Participants' Experiences in Heutagogy Teacher Professional Education in Indonesia

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Abstract: This study investigated a heutagogy-informed teacher professional education model designed to assist Indonesian teachers in achieving the competencies established by the Indonesian government to address teacher quality issues. The critical concepts of the model include self-determined learning, metacognitive reflection, collaborative learning, and capability development. An embedded design methodology, grounded in pragmatism as the overarching research paradigm, was employed for this investigation. The findings of this study provide significant insights for enhancing teachers' professional education in Indonesia, particularly in terms of the effectiveness of heutagogy-informed approaches compared to traditional approaches of teacher training, with additional benefits stemming from heutagogy-informed, technology-facilitated learning impacting both their professional development and intended classroom practices.

Keywords: heutagogy, teacher professional education, technology.

Introduction

In Indonesia, a teacher professional education (TPE) program is considered fundamental to the production of competent teachers, who are, in turn, responsible for producing capable student learning outcomes in schools. As such, an effective TPE program is vital in advancing the nation's education system. In this respect, Indonesian TPE programs focus on aligning teacher practice with education standards established by the Indonesian government (Irnidayanti & Fadhillah, 2023; Yarrow et al., 2022). This focus represents a national teacher training agenda for Indonesia, with the aim of improving the quality of teaching and learning over time. In this regard, the TPE in Indonesia has undergone several changes to accommodate the national agenda of education by the government, but unfortunately the outcomes of these changes have been mixed (Irnidayanti & Fadhillah, 2023; Revina et al., 2020; Tias & Tongjean, 2022), and have largely failed to produce teachers with the necessary competencies to become high-quality professional educators (Revina, 2022; Tias & Tongjean, 2022; Yarrow et al., 2022). Because of this, prioritising a revision of the TPE program has become a focal point for improving teacher training in Indonesia (Saputri et al., 2021; Sukmayadi & Yahya, 2020).

Importantly, this focus on program revision in Indonesia has set the stage for thinking critically about additional factors that can also influence the Indonesian TPE program. One of these is the need to ensure that this program can prepare student teachers to incorporate

technology effectively into their teaching practice, seeking to modernise the TPE program in response to the impact of technology on education (Yarrow et al., 2022). This factor stems from the general impact of technology on teaching and learning that has emerged from the rise of the Knowledge Economy (CORE Education, 2019) and, thus, represents a salient aspect of modernising the Indonesian system of teacher training more broadly (Bhardwaj et al., 2020; Yarrow et al., 2022). A primary focus for this aspect of program revision is to include ICT knowledge and digital media skills as part of the TPE, acknowledging the need to help prepare the national education system to embrace 21st-century teaching and learning challenges.

Another particularly crucial factor that influenced the need to revise teacher training in Indonesia at the time the current research took place was the impact of the COVID-19 pandemic, which disrupted the traditional face-to-face (f2f) TPE program in Indonesia. Although time-delimited, the impact of this pandemic was global during the years 2020 – 2021 and caused educational facilities and systems at all levels (schools, universities and early childhood centres) to shift suddenly from f2f teaching and learning to online-only teaching and learning (Lieberman, 2020; 2021; Yeigh & Lynch, 2020). The suddenness of this shift, coupled with the lack of preparedness many teachers experienced in terms of their ability to use technology-based pedagogies, raised several issues relating to the ability of education systems to provide quality teaching and learning within the confines of a virtual pedagogy. These included issues around teacher capabilities (NSW Government, 2020; Thomson, 2020), the quality of online learning experiences (Newcomb, 2020), the impact that school lockdowns have on both student and teacher wellbeing (Prothero, 2020; Francis, 2020), and the ability of teachers to adapt to the 'new normal' of blended and online teaching and learning (Collie & Martin, 2020). At the heart of these issues lies the ability of teachers to use technology in ways that provide effective teaching and learning at the classroom level of instruction (Arnett, 2021; Klein, 2021). Of relevance to the current research, this created the need to develop an alternative TPE program in Indonesia that occurred within an online-only teaching and learning environment and included a clear focus on training teachers to use and design technology as an integral part of their instructional approach. Of further relevance to this situation, many countries have experienced evolving waves of COVID-19 variant infections (e.g., Delta and Omicron; cf. Zhang, 2021), and there are ongoing warnings of new pandemics that might arise in the near future (Eldred, 2023; Guttentag, 2020; Podovšovnik, 2020; WHO, 2022).

Altogether, this situation has created a context wherein education, including educational training programs, operates under an imperative to further develop and solidify technology-driven pedagogies as inherent components of teacher training. The research reported here represents one response to this context, seeking to investigate a heutagogy-based model of online teacher training as a viable alternative to the traditional f2f training approach. The key goals of this heutagogy-based model are to train teachers effectively and to instil in them the confidence and competence required to utilise technology in their teaching practice in ways aligned with the needs of education within a changing and often unpredictable world. To better understand how heutagogy can offer these outcomes, we now examine what heutagogy is as a pedagogical approach.

Heutagogy and Technology

This study uses key elements of heutagogy established in previous research related to its use in educational settings. These include the primacy of self-determined learning, along

with metacognitive reflection, collaborative learning, and capability development (Blaschke & Hase, 2019; Blaschke & Marín, 2020).

In theorising Heutagogy, Blaschke and Hase (2016) proposed heutagogy as the continuation of preceding theories that emerge from the current digital society. Modern digitally-influenced learning encourages students to self-direct their pursuit of knowledge with limited teacher assistance. This situation proposes that a shift in teaching and learning instruction is required by involving technology that supports teachers to be innovative and creative in designing student-centred learning (Kenyon & Hase, 2001). Technology assists this process because it can relieve teachers from the intensity of the teaching workload and encourage students to be involved in self-directed learning (Yeigh et al., 2020). However, it is essential to highlight that to integrate learning with technology, educators and students must be familiar with the learning tools and understand the utilisation of tools that are needed to support the learning goals (Bedenlier et al., 2020).

For teacher education programs, Yeigh and Lynch (2017) propose that it is crucial for teacher training to provide a learning model that emphasises practical skills for developing teaching skills. The combination of technology in the heutagogy framework allows students to be actively involved in learning and enhance their creative thinking (Blaschke, 2021; Blaschke & Marin, 2020). Based on their research in a blended heutagogy approach, Ashton and Elliot (2007) claimed that combining learning in heutagogy is preferred and more convenient for students. Blaschke (2014) suggests that integrating heutagogy and social media equips students with digital skills appropriate to the working environment, both now and in the future. Blaschke (2012) also elaborates that including online media in heutagogy can encourage the "creation of learner-generated content, active engagement in the learning process and with instructors and other learners, group collaboration, and reflective practice through double-loop learning" (p.63).

The current study's expectations do not occur in a vacuum. In Indonesia, teacher professional training has undergone a transformation specifically designed to improve quality outcomes (Sukmayadi & Yahya, 2020). Therefore, it is essential to prepare educators who can implement a new education model and teacher training based on the notion of lifelong learning, which canvasses the life cycle and includes formal, nonformal, and informal education and training. In this regard, heutagogy has emerged as a key approach that best facilitates learning combined with technological advancement (Blaschke & Hase, 2016; 2019). Indeed, heutagogy engages the use of the World Wide Web 2.0 and 3.0 to accommodate learners sharing ideas, working together, and reflecting on previous learning (Blaschke & Hase, 2016), preparing the learner to operate with the 21st Century Skills that have been broadly promoted as necessary for modern education (CORE Education, 2019; Kaput, 2018; Van Laar et al., 2020). Heutagogy also facilitates the learner in developing the necessary capabilities around technology. Capable learners can implement competencies developed through education in different workplace types and constantly changing situations (Hase & Davis, 1999). Thus, applying heutagogy to the Indonesian Teacher Training program appears relevant, timely and logical.

Methodology

Participants

All study participants were early childhood education preservice teachers ($N = 69$) in the 2021/2022 TPE cohort at Medan State University. These participants were organised into a control group (33 participants: 24 female and 9 male) and an experimental group (36 participants: 31 female and 5 male).

Research Design

This study involved a mixed-methods *Embedded Design* (ED), using quantitative and qualitative approaches to gain in-depth insight into participants' experiences (Creswell & Clark, 2017; Creswell & Creswell, 2017). The implementation of quantitative and qualitative data within an ED for this study occurred across four phases: 1) designing the experiment and determining the use of qualitative data in supporting the quantitative results, 2) collecting and analysing qualitative data in enhancing the experiment results, 3) collecting and analysing quantitative results from the experiment, and 4) interpreting the role of qualitative data in enhancing the overall results from the research (Creswell & Clark, 2017).

Data Collection

A quantitative pre-training competency test was administered to both study groups before the TPE training commenced to measure the baseline competencies of participants prior to their TPE training. Following this pre-test, TPE training began for both study groups, with the control group undertaking their training within the traditional, face-to-face (f2f) TPE model (identified as T-TPE) and the heutagogy group undertaking their training within the novel heutagogy TPE model (identified as H-TPE). Ongoing qualitative data collection, using reflective learning journals, occurred for the H-TPE group, with journal entries collected weekly at the end of each instructional meeting. Upon completing all TPE training stages, both groups again completed the same competency test to measure differences in their competencies that may have taken place across the 10-week training program. Interviews were then conducted as the final data collection phase to help explain the competency test results by exploring how participants in each group (T-TPE and H-TPE) had experienced their TPE learning.

Figure 1 presents the overall research design of this study concerning the embedded design approach to data collection for the study. Note that the salient elements of this design are the quantitative pre-training competency test, the use of two study groups (T-TPE and H-TPE) to measure and explain outcome differences across the study, the use of ongoing qualitative data collection using reflective learning journals to document specific experiences of the H-TPE group, the use of a post-training competency test to measure competency differences between and within each study group, and the use of interviews to explore further and explain the results of these competency tests.

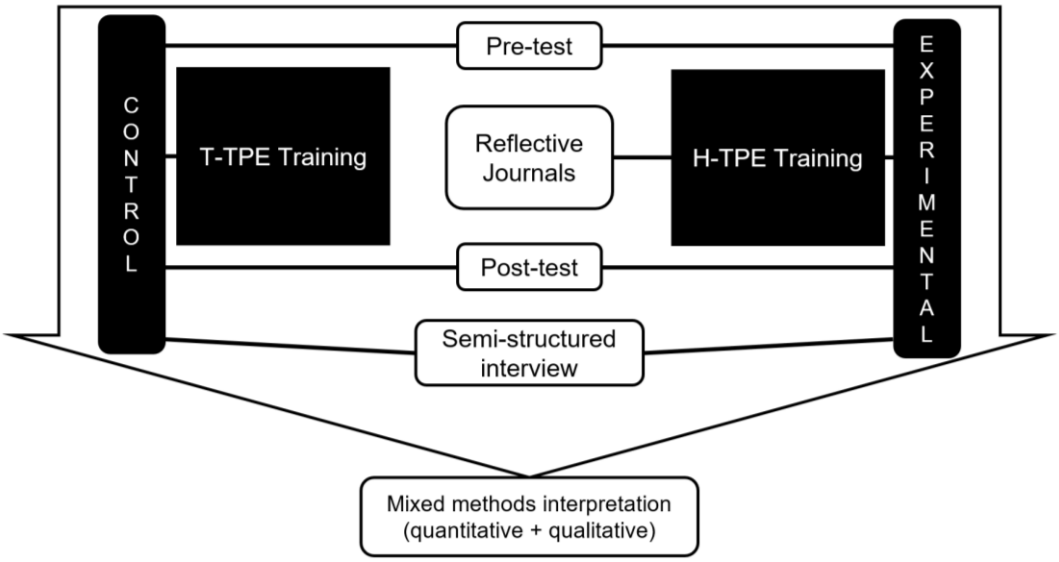

Figure 1. Embedded design data collection

Within this methodological approach, the current study used the following research questions (RQs) to investigate the study's comparison of T-TPE and H-TPE training outcomes:

RQ1: To what extent does the H-TPE model impact teacher competency outcomes compared to the T-TPE model in Indonesia?

RQ2: What do H-TPE participants report as critical aspects of the H-TPE model that contributed to their competency learning?

RQ3: How did the experiences of H-TPE participants compare to and differ from the experiences of T-TPE participants in relation to personal TPE learning?

RQ4: To what extent did the H-TPE learning model inspire participants to apply new technology-driven knowledge and skills to teaching practice?

Results

This section presents the quantitative and qualitative data collected to address the research questions. For the quantitative analysis, SPSS version 28 was used to compare and contrast the results of the two groups in terms of between-group and within-group test changes. In this respect, a paired samples t-test was used to analyse mean differences between the control and experiment groups and identify whether the test differences between these groups were significant. ANCOVA was then used to measure the difference between the control and experiment groups by identifying error variance within the groups. In this respect, an F-test was used to identify the differences between both groups (Field, 2017).

As for the qualitative process, data taken from reflective journals and interviews were coded to elicit the key concepts, understandings and insights each group experienced in relation to their TPE training. Initially, the data from reflective journals were analysed to establish codes to help inform the interview questions. The interview data was then analysed to establish new codes to address the research questions (Creswell & Poth, 2018). These qualitative analyses were performed using NVivo 12 Plus.

Pre and Post-Test Score Comparisons

A summary of group-based pre-and-post competency test score comparisons is shown in Tab. 1.

Score ranges	Pre-test		Post-test		Competency level
	T-TPE	H-TPE	T-TPE	H-TPE	
91 - 100	0	0	2	5	Expert
81 - 90	0	0	5	10	Proficient
71 - 80	0	0	20	19	Competent
61 - 70	0	2	6	2	Advanced
51 - 60	3	7	0	0	Novice
< 50	30	27	0	0	Incompetent
N	33	36	33	36	
Mean	40.06	44.5	75.45	80.39	

Table 1. Between-group pre and post-test score comparisons

In Tab. 1, the pre-test scores showed that most participants were in the 'incompetent' competency level for both the T-TPE and H-TPE groups. These results were expected at the beginning of the TPE training, and it suggests that both study groups began the TPE training at similar levels of test-related competency knowledge. Specifically, 30 T-TPE participants scored within the 'incompetent' competency level (score < 50) and three participants scored in the 'novice' competency level (score 51-60), with 27 H-TPE participants scoring in the 'incompetent' level, seven participants in the 'novice' level, and two participants in the 'advanced' level. Importantly, in the TPE pre-test, no participant achieved the overall 'competent' level stipulated by the Indonesian government as the minimum criteria for certification as a professional teacher.

Analysis of the competency post-test scores showed a marked improvement compared to the pre-test outcomes. In the post-test, most participants scored in the 'competent' competency level for both study groups. For the T-TPE group, two participants scored in the 'expert' level, five in the 'proficient' level, 20 in the 'competent' level, and six in the 'advanced' level. For the H-TPE group, five participants scored in the 'expert' level, 10 in the 'proficient' level, 19 in the 'competent' level, and two in the 'advanced level'. Overall, these data show that 81.9% of participants met the minimum criteria to pass the competency post-test in the T-TPE group, and 18.1% did not meet this minimum criterion. In the H-TPE group, 94.4% of participants met the minimum criteria, and 5.6% did not. From these test score comparisons, it also appears that participants in the H-TPE group obtained higher post-test competency scores than those obtained by the T-TPE group. These comparisons suggest that the heutagogy TPE approach designed for this study produced positive teacher training competency outcomes that may have been more improved than those produced by the traditional TPE training approach.

As shown in Tab. 2, to further analyse these findings, an analysis of within-group test-score comparisons was conducted to compare the degree to which TPE competency knowledge improved across the training program within each group.

	Groups	Mean	SD	Variance	Min	Max	N
Pre-test	T-TPE	40.06	7.866	61.871	24	58	33
	H-TPE	44.5	8.147	66.371	28	62	36
		42.38	8.262	128.242	52	120	69
Post-test	T-TPE	75.45	7.086	50.205	64	92	33
	H-TPE	80.39	7.342	53.902	66	96	36
		77.68	7.713	104.107	130	188	69

Table 2. Descriptive statistics

As presented in Tab. 2, both study groups had a similar mean increase before and after completing their TPE training. The mean T-TPE score increased from 40.06 in the pre-test to 75.45 in the post-test (increased by 34.67 points). For the H-TPE group, the mean increased from 44.50 in the pre-test to 80.39 in the post-test (increased by 35.39 points). These similar increases were supported by the H-TPE group, having scored higher than the T-TPE group on both the pre-and-post competency tests, with the minimum and maximum score differences being roughly four points in each case. The mean score differences were also very similar, with just 0.50 separating the two group means, and the SD differences were also quite close (separated by only 0.103 points). Although not definitive, these findings suggest that students selected for the H-TPE group were initially more capable of higher TPE scores than those in the T-TPE group and maintained this difference throughout the TPE course.

These comparisons provide two critical insights. The first is that progressive TPE competency learning for the two study groups was relatively stable (both groups progressed learning at relatively similar levels and pace). Second, and progressing from this, is that the H-TPE group maintained TPE competency learning ahead of T-TPE despite the novel nature of the H-TPE learning for this group. These outcomes both support the effectiveness of a heutagogy approach to online-only TPE training in more general terms, suggesting it is at least as viable as the traditional TPE learning that has been exclusively used for this training program in the past and thus support its ongoing use and exploration as a pedagogical strategy for teacher training.

In order to follow up on test score comparisons*, Repeated Measures ANOVA* was used to determine the degree to which the increase in competency learning was significant for each study group.

First, the relevant assumptions were tested. As the *Fmax* = 1.359 was less than 10, homogeneity of variance was assumed. *Box's test of equality of covariance matrices p-value* was 0.396, which was greater than 0.01 (not significant), indicating that the assumption of homogeneity of covariance matrices had not been violated (Fidell & Tabachnick, 2014). *Levene's test of equality of error variance* test found $F(1, 67) = .005$, $p = .944$ and $F(1, 67) = .348$, $p = .557$; therefore, the assumption of variance for the *between-subject factors* was not violated (Fidell & Tabachnick, 2014).

Second, *the tests of between-subjects effects* (the impact of group placement) found $F(1, 67) = 13.27$, $p < .001$, $\eta^2 = .165$, suggesting that, collapsed across pre-and-post-test scores, TPE group placement had a significant effect on the combined pre-and-post-test competency scores, with the H-TPE group scoring significantly higher than the T-TPE group. Tests of *within-subjects effects* also found a significant main effect between these pre-and-post test results, $F(1, 67) = 853.92$, $p < .001$, $\eta^2 = .927$, as well as a non-significant interaction effect between the pre-and-post tests and group placement, $F(1, 67) = .256$, $p = .614$, $\eta^2 = .004$. These results suggest that as a cohort, and not considering whether a participant was in the T-TPE or H-TPE group, competency test results on the post-test were significantly

higher than those on the pre-test. Furthermore, this result accounted for 92.7% of the variance in TPE scores, demonstrating no interaction between the time-related progressive learning that took place across the TPE program and group placement.

In summary, these results first indicate that the TPE scores of H-TPE were higher than the T-TPE group when collapsed across time, i.e., merging the pre-and-post-test scores for each group. Second, regardless of whether participants were in the T-TPE or H-TPE group, the TPE scores of all participants significantly improved between the pre-to-post-tests, showing that the effects of progressive learning for both groups were highly similar. Third, group participation had no significant impact on the degree to which participant TPE scores changed between the pre-and-post-tests, i.e., there was no interaction between groups and the participants' pre and post-TPE scores. Therefore, participants in the H-TPE group were neither advantaged nor disadvantaged regarding TPE score improvement compared to the T-TPE group, again indicating its viability as an alternative approach to TPE teacher training.

Thematic Coding Analysis

The qualitative data in this study were collected from two instruments: reflective journals and interviews. While all participants in the H-TPE group completed reflective journals, seven such reflective journals were used for analysis, with this number determined by reaching a saturation point in the coding process. Interview data were collected from 14 participants in the H-TPE group and seven in the T-TPE group, who all volunteered to participate in interviews. Using the coding process strategy outlined by Creswell and Poth (2018), the coding in this study began with reading through the database slowly to make sense of what the participants were saying and then writing down some ideas while reading the database to establish notes on initial thoughts or ideas.

In this regard, the key ideas in heutagogy elements become the starting point for creating notes on the data. The next step was to develop codes by assigning a code label to particular topics from the transcription and finally creating themes by grouping similar codes to build evidence of support for broader categories of information. These themes described the heutagogical learning experiences of the participants and thus provided additional information to answer the research questions.

For *reflective journals,* the range of emergent themes for each heutagogy element was as follows:

- **Self-determined learning**: 'self-empowerment', 'active learner', 'critical thinking', 'self-management', and 'facilitator's role'.
- **Metacognitive reflection**: 'self-evaluation', 'reflective reading', 'initiating ideas', and 'cognitive development'.
- **Collaborative learning**: 'adapt and modify teaching strategies', 'problem-solving', 'communication skills', and 'engagement'.
- **Capability development**: 'professional development', 'increased competencies', 'innovation in learning', and 'creativity in learning'.

Lastly, for 'participant negative comments', the researcher categorised the notes into two codes, i.e. 'assignment pressure' and 'participation in group work'.

For the *interviews*, participant responses were also coded in relation to each heutagogy element. Through this process, a range of emergent themes for each heutagogy element produced the following codes:

- **Self-determined learning**: 'critical analysis', 'independent learning', and 'screening of knowledge'
- **Metacognitive reflection**: 'self-concept' and 'knowledge update';

- **Collaborative learning**: 'in-depth content knowledge'
- **Capability development**: 'practical analysis', 'skills development', 'professional development' and 'creativity and innovation'.

At the final coding stage, the codes from reflective journals and interviews were grouped into each heutagogical element to ascertain the extent of overall connections between the generated categories and to reduce redundancy among these categories. The researcher compared and refined the codes to create a list of themes with a coherent relationship. Quotes from participants in the reflective journals and interviews in both study groups were used to present the differences in learning experiences between the groups. As a result of these processes, three specific themes emerged from the data.

- **Theme 1: Teacher professional development in heutagogy TPE**, including 'self-empowerment', 'critical analysis', 'self-evaluation', and 'cognitive development.'
- **Theme 2: Issues of implementing heutagogy TPE**, including 'issues and obstacles.'
- **Theme 3: Recommendations from heutagogy TPE**, including 'creativity and innovation in teaching', 'implementation of IT in learning', and 'teaching innovation.'

Further results are included in the discussion section to maintain coherence with the research questions to which they pertain.

Discussion

Findings in this study are herein grouped using each research question (RQ) to address the findings and systematically present the study's implications.

RQ1: To what extent does the H-TPE model impact teacher competency outcomes compared to the T-TPE model in Indonesia?

The key finding for this RQ was that participants in the H-TPE and T-TPE groups both performed well in developing teacher competencies. This finding suggests that integrating heutagogy into TPE training in Indonesia can provide an alternative as efficacious as the traditional f2f training approach to facilitate desired teacher competencies. It further suggests that the use of heutagogy for Indonesian teacher professional training is an appropriate way to help modernise Indonesian TPE training post-COVID-19, which was an important outcome sought by implementing the H-TPE model in this research. This result is similar to the findings of Lapele et al. (2022), who implemented heutagogy and found that heutagogy can be a viable approach to facilitating online Distance Learning via the use of technology. That study showed that learners in heutagogy develop a sense of wanting to know and become more mature, independent and self-motivated learners. Furthermore, while teachers could 'provide guidance and support', there were limits to their involvement in the distance learning process, making the learners more responsible and, at the same time, more free to develop creativity and personal ideas in connection to their learning.

These findings are also supported by Prayitno, and Supriyanto (2020), who used a literature review to analyse the effectiveness of heutagogy during the COVID-19 pandemic. The first step in this study was to review the concept of heutagogy within the context of 'new normal learning' impacted by the pandemic. The second step discussed the possibility of incorporating heutagogy in designing learning integrated with technology to promote post-pandemic learning. As a result, their study, like the current study, recommends heutagogy as appropriate to instructional situations that utilise technology to provide guidance and digital instruction for learning.

Both of these studies (i.e., Lapele et al., 2022; and Prayitno & Supriyanto, 2020) provide findings that support those of the current thesis research and overall support the use of heutagogy as a viable alternative for teaching and learning within online contexts more generally.

RQ2 What do H-TPE participants report as critical aspects of the H-TPE model that contributed to their competency learning?

Participants identified all three components of the heutagogy model: Self-Directed Learning (SDL), Metacognitive Reflection (MR), and Collaborative Learning (CL), as supporting the development of their teaching capabilities. Of these, CL was identified as contributing the most and MR as contributing the least to developing these capabilities. In this regard, SDL was the component that allowed participants to cross-confirm information during their learning, thereby determining how the information they were learning contributed to their required teacher competencies. In turn, MR allowed participants to self-identify their personal competency strengths and limitations, resulting in knowing what to do in the future to improve their teaching practice (i.e., contributing to their ability to self-direct their learning). Finally, sharing information and experiences in CL was identified as assisting participants in grasping critical ideas and improving teaching competencies derived from collegial sharing of successful teaching practices.

These findings accord with several prior studies concerning the use of heutagogy (e.g., Blaschke, 2021; Blaschke & Marin, 2020; Blaschke & Hase, 2019), which reported similar key findings for these heutagogy components and identified them as facilitating participants to develop 'capability' as an essential outcome of heutagogy learning. In the current investigation, the efficacy of these components was facilitated through the use of technology to modernise TPE training.

Overall, these heutagogy components, as applied to the H-TPE learning activities of the research, indicate critical aspects of the H-TPE model that contributed to participant competency learning, allowing participants to obtain more awareness of the responsibilities and duties teachers are required to demonstrate by the education system in Indonesia.

RQ3: How did the experiences of H-TPE participants compare to and differ from the experiences of T-TPE participants in relation to personal TPE learning?

H-TPE and T-TPE significantly differed in terms of how each mode used technology to facilitate learning. The technology used to deliver the T-TPE training was to facilitate online meetings due to COVID-19 in-person restrictions. Thus, technology use was fairly traditional and straightforward for this group. Technology was comprehensively integrated into learning for the H-TPE group to facilitate participants' experience of the heutagogy elements and support capability development through online and cloud-based collaboration platforms. For example, participants could discover and explore several online learning tools (e.g., Google Site, MindMap, Google Classroom). They reported that they enjoyed these experiences and found them valuable and fundamental to their engagement with principles of heutagogical learning.

These findings are similar to studies by Moore (2020) and Blaschke and Hase (2019), who also identified that technology's critical role is integrating key heutagogy ideas into learning. Similar to the present study, they highlight that technology facilitates collaboration, reflection, and self-learning, empowering learners to become self-determined. These findings,

and those of the current study, emphasise the fundamental relationship between technology and heutagogy. A key difference in technology use between these groups thus seems to be that, whereas technology can be used to facilitate learning in other pedagogical approaches (e.g., f2f; blended learning) across a range of pedagogical activities, it is far more innate and necessary to a heutagogical approach, where its use is both more ubiquitous and directly instructional. Although we can selectively use technology to support any pedagogical approach to teaching and learning in general, its use in heutagogy is inseparable from the pedagogy itself, with technology use in relation to heutagogy forming an intrinsic part of the learning design.

Because of this, the facilitator's (teacher's) role in H-TPE is to guide learning in ways that position the use of technology as a vital part of the learning. This study found that the notion of SDL, as explored through online tools, allowed participants to shift from a teacher-centred understanding of teaching and learning to a student-centred understanding. This shift was observable in how the H-TPE participants actively searched for other learning sources to confirm knowledge and ensure the relevance of this knowledge to their teacher competencies. This finding was similar to Abraham and Komattil (2017), who implemented heutagogy in a problem-based learning context and found that the use of heutagogy in this context also led to an understanding that when the teacher is not considered the only information provider, an increase in self-regulated learning can occur more easily.

RQ 4: To what extent did the H-TPE learning model inspire participants to apply new technology-driven knowledge and skills to their teaching?

The technology used for the H-TPE group was chosen to be convenient and easy to use. Specifically, this technology was chosen to facilitate knowledge exploration, sharing and storing information, collaborating and connecting with colleagues (and others), and critical reflection. The main reason for this approach was that most TPE participants initially had limited skills in using and understanding the function of online tools in learning, as this has not been part of their prior teacher training in Indonesia.

Key findings related to RQ4 were that implementing H-TPE required online learning tools to promote learning, leading participants to develop personal technology skills for integrating IT into their learning and teaching practices. At the end of the TPE program, most of the H-TPE participants had developed 'capability', an essential goal of heutagogy, by indicating they could implement sufficient teaching skills as part of their teaching tasks, integrate ICT to promote effective learning in their classroom, and had become autonomous learners who were capable of ongoing self-determined learning. In addition to understanding and appreciating the practicality and benefits of online tools for ongoing professional learning, participants in the H-TPE group were more confident and inspired to use technology and heutagogy-informed approaches in their future teaching practices. These findings align with Blaschke and Hase (2019), who found that technology can promote learner-centred teaching and learning when used for this purpose. Further, this reinforces that the relationship between technology and heutagogy is fundamentally pedagogical and is foundational to supporting self-directed learning.

In summary, this study supports the use of heutagogy-informed approaches as a viable alternative for teacher training in Indonesia and potentially in jurisdictions more globally. The key focus of the current study was on the relationship between a technology-driven pedagogy and the traditional TPE model, which is distinctly instructor-directed and f2f, and uses technology to deliver learning instead of facilitating learning. From this perspective, the use of technology as a facilitator of SDL appears to offer an effective alternative for dealing

with many of the difficulties relating to TPE training that can occur when disruptive innovation is required, whether this be unexpected (e.g., a pandemic), or part of the natural progression of technology's more general impact on teaching and learning.

The main implication of this study, in terms of a technology-driven approach to teaching and learning, is to re-imagine and extend our understanding of teacher training in ways relevant to modern educators, thus providing them with the means to engage in their professional learning, as well as learning how to adapt such means to their teaching practice. In particular, the H-TPE findings of the thesis study demonstrate that SDL provides a viable option for teacher training that is personalised, flexible and scalable within an online learning approach.

Study Limitations

This section presents four limitations, acknowledging that there are likely additional limitations.

First, the Indonesian TPE training curriculum constrained the H-TPE model design in this study, such that all learning content and activities had to adhere to the stipulated TPE curriculum and objectives. This requirement was to ensure that all mandated TPE learning objectives were addressed by the end of learning.

Second, H-TPE learning activities focused on developing SDL as the core learning principle, wherein all learning activities focused on the learners self-regulating and self-determining their learning. However, in implementing this principle, participants implied they needed more interactions with the facilitator and desired more explanations about the learning content. Therefore, the role of the facilitator in the heutagogy learning framework should be determined and established according to the level of learner need within the targeted learning environment for ongoing research of this nature.

Third, the scarcity of resources as references to outline the specifics of learning activities within a heutagogical framework posed a limitation for the current study. Subsequently, the learning activities were derived from a limited pool of studies concerning applied heutagogy, particularly those focusing on teacher training.

Finally, some participants were reluctant to share personal teaching experiences for privacy reasons. Thus, the depth of investigation relating to participants' teaching evaluation may have been limited for some participants in this study.

Future Research

We suggest that other researchers may consider three main concerns when conducting future research concerning heutagogy-informed learning design.

First, the extent to which the role of the facilitator be clearly defined and established when designing a heutagogy-informed curriculum to ensure participants receive sufficient facilitator-led knowledge transfer. This role definition would likely include time allocation for the facilitator to interact in assisting learning in ways that adapt to participant needs, as there will likely be differences among students, with some needing more time to communicate and discuss ideas with the facilitator to comprehend the learning content.

Second, providing flexibility within the learning design, especially when the learning content is highly regulated, as was the case in the present study. This flexibility would likely include negotiation of the learning, allowing learners to add, remove or modify some of the learning content.

Finally, the reflective journals' data showed that when participants worked on reflections together, they grasped the essence of the learning more comprehensively than when writing individually in their journals. Thus, future research could explore the impact on participants' heutagogical learning skills of working with the facilitator on some reflection activities – perhaps including this as a form of double-loop learning.

Conclusion

In Indonesia, as it is globally, teacher education programs are increasingly challenged to adapt to ever-changing learning landscapes. Preservice teachers must enter the workforce ready to lead students' learning and have the means to develop their professional learning to adapt to meet students' needs continually. This study indicates that a heutagogy-informed and technology-facilitated approach to teacher training is likely essential to such training, especially as it creates self-directed teachers who, as learners, are adaptive to changing circumstances and confident in using these means to enhance educational outcomes for their students.

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