .752$ ). Even though it was not significant, it was further indicated that higher agency was seen in the male participants ( $M = 4.15$ ) and the participants with 5-10 years ( $M = 4.15$ ) and more than 10 years of teaching experience ( $M = 4.16$ ). Last, the statistical analysis for differentiated learning showed no significant differences across gender ( $p = .938$ ) and teaching experiences ( $p = .243$ ). However, the average scores were considered similar between the male and female participants ( $M = 4.12$  and  $M = 4.14$ , respectively). Meanwhile, the participants with 5-10 years of teaching experience ( $M = 4.32$ ) hold higher average scores than the others. Overall, it can be inferred that gender and teaching experiences do not significantly contribute to the teachers' perceptions of TPK and



agency in responding to differentiated learning. However, the trend suggests high TPK, agency, and differentiated learning levels are noted in the male teachers with 5-10 years of teaching experience.

## 5. Discussion

### 5.1. Teachers' TPK, Ecological Agency, and Differentiated Learning Implementation

The analysis showed that the teachers had a high overall perception of their TPK, ecological agency, and differentiated learning instruction. The high perception of TPK among Indonesian EFL teachers can be attributed to their previous exposure to technological tools and their eagerness to explore and learn about new digital tools (Aisyah et al., 2021; Ningsih et al., 2022). It is obvious that the integration of technology into language education has been gaining more attention worldwide, and Indonesia is no exception. Recently, the Indonesian Ministry of Education of the Republic of Indonesia has emphasized the importance of technology integration in language teaching (Kristiawan et al., 2022). As a result, more and more teachers are embracing it. Furthermore, the COVID-19 pandemic accelerated technology integration in language education since many classes had to switch to online platforms due to the social distancing policy.

The sudden transition from offline classes to online teaching became a significant challenge for Indonesian EFL teachers, but it also encouraged them to explore and experiment with various new digital tools that can be used in EFL teaching and learning (cf. Aisyah et al., 2021; Ardi & Rianita, 2022; Ningsih et al., 2022; Sugianto & Muslim, 2022; Tutyandari et al., 2022). At the same time, many EFL teachers in Indonesia proactively attended professional development programs, such as workshops and seminars, to improve their technological literacy and understanding of integrating technology in their classes (Hidayat et al., 2023; Kristiawan et al., 2022). Through these programs, they gained knowledge and skills in utilizing various digital tools, such as learning management systems, online collaboration tools, gamification, and multimedia applications. Moreover, they also learned how to design and implement technology-enhanced learning activities aligned with their learning objectives and students' needs (Cahyono et al., 2023; Kristiawan et al., 2022). Accordingly, the COVID-19 pandemic was a blessing in disguise as it pushed Indonesian EFL teachers to explore and embrace new digital tools in their classes, resulting in an increased familiarity with technology and an enhanced understanding of TPK. This perception is in line with previous research that has shown that teachers' belief in their technological abilities can positively influence their actual use of technology in the classroom (e.g., Aisyah et al., 2021; Cahyono et al., 2023; Kristiawan et al., 2022; Ningsih et al., 2022).

Furthermore, the analysis revealed that Indonesian EFL teachers had a good perception of ecological agency. Ecological agency refers to the teacher's ability to adapt and respond to changes in their school environment, including the use of technology (Gao & Tao, 2020; Kayi-Aydar, 2019; Sang, 2020). As the pandemic required teachers to be more adaptable and creative in their teaching methods, the high perception of ecological agency among Indonesian EFL teachers indicates that they have been able to respond effectively to these challenges and anticipate potential challenges related to using technology in the classroom, such as connectivity issues, and having a plan in place to address them (Aryani et al., 2022; Kristiawan et al., 2022). It might also involve identifying opportunities to enhance students' learning through the use of technology, such as by incorporating online multimedia resources, gamification, or collaboration tools into English lessons (Ningsih et al., 2022).

Among the three aspects of ecological agency, the projective aspect was the highest. It indicates that the teachers possessed a high level of short- and long-term goals related to their beliefs, capacities, and values (Ghamoushi et al., 2022; Priestley et al., 2015). The EFL teachers could imagine and project a future state of themselves as agents who actively promote sustainability in their teaching practices and envision a future where they are making a positive impact through their teaching practices (Davis & Howlett, 2022). They are also able to take concrete steps toward achieving their goals by proactively seeking out information about best practices and engaging in ongoing professional development to improve their knowledge and skills (Ghamoushi et al., 2022; Kristiawan et al., 2022; Priestley et al., 2015). Moreover, the projective aspect of ecological agency encourages EFL teachers to collaborate with colleagues, students, and community members to promote innovative learning in their classrooms and beyond (Kayi-Aydar, 2019). Through collaborative and collective actions, they can have a more significant impact and contribute to a more sustainable future for their school communities.

Finally, the analysis also showed that the Indonesian EFL teachers had a good perception of differentiated instruction. Differentiated instruction refers to a teaching approach that considers the diverse learning needs, interests, and abilities of students in the classroom (Tomlinson, 2014). The good perception of differentiated instruction among Indonesian EFL teachers suggests that they are aware of the importance of adapting their instructions to meet the needs of individual students, and they have developed the skills and knowledge to do so effectively (Glas et al., 2023). This may involve using a variety of teaching strategies, such as using multimedia resources, providing additional support for struggling students, or providing enrichment activities for advanced learners.

Teachers' readiness received the highest score among the four aspects of differentiated instruction. This indicates that teachers are committed to providing all students with appropriately challenging learning experiences based on their individual readiness requirements (Santangelo & Tomlinson, 2012). Therefore, teachers' readiness to personalize learning activities plays a crucial role in determining students' acceptance of differentiated instruction. While considering students' interests and learning profiles is essential, readiness should be given priority as it reflects the teachers' underlying belief in implementing differentiated instruction (Gheysens et al., 2022).

## 5.2. Teachers' TPK and Ecological Agency in Responding to Differentiated Learning

The statistical computation showed that there was a significant positive correlation between TPK and differentiated learning as well as between the teachers' ecological agency and differentiated learning. It means that the higher teachers' TPK level, the higher their perception towards differentiated learning. The same goes for the teachers' ecological agency. To be able to assist students in differentiated learning, teachers are supposed to be prepared with teaching-related knowledge and willingness to take actions in their teaching activities that are supported by their ability to utilize technology (Glas et al., 2023). There was evidence that technological-supported pedagogical knowledge enabled teachers to provide students with various, meaningful learning options by which the teachers could consider the students' learning path in obtaining the intended learning outcomes (Wekerle et al., 2022). Moreover, teachers with a high level of agency feel empowered to make decisions about their teaching and employ it to set differentiated learning as they are able to tailor their instructions to meet the diverse needs of their students (Kristiawan et al., 2022). Once they are combined, TPK and agency can lead to more effective differentiation in the classroom. The teachers having considerable TPK and agency could use and decide well what technology and other resources to use to personalize learning experiences for students as well as when and how to use the resources (Glas et al., 2023; Kristiawan et al., 2022).

Based on the teachers' perceptions of their TPK and ecological agency in response to the differentiated learning policy, it was found that both TPK and agency were highly perceived by the teachers, and both of them had a positive correlation with differentiated learning. However, it was also found that teachers' ecological agency had a stronger correlation with differentiated learning than TPK. One potential reason for this could be that the agency held by teachers is influenced and enhanced by various factors, including their ability to use technology and their justification for employing such learning resources (Aisyah et al., 2021; Ningsih et al., 2022). In their study, Kim et al. (2022) also found that technology issues were among the challenges of teachers' agency enhancement. Therefore, when the teachers feel fully empowered to take agentic actions in their instruction, it is believed that they also understand how to integrate technology into their classes to support teaching and learning activities (Cahyono et al., 2023; Kristiawan et al., 2022).

Among the factors that may influence teachers' ecological agency in responding to the differentiated learning policy, EFL TPD becomes the foremost factor that should be considered as teachers receiving better professional development seem to be more confident in carrying out the learning activities and giving instructional materials needed by students individually (Kara, 2020; Tao & Gao, 2022). Besides, as differentiated learning requires a deep understanding of students' needs, interests, and learning styles or strategies, teachers' agency plays a bigger role in enhancing the teachers to make decisions according to students' situations and conditions (Priestley & Drew, 2019). While TPK is essential in terms of integrating technology into instructions, teachers' ecological agency that allows them to justify the technological enhancement is more significant in assisting students learning to be more personal (Glas et al., 2023; Kristiawan et al., 2022). Simply, it can be inferred that TPK is an integral part of the agency and it contributes to the higher significance of the correlation held by the teachers' ecological agency.

## 6. Conclusion

The present study investigated the levels of EFL teachers' TPK, ecological agency, and differentiated learning implementation. It involved secondary school EFL teachers from across the nation with diverse backgrounds. The results showed that teachers had a high level of TPK, ecological agency, and differentiated learning implementation. Whereas teachers' favorable perception of TPK can be attributed to their exposure to technology and eagerness to learn about new digital tools, their perception of ecological agency indicates that the teachers were adaptable and able to respond effectively to the changes in their school environment. The perception of differentiated instruction suggests that the teachers were aware of the importance of tailoring their instruction to meet the diverse needs of their students and have developed the skills and knowledge to do so effectively. In terms of the correlation between TPK, ecological agency, and differentiated learning, the analysis revealed a significant relationship between TPK and ecological agency in the implementation of differentiated learning. However, compared to TPK, the teachers' ecological agency showed a stronger correlation, indicating that it played a greater role in promoting differentiated instruction.

Despite offering valuable insights, this study is not without any limitations. As this study focused on how the teachers perceived their current TPK and agency in responding to differentiated learning policy, one limitation was whether the teachers had previously received professional development programs related to TPK, agency, or differentiated instruction. The participating teachers come from various schools, which might have different instructional leadership and policies on EFL teaching (cf. Riyadi et al., 2023; Stroupe et al., 2023). These policies could influence technological affordances in the classroom and the degree of agency teachers feel when implementing differentiated learning. Thus, whereas this study established a correlation between TPK, ecological agency, and differentiated learning policy, it could not determine the causal relationship among them.

This study suggests that EFL teachers should be encouraged to increase their TPK and ecological agency to facilitate differentiated learning implementation. Schools can provide professional development programs to enhance the teachers' TPK and ecological agency. Moreover, the study highlights the importance of differentiated learning implementation in EFL classes, which can lead to better learning outcomes for students. Thus, schools and teachers should consider incorporating differentiated learning policies in their teaching practices. As the findings revealed that TPK, ecological agency, and differentiated instruction practices were interrelated, teachers are supposed to enhance the development of these aspects in an integrated way. This study can also be replicated in other educational settings to further explore the levels of TPK, ecological agency, and differentiated learning implementation. Based on the findings, insights can be used to inform policymakers and stakeholders in education and improve the quality of EFL teachers by facilitating them to be both more technologically knowledgeable and agentive in their instructional approaches.

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## Conflict of Interest

The authors declare that there is no conflict of interest.

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## Appendix

### Questionnaire of Teachers' TPK and Agency in the Differentiated Learning Implementation

**Directions:** To respond to this questionnaire, please choose one of five options in each item which is suitable to your own situation and condition. 1: Strongly disagree, 2: Disagree, 3: Neutral, 4: Agree, 5: Strongly Agree



1. I can choose technological tools that enhance the strategies in teaching English.
2. I can choose technological tools that enhance students' English learning.
3. My educational background encourages me to think more deeply about how technology could influence the teaching strategies I use in my class.
4. I think critically about how to use technology in my class.
5. I can adapt the use of the technological tools to different teaching activities.
6. Personal beliefs that I bring to my class affect my teaching-related activities.
7. My professional knowledge plays a crucial role in the use of various of teaching activities in my class.
8. I make use of my past professional experiences to find practical teaching activities in my class.
9. I draw upon my day-to-day teaching experiences to make necessary changes in my teaching practice.
10. My educational background has an important role in the development of my potential to make innovations in my teaching practices.
11. I employ my personal experiences to respond strategically to the challenging situations imposed by the school policy.
12. I set goals to promote my students' learning outcomes through the use of ICT.
13. One of the goals of education is to enable students to participate effectively in society.
14. I set clear long-term goals in teaching to achieve the best results.
15. I try to keep my students engaged in my class.
16. I try to analyze my goals strategically in my class.
17. I am interested in introducing new forms of teaching strategies to promote the quality of education.
18. The availability of teaching resources can improve my teaching-related activities.
19. The improvement of my ability in using technology-based learning resources influences my teaching practices in a positive way.
20. School principals have an important role in providing facilitation for me.
21. School authorities should provide me with professional development programs to promote both of my knowledge and skills.
22. I can make appropriate changes in my classes when I am given the voice and power to act.
23. Access to wider professional development programs about teaching should be an integral part of teacher education.
24. Students in my class differ significantly in their background knowledge.
25. Students in my class differ significantly in their basic academic skills (e.g., reading comprehension, written expression, problem solving).
26. Students in my class differ significantly in their study skills (e.g., note taking, exam preparation, time management).
27. Students in my class differ significantly in their motivation towards course performance.
28. My understanding about the differences of students' readiness (background knowledge, study skills, and motivation) impacts both what and how I teach.
29. Students in my class differ significantly in their preferred learning modalities (e.g., visual, auditory, or kinesthetics; active or passive; intelligence preferences).
30. Students in my class differ significantly in their preferred grouping orientations (e.g., whole class, small group, pair).
31. My understanding of variance in students' learning profile (learning modalities, grouping orientation) impacts on both what and how I teach.
32. I create technology-integrated activities to develop students' communicative skills.
33. I take deliberate efforts to ensure that students participate consistently during my class.
34. I follow up privately on behaviors or circumstances of concern (e.g., absences, low grades, conflict between students).
35. I use a variety of grouping formats during class (e.g., whole class, small group, pair).
36. I group the students on purpose by considering their levels of readiness (e.g., relevant background knowledge, academic skills).
37. I create activities that offer format options (e.g., write a paper, create a visual, design a web page, or give a presentation).
38. I provide additional support for students who have difficulty in completing activities.
39. I use three or more forms of assessment to determine course grades (e.g., a paper, presentation, participation, final exam).



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