Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Evaluating and Refining a Heutagogical Learning Model in Elementary Teacher Education

Fasti Rola

fastirola@usu.ac.id

Universitas Negeri Medan

Bornok Sinaga

Universitas Negeri Medan

Wisman Hadi

Universitas Negeri Medan

Research Article

Keywords: heutagogy, self-determined learning, educational design research, practicality evaluation, elementary teacher education

Posted Date: November 19th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11230243/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

The application of heutagogy in pre-service teacher education requires instructional designs that support autonomy while also being practical to implement. This study aims to evaluate the practicality of the Heutagogy Instructional Model and to explore improvements based on evidence from its implementation. The study employed Educational Design Research through two prototype phases, involving 36 students in Prototype 1 and 34 students in Prototype 2. Practicality was evaluated through “expected practicality” based on assessments by six experts and practitioners, as well as “actual practicality” based on observations of implementation, with instructional management and student responses serving as supporting evidence. The results showed that expected practicality fell into the high category (M = 4.55), while actual practicality in Prototype 1 fell into the moderate category (M = 3.43). Implementation evidence from Prototype 1 was used as the basis for formative improvements to the model. In Prototype 2, actual practicality was in the high category (M = 4.09), and 88.2% of students responded positively. The findings indicate that formative evaluation is effective in refining the heutagogical learning design for prospective elementary school teachers.

1 Introduction

Pre-service teacher education is not only expected to equip students with professional competencies but also to develop the skills necessary to address the demands and complexities of 21st-century education [1, 2, 3]. However, prospective teachers still need greater opportunities to take control of their learning process in the context of higher education [4]. This situation highlights the need for learning experiences that not only actively engage prospective teachers but also provide them with the space to determine, manage, and reflect on their own learning processes.

Heutagogy offers a relevant approach to these needs. As an approach to self-determined learning, heutagogy positions learners as managers of their own learning process through goal-setting, the selection of learning strategies and resources, and reflection on the learning process and outcomes [5]. In the context of teacher education, heutagogy shows potential in fostering self-determined learning and metacognitive reflection [6]. However, its implementation is not necessarily straightforward. Research indicates variations in understanding and acceptance of heutagogy, as well as in pre-service teachers’ readiness to engage in more self-directed learning [7], while its implementation may require *scaffolding* and facilitation that are adaptive to learners’ readiness [8]. Thus, the challenge of implementing heutagogy lies not only in granting autonomy to students but also in how that autonomy is supported through adequate structures and facilitation.

Although research on heutagogy continues to evolve, its application in various educational contexts still faces a number of challenges [9, 10], including in pre-service teacher education [7]. Recent research is beginning to shed light on learner readiness and facilitation practices in heutagogical environments [8, 7]. This highlights the need for a deeper understanding of how the principles of heutagogy can be operationalized into structured learning models and refined based on evidence from implementation.

To address this gap, Educational Design Research (EDR) provides a framework for iteratively developing, implementing, evaluating, and refining educational interventions in real-world learning contexts. In EDR, empirical evidence gathered during implementation can be used to guide iterative design refinements [11, 12]. One of the criteria for intervention quality in EDR is practicality, which encompasses expected practicality and actual practicality [13]. This distinction allows practicality to be examined both in terms of whether the intervention is expected to be usable and in terms of its actual use in real-world contexts.

Based on this framework, this study evaluates the practicality of the Heutagogy Learning Model while examining how evidence from its implementation is used to guide the model's refinement. This model operationalizes the principle of self-determined learning into five structured learning syntaxes and is implemented through two prototype phases, each consisting of eight sessions. Practicality is evaluated through expected practicality and actual practicality, while learning management and student responses are used as supporting evidence. This study addresses three questions:

1. To what extent does the Heutagogy Learning Model meet the criteria for "expected practicality" based on expert and practitioner assessments of the model's components?
2. To what extent does the Heutagogy Learning Model meet the criteria for actual practicality based on its implementation in an actual learning context?
3. How was the evidence obtained during implementation used to identify obstacles and refine the Heutagogy Learning Model from one prototype to the next?

Through this process, this study provides empirical evidence regarding the practicality of the Heutagogy Learning Model while also demonstrating how evidence from its implementation can be used formatively to guide the refinement of heutagogical design in the education of prospective elementary school teachers.

2 Literature Review

2.1 Heutagogy and Self-Determined Learning

Heutagogy is a self-determined learning approach that positions the learner as the primary agent in determining and managing their learning process [14, 5]. Learner agency, capability, reflection and metacognition, as well as non-linear learning, are key characteristics of this approach [15, 16]. Learners are not only oriented toward mastering knowledge but also toward the ability to manage and reflect on their own learning processes [17].

Reflection in heutagogy is related to double-loop learning, which occurs when learners not only evaluate the actions or strategies they use but also revisit the underlying assumptions and ways of thinking. Heutagogy also emphasizes the development of capability—the ability to adaptively apply competencies in new, unfamiliar, and changing situations [17].

2.2 Heutagogy in Pre-Service Teacher Education

In pre-service teacher education, heutagogy provides space for students to develop autonomy, reflection, and the ability to manage their own learning processes. Studies on pre-service teacher education indicate that the implementation of heutagogy must take into account students' readiness to learn and the forms of facilitation provided [8, 7]. Thus, autonomy and facilitation must be considered together in the design of heutagogical learning.

Consequently, the principles of heutagogy need to be operationalized into learning activities and tools that provide students with the space to manage their own learning process while receiving appropriate support. In pre-service teacher education, this requires instructional designs that translate the principles of self-determined learning into procedures that can be applied in actual learning contexts.

2.3 Practicality and Formative Evaluation in Educational Design Research

Educational Design Research (EDR) views the development of educational interventions as an iterative process involving design, implementation, evaluation, and refinement based on empirical evidence from the context of their use [12, 18]. In EDR, practicality is one of the criteria for the quality of an intervention. Nieveen and Folmer [13] distinguish between "expected practicality" and "actual practicality." This distinction is important because an intervention that is expected to be practical does not necessarily demonstrate the same level of practicality when applied in actual learning settings. In formative evaluation, evidence obtained through the implementation and evaluation of an intervention can be used to identify aspects of design and implementation that require refinement in subsequent prototypes [13]. Thus, evaluating practicality not only provides information about the quality of the intervention but also serves as a basis for iterative design improvements.

3 Methodology

3.1 Research Design

This study employs Educational Design Research (EDR) to iteratively evaluate and refine the Heutagogy Learning Model based on evidence from its implementation in actual learning contexts [11, 12]. The evaluation focused on expected practicality through assessments by experts and practitioners, as well as actual practicality through observations of the model's implementation [13]. Instructional management and student responses were used as supporting evidence of the model's practicality.

The research began with a preliminary field trial to identify aspects requiring refinement prior to Prototype 1. Subsequently, the model was implemented in two prototype phases, each lasting eight sessions. Evidence from the implementation of Prototype 1 was used to identify obstacles and guide formative revisions. The revised model was then implemented and evaluated in Prototype 2.

3.2 Participants

The study was conducted in the Elementary School Teacher Education (PGSD) program at a state university in Indonesia as part of the Educational Psychology course. The participants were second-semester students from existing regular classes (intact classes). Classes were selected based on availability without altering class assignments or the course schedule. Therefore, participants were not randomly assigned.

The pre-field trial involved 38 students (4 males and 34 females), Prototype 1 involved 36 students (4 males and 32 females), and Prototype 2 involved 34 students (5 males and 29 females). All three phases were conducted in different classes and were not used formatively to inform model refinements prior to the next phase.

The implementation of the model was facilitated by the instructor of the Educational Psychology course, who had received training on the principles of heutagogy, the model's syntax, and the procedures for its implementation. The instructor used a facilitator's guide, while the students used learning modules as supporting tools for implementing the model.

All students participated voluntarily after receiving an explanation of the research objectives and procedures. The confidentiality of participants' identities was maintained throughout data collection, analysis, and reporting.

3.3 Development of the Heutagogical Learning Model

The Heutagogy Learning Model was developed based on L. M. Blaschke and Hase [15] heutagogy design framework, which includes three interrelated components: learning contract, learning activities, and learning outcomes. The learning contract outlines the agreement and commitment to learning; learning activities provide students with the space to determine strategies and explore various learning resources; while learning outcomes encompass the achievement and evaluation of learning outcomes through reflection and evidence of learning. These three components form the foundation for designing heutagogical learning experiences for prospective elementary school teachers.

Based on this framework, the Heutagogy Learning Model is operationalized through a learning syntax consisting of five interrelated phases: (1) Psychological Problem Identification, (2) Heutagogical Problem Examination, (3) Collaborative Problem Exploration and Guidance, (4) Presentation of Problem-Solving Outcomes, and (5) Schema Reconstruction. These five phases form the operational structure of the model during the implementation of learning. The relationship between the theoretical foundations of heutagogy, the design components, and the five learning phases is presented in Fig. 1.

As shown in Fig. 1, the syntax of the Heutagogical Learning Model consists of five learning phases that describe the flow from the identification of psychological problems and learning needs to the reconstruction of students' understanding. Although the five phases are presented sequentially, the implementation of the model occurs iteratively. Students can return to previous phases to review problems, explore additional learning resources, refine solutions, or utilize feedback according to their learning needs.

The reflective process in the model refers to the principle of double-loop learning, in which students not only evaluate their actions and learning outcomes but also revisit the assumptions and understandings that underlie their learning process [17]. This principle is primarily operationalized through the Schema Reconstruction phase, which provides space for students to review and, if necessary, reconstruct their existing understandings. Thus, the model integrates an iterative learning process with double-loop reflection.

In its implementation, students play an active role in identifying learning needs, determining strategies, exploring learning resources, collaboratively developing solutions, utilizing feedback, and reconstructing their understanding. Facilitators support this process through reflective questions, guidance on exploration, facilitation of collaboration and the use of learning resources, and the provision of feedback tailored to students' needs. A description of each phase, student activities, and the facilitator's role is presented in Table 1.

Table 1
Syntax and Instructional Phases of the Heutagogical Learning Model

Syntax	Description of Each Step	Student Activities	Facilitator's Role
1. Psychological Problems Identification	Identifying learning needs and psychological problems based on learners' experiences.	Reflecting on prior experiences, identifying learning needs, and formulating psychological problems.	Facilitating reflection and supporting learners in identifying learning needs and formulating problems.
2. Heutagogical Problem Examination	Examining identified problems through self-directed inquiry and exploration of relevant learning resources.	Determining inquiry strategies, exploring relevant learning resources, and analyzing the identified problems.	Guiding the inquiry process and supporting learners in identifying and utilizing relevant learning resources.
3. Collaborative Problem Exploration and Guidance	Developing and refining solutions through collaborative knowledge construction.	Generating, discussing, evaluating, and refining possible solutions collaboratively.	Facilitating collaborative discussion and providing guidance and feedback as needed.
4. Presentation of Problem-Solving Outcomes	Presenting proposed solutions and obtaining feedback for improvement.	Presenting proposed solutions, responding to feedback, and refining solutions based on the feedback received.	Facilitating presentations, encouraging constructive feedback, and supporting the refinement of solutions.
5. Schema Reconstruction	Reconstructing understanding through reflection and re-examination of underlying assumptions and prior understanding.	Reflecting on the learning process, re-examining underlying assumptions and understanding, and reconstructing understanding when necessary.	Facilitating reflective questioning and supporting learners in re-examining their assumptions and understanding, reconstructing understanding when necessary, and revisiting previous phases as needed.

3.4 Research Instruments

The practicality of the heutagogy learning model was evaluated using four instruments: the Expert and Practitioner Assessment Sheet of Model Implementation, the Model Implementation Observation Sheet, the Learning Management Observation Sheet, and the Student Response Questionnaire. The first instrument was used to assess expected practicality, while the second was used to assess actual practicality. The other two instruments provided supporting evidence regarding learning management and student responses.

The Expert and Practitioner Assessment Sheet for Model Implementation consists of 21 items covering the model's four components: syntax (7 items), social system (6 items), principles of reaction (5 items), and support system (3 items). The instrument was developed based on the model's theoretical foundation and operational characteristics and was reviewed by experts. Six experts and practitioners with expertise in instructional model development, educational psychology, and instructional material development were involved in this process. The content validity of the instrument was analyzed using Aiken's V and yielded values ranging from .79 to .96 (M = .88). Feedback from the validation experts was used to refine the instrument. After the instrument was refined, the six experts and practitioners used it to assess the model's expected practicality.

The Model Implementation Observation Sheet consists of 21 items covering syntax, the social system, principles of reaction, and the support system. This instrument is used to observe the implementation of the model in actual learning situations. The Learning Management Observation Sheet consists of 15 items covering opening activities, management of learning activities, assessment, closing activities, and classroom atmosphere, and is used to observe the facilitator's management of the learning process.

The observations were conducted by two observers with bachelor's degrees in psychology. Prior to data collection, both observers received an explanation of the indicators, assessment criteria, and observation procedures, and participated in a training session to ensure consistency in the use of the instruments. Inter-observer reliability was analyzed using Cohen's kappa. The results showed $\kappa = .644$ for the Model Implementation Observation Sheet (substantial agreement) and $\kappa = .815$ for the Learning Management Observation Sheet (almost perfect agreement) based on the criteria established by Landis and Koch [19].

The Student Response Questionnaire consists of 21 items on a four-point Likert scale covering cognitive, affective, and conative aspects, with seven items in each category. The instrument was previously pilot-tested on students other than the research participants. The corrected item–total correlations ranged from .388 to .751, so all items were retained. The instrument demonstrated high internal consistency with a Cronbach's α of .932.

3.5 Research Procedure

An evaluation of the practicality of the Heutagogy Learning Model was conducted in the context of the Educational Psychology course from January through May 2025. After the model and learning materials underwent validation by experts and practitioners, the research continued with a preliminary field trial and two phases of prototype implementation (Prototype 1 and Prototype 2) as part of the formative evaluation.

A pre-field trial was conducted to identify aspects of the design and implementation that required refinement before Prototype 1. The evidence gathered was used to refine the exploration and reflection activities, the facilitator's role, the allocation of learning time, and the model's supporting tools.

Prototype 1 was then implemented over the course of eight sessions. Data were collected to evaluate the model's feasibility, the facilitators' management of the learning process, and the students' responses. The implementation data were used formatively to identify aspects that still needed improvement and to guide revisions to the model. The revisions included strengthening the facilitator's guidelines for each phase of learning, providing more concrete instructions for exploration and reflection, adjusting the time allocation for independent learning activities, strengthening peer feedback, implementing more structured reflection, and reinforcing the instructor's role as a facilitator. The facilitator's guide and student modules were also refined to support a more operational implementation of the model.

The revised model was then implemented in Prototype 2 over the course of eight sessions. In both prototype phases, data on the model's feasibility and learning management were collected through observations during implementation, while student feedback was gathered at the end of each phase. Data from Prototype 1 and Prototype 2 were used to evaluate the model's actual practicality and to provide a descriptive account of the model's practicality at each stage of implementation.

3.6 Data Analysis

The practicality of the heutagogy learning model was analyzed based on expected practicality and actual practicality within the framework of practicality evaluation in Educational Design Research [13]. Expected practicality was determined based on expert and practitioner assessments of the model's components, while actual practicality was determined based on observations of the model's implementation in actual learning settings.

The scores for expected practicality and actual practicality were analyzed descriptively based on the model's four components: syntax, social system, principles of reaction, and support system. The overall score was calculated as the average of the scores for the four components, so that each component had equal weight. The scores were interpreted using criteria established in the model development procedure: 1.00–1.99 = very low, 2.00–2.99 = low, 3.00–3.99 = moderate, 4.00–4.99 = high, and 5.00 = very high. A model meets the practicality criteria if both expected practicality and actual practicality reach at least the "high" category.

Data on instructional management were analyzed descriptively based on five aspects: opening activities, management of learning activities, assessment, closing activities, and classroom atmosphere. The overall score was calculated as the average of all 15 items and interpreted using the same categorical criteria.

Student responses were analyzed descriptively based on cognitive, affective, and conative aspects, as well as overall scores. The analysis included the mean and standard deviation for each aspect, while the overall scores were accompanied by 95% confidence intervals and the proportion of positive responses. On a four-point Likert scale, overall responses were categorized as positive if the mean score was > 3.00, moderate if it fell within the range of 2.00–3.00, and negative if it was < 2.00. The proportion of positive

responses was calculated based on the number of students in the positive category compared to the total number of students at each prototype stage.

Data from Prototype 1 and Prototype 2 were analyzed descriptively to describe the results regarding actual practicality, learning management, and student responses at each stage. Since the two prototypes were implemented in different classes without random allocation, differences between stages were not interpreted as causal effects of the model revisions. The evidence obtained during Prototype 1 was used formatively to identify implementation constraints and guide model refinement prior to Prototype 2.

4 Results

4.1 Expected Practicality

Expected practicality was evaluated based on the assessments of six experts and practitioners regarding 21 items covering the model's four components: syntax, social system, principles of reaction, and support system. The assessment results are presented in Table 2.

Table 2
Expected Practicality of the Heutagogical Learning Model

Component	Mean Score	Category
Syntax	4.5	High
Social System	4.56	High
Reaction Principles	4.47	High
Support System	4.67	High
Overall Mean	4.55	High

Note. Interpretation criteria: 1.00–1.99 = very low; 2.00–2.99 = low; 3.00–3.99 = moderate; 4.00–4.99 = high; and 5.00 = very high.

The assessment results indicate that the expected practicality of the Heutagogy Learning Model overall, falls within the high category (M = 4.55). All components also fall into the high category, with scores ranging from 4.47 to 4.67. The support system received the highest score (M = 4.67), while the principles of reaction received the lowest score (M = 4.47). Based on these results, the model meets the established criteria for expected practicality.

4.2 Actual Practicality

Actual practicality was evaluated through observations of the implementation of the Heutagogy Learning Model in real-world learning settings. Two observers assessed 21 items covering the model's four components—syntax, social system, principles of reaction, and support system—during eight sessions in each of the Prototype 1 and Prototype 2 phases. The observation results are presented in Table 3.

Table 3
Actual Practicality of the Heutagogical Learning Model in Prototype 1 and Prototype 2

Component	Prototype 1	Category	Prototype 2	Category	Descriptive Change
Syntax	3.33	Moderate	4.00	High	+ 0.67
Social System	3.39	Moderate	4.11	High	+ 0.72
Reaction Principles	3.50	Moderate	4.13	High	+ 0.63
Support System	3.50	Moderate	4.00	High	+ 0.50
Overall Meedn	3.43	Moderate	4.06	High	+ 0.63

Note. Interpretation criteria: 1.00–1.99 = very low; 2.00–2.99 = low; 3.00–3.99 = moderate; 4.00–4.99 = high; and 5.00 = very high. Descriptive change represents the difference between the Prototype 2 and Prototype 1 scores and is not interpreted as a causal effect of the model revision.

In Prototype 1, overall actual practicality fell into the moderate category (M = 3.43). All components of the model also fell into the moderate category, with scores ranging from 3.33 to 3.50. Compared to expected practicality, which was previously in the high category (M = 4.55), these results indicate a gap between expected practicality and the model's feasibility in actual learning. Evidence from the implementation of Prototype 1 was then used formatively to identify aspects requiring refinement before Prototype 2.

Following formative evaluation and revision, the refined model was implemented in Prototype 2. At this stage, overall actual practicality fell into the high category (M = 4.06), with all components achieving the high category and scores ranging from 4.00 to 4.13. Descriptively, the largest difference in scores between the two stages was found in the social system (+ 0.72), followed by syntax (+ 0.67), principles of reaction (+ 0.63), and support system (+ 0.50). Thus, in Prototype 2, all components of the model met the established criteria for actual practicality.

4.3 Formative Evaluation and Revisions from Prototype 1 to Prototype 2

Evidence gathered during the implementation of Prototype 1 was used formatively to identify implementation challenges and inform model refinements prior to Prototype 2. The evaluation revealed that several aspects still required refinement, particularly student autonomy in carrying out the learning phases, reflection and setting learning goals, time management, the facilitator's role, feedback mechanisms, and learning tool support.

Based on this evidence, revisions were made to the implementation procedures and learning materials without altering the core structure of the Heutagogy Learning Model. The revisions focused on strengthening the guidelines for each phase of learning, the structure of reflection and feedback, time allocation, the facilitator's role, and supporting materials, including the facilitator's guide, student

modules, and lesson plans. A summary of the implementation evidence, identified challenges, and revisions for Prototype 2 is presented in Table 4.

Table 4
Implementation Evidence, Identified Constraints, and Formative Revisions for Prototype 2

Implementation Evidence for Prototype 1	**Identified Constraints**	**Revisions for Prototype 2**
Students are not yet fully independent in carrying out the learning stages	Exploration and independent learning activities still require guidance from the facilitator	Guidelines for each *syntax* were made more operational, and instructions for self-exploration were made more concrete
Reflection and the setting of learning goals have not been carried out optimally	Students are not yet accustomed to reflecting and setting learning goals independently	Reflection activities are made more structured through reflective questions, guided reflection formats, and digital reflection
Some learning phases took longer than planned	Time for exploration, reflection, discussion, and independent learning activities remains limited	Time allocation was adjusted to provide more adequate space for exploration, reflection, discussion, and independent learning activities
Facilitators still play a relatively dominant role in guiding learning activities	The facilitator's role has not yet fully provided space for *self-determined learning*	The role of the facilitator is clarified as that of a reflective facilitator, with more operational facilitation guidelines
Facilitator feedback remains general and is not yet reflective	The feedback does not yet fully support students' reflection and independent learning	Feedback guidelines have been made more adaptive and personalized, and *peer feedback* has been strengthened in reflective activities
The facilitator's guidelines are not yet fully operational in supporting the implementation of the model	Facilitators need more practical guidelines for giving instructions, managing the class, and facilitating independent learning	The facilitator's guide provides detailed instructions on opening the session, giving instructions, managing a conducive and collaborative classroom environment, and facilitating heutagogical learning
The student modules do not yet fully support independent learning	Students need more explicit guidance to adapt to self-directed learning and monitor their learning process	The modules are enhanced with step-by-step learning instructions, an orientation to the model, time management strategies, reflective questions, additional learning resources, and *an* activity *checklist*
The lesson plans do not yet fully accommodate the needs for implementing the model	Faculty and student activities, time allocation, and the relationship between learning objectives, activities, and indicators still need to be clarified	The lesson plan was revised to specify faculty and student activities in greater detail, strengthen reflective activities, adjust time allocation, and align learning objectives, activities, and indicators

Note: Formative revisions were based on evidence gathered during the implementation of Prototype 1 and were used to refine the implementation procedures and supporting learning materials prior to Prototype 2.

This formative revision did not alter the syntax of the model—which consists of five learning phases—but clarified the implementation procedures and strengthened the supporting tools. The refined model and tools were subsequently used in Prototype 2. Thus, evidence from the implementation of Prototype 1 was used to evaluate practicality and inform formative refinements to the model prior to the next implementation phase.

4.4 Supporting Evidence of Practicality

4.4.1 Learning Management

Instructional management was analyzed as evidence supporting the practicality of the Heutagogy Learning Model in real-world learning settings. The assessment was conducted by two observers using 15 indicators covering five aspects: opening activities, management of learning activities, assessment activities, closing activities, and classroom atmosphere. Observations were conducted over eight sessions in each of the Prototype 1 and Prototype 2 phases. The assessment results are presented in Table 5.

Table 5
Learning Management in Prototype 1 and Prototype 2

Aspects of Learning Management	Prototype 1	Category	Prototype 2	Category	Changes
Opening Ceremony	2.54	Low	4.15	High	+ 1.61
Management of learning activities	3.21	Moderate	4.11	High	+ 0.90
Assessment activities	3.27	Moderate	4.06	High	+ 0.79
Closing activity	3.28	Moderate	4.06	High	+ 0.78
Classroom atmosphere	2.72	Low	4.00	High	+ 1.28
Total	3.03	Moderate	4.09	High	+ 1.06

Note. Interpretation criteria: 1.00–1.99 = very low; 2.00–2.99 = low; 3.00–3.99 = moderate; 4.00–4.99 = high; and 5.00 = very high. The overall score was calculated as the mean of all 15 learning management indicators. Descriptive change represents the difference between the scores for Prototype 2 and Prototype 1 and is not interpreted as a causal effect of the model revision.

In Prototype 1, overall learning management fell into the moderate category (M = 3.03). Opening activities (M = 2.54) and classroom atmosphere (M = 2.72) received the lowest scores and fell into the low category, while the management of learning activities (M = 3.21), assessment activities (M = 3.27), and closing activities (M = 3.28) fell into the moderate category. These findings indicate that instructional management during the initial implementation still requires refinement, particularly regarding opening activities and classroom atmosphere, and will be used as part of the formative evidence prior to Prototype 2.

In Prototype 2, overall learning management fell into the high category (M = 4.09), with all aspects also falling into the high category (M = 4.00–4.15). Descriptively, the largest differences in scores between the two stages were found in opening activities (+ 1.61) and classroom atmosphere (+ 1.28), which were the two aspects with the lowest scores in Prototype 1. These results provide supporting evidence regarding the model's applicability in actual learning.

4.4.2 Student Responses

Student responses were analyzed as evidence supporting the practicality of the Heutagogy Learning Model from the students' perspective. Responses were measured at the end of each prototype stage using 21 items covering three aspects: cognitive, affective, and conative. The analysis was conducted descriptively using the mean, standard deviation, 95% confidence interval for the overall score, and the proportion of positive responses. The results of student responses to Prototype 1 and Prototype 2 are presented in Table 6.

Table 6
Student Responses to Prototype 1 and Prototype 2

Indicators	**Prototype 1 (n = 36)**	**Prototype 2 (n = 34)**
Cognitive, M (SD)	23.17 (2.51)	24.97 (2.97)
Positive cognitive responses	80.6%	88.2%
Affective, M (SD)	23.17 (2.51)	25.21 (3.21)
Positive affective response	80.6%	88.2%
Conative, M (SD)	23.53 (2.69)	24.94 (3.09)
Positive conative response	83.3%	82.4
Total score, M (SD)	69.86 (7.41)	75.12 (9.05)
95% CI for total score	[67.35; 72.37]	[71.96; 78.28]
Overall positive response	83.3%	88.2%

Note: M = mean; *SD* = standard deviation; CI = confidence interval. Positive responses were defined as an average item score greater than 3.00, corresponding to scores greater than 21 for each of the seven-item dimensions and greater than 63 for the 21-item total scale. Comparisons between Prototype 1 and Prototype 2 are descriptive because the two stages involved different groups of students.

In Prototype 1, students generally showed a positive response to the implementation of the Heutagogy Learning Model. The total score for student responses averaged 69.86 (SD = 7.41; 95% CI [67.35, 72.37]), with 83.3% of students falling into the positive response category. For each aspect, the proportion of positive responses ranged from 80.6% to 83.3%. These findings indicate that although the model's actual practicality in Prototype 1 was still in the moderate category, the majority of students responded positively to the learning experience.

In Prototype 2, the total student response score had a mean of 75.12 (SD = 9.05; 95% CI [71.96, 78.28]), with 88.2% of students showing positive responses overall. The proportion of positive responses across the three aspects ranged from 82.4% to 88.2%. Descriptively, the average total score and the overall proportion of positive responses in Prototype 2 were higher than those in Prototype 1. However, the proportion of positive responses in the conative aspect was relatively similar, at 83.3% in Prototype 1 and 82.4% in Prototype 2.

Overall, the majority of students in both prototype phases responded positively to the implementation of the Heutagogy Learning Model. In Prototype 2, students' positive responses coincided with high ratings for practicality and learning management. These findings provide supporting evidence regarding the model's practicality from the students' perspective.

5 Discussion

This study reveals a gap between expected practicality and actual practicality in the initial implementation of the Heutagogy Learning Model. Although experts and practitioners rated the model as having high expected practicality, the actual practicality of Prototype 1 remained in the moderate category. This indicates that a model deemed practical is not necessarily immediately applicable with the same level of practicality in actual learning contexts. This distinction aligns with Nieveen and Folmer [13], who define practicality not only in terms of whether an intervention is expected to be usable but also in terms of its use within the intended context.

This gap is primarily related to students' readiness to engage in self-directed learning. In Prototype 1, students still required support in learning exploration, goal-setting, and reflection. This finding aligns with self-determined learning, which identifies learner agency, autonomy, and reflection as the key characteristics of heutagogical learning [17, 20]. In pre-service teacher education, students' readiness to engage in heutagogical learning can vary [7], so scaffolding and adaptive facilitation remain necessary to balance autonomy with learners' readiness [8]. Thus, the findings from Prototype 1 indicate that granting autonomy must be accompanied by support appropriate to students' readiness.

These findings also underscore the importance of the facilitator's role. In heutagogy, the shift from the instructor as the primary guide to a facilitator does not mean eliminating support, but rather changing the form of support to make room for learner agency. Facilitators remain necessary to support goal-setting, exploration, feedback, and reflection without taking control of students' learning [17]. This aligns with Beer [8], who highlights the importance of adaptive facilitation in balancing learners' autonomy with their need for support. Thus, the operationalization of self-determined learning requires a balance between adequate structure and space for students to take responsibility for their own learning process.

Formative evaluation allows the gaps between the design and implementation to be used as a basis for refining the model. Evidence from Prototype 1 informed revisions to the procedures for implementing the learning, reflection, and feedback phases; time allocation; facilitation strategies; and supporting tools—without altering the syntax of the model, which consists of five learning phases. This process reflects the

iterative nature of Educational Design Research, in which implementation evidence is used to refine the intervention in subsequent stages [12, 13]. In Prototype 2, actual practicality reached a high category and demonstrated a stronger alignment with expected practicality. However, since both prototypes involved different groups of students without random allocation, this pattern is understood as descriptive evidence regarding practicality following formative refinement, rather than as a causal effect of the revisions or evidence of the model's effectiveness.

The management of the learning process and student responses reinforce the evaluation of practicality from different perspectives. In Prototype 2, the management of the learning process achieved a high rating, and the majority of students provided positive feedback. However, the majority of students had already provided positive feedback on Prototype 1 when actual practicality was still rated as moderate. This pattern indicates that student responses and the model's implementation are complementary sources of evidence, but they do not always show the same pattern. Therefore, using multiple sources of evidence provides a more comprehensive picture of the model's practicality than relying on a single indicator.

The contributions of this study lie in two aspects. First, this study demonstrates how the principle of self-determined learning can be operationalized into a framework consisting of five learning phases while still providing space for autonomy, reflection, exploration, and learner agency. Second, this study highlights the importance of considering the alignment between expected practicality and actual practicality in the development of heutagogical designs. Formative evaluation provides a mechanism for using implementation evidence to iteratively refine the design. Thus, this study provides evidence regarding the practicality of the Heutagogical Learning Model, while also demonstrating how heutagogical principles can be translated into an operational learning design for the education of prospective elementary school teachers.

5.1 Implications for Teacher Education

The findings of this study indicate that the application of heutagogy in pre-service teacher education requires a balance between autonomy and structured support. Pre-service teachers need to be given the space to determine their learning needs and goals, explore learning resources, and reflect on their learning processes and outcomes. At the same time, facilitators provide scaffolding and feedback tailored to students' readiness and independence.

In practice, implementing heutagogy requires more than simply granting students freedom to learn. Facilitator guidelines, student modules, mechanisms for reflection and feedback, and time allocation must be designed in a practical way to support self-determined learning. In pre-service teacher education, this type of learning experience provides students with the opportunity to directly experience how autonomy, reflection, and facilitator support are integrated into the learning process. This experience can serve as a reference for pre-service teachers in designing instruction that allows for greater student autonomy.

5.2 Limitations and Future Research

This study has several limitations. First, the study was conducted in a single elementary school teacher education program at one university using intact classes; therefore, the findings regarding the model's practicality remain contextual. Second, Prototype 1 and Prototype 2 involved different groups of students without random allocation; therefore, differences between the prototypes cannot be interpreted as a causal effect of the model revisions. Future research could evaluate the model's practicality in more diverse teacher education contexts to gain a broader understanding of the model's application across different learner characteristics and learning environments.

6 Conclusion

This study shows that the Heutagogy Learning Model meets the criteria for practicality following formative evaluation and refinement. Although expected practicality was rated highly by experts and practitioners, initial implementation indicated that actual practicality still requires refinement. Evidence from Prototype 1 was used formatively to inform revisions to the implementation procedures and supporting tools for the model. In Prototype 2, actual practicality fell into the high category, supported by learning management that also fell into the high category and positive responses from the majority of students.

These findings underscore the importance of evaluating the practicality of heutagogical designs not only through assessments during the design phase but also through their implementation in actual learning contexts. Formative evaluation provides evidence for iteratively refining the design. Thus, this study demonstrates that the principles of self-determined learning can be operationalized into a structured learning syntax consisting of five phases, while still providing space for autonomy, reflection, exploration, and learner agency in the education of prospective elementary school teachers.

Declarations

Ethics approval and consent to participate

This study received ethical approval from the Ethics Committee of the Faculty of Psychology, Universitas Sumatera Utara, Indonesia (Approval No. 02/Komet/FPsi/2025). All procedures involving human participants and their data were conducted in accordance with relevant institutional guidelines, national regulations, and the ethical principles of the Declaration of Helsinki. Written informed consent was obtained electronically from all participants via Google Forms prior to data collection. Participation was voluntary, and all participants were informed about the study objectives, research procedures, and their rights as research participants before providing consent. The confidentiality of participants' identities and personal data was maintained throughout the study.

Consent for publication

Not applicable. The data collected and reported in this study are fully anonymized, and no individual identifiable personal information is included, in accordance with the informed consent obtained from the participants.

Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Funding

This research did not receive any specific grants from funding agencies in the public, commercial, or nonprofit sectors.

Author Contribution

Fasti Rola contributed to conceptualization, methodology, software, validation, formal analysis, investigation, resources, data curation, writing – original draft, writing – review and editing, visualization, project administration, and funding acquisition; Bornok Sinaga contributed to conceptualization, methodology, validation, investigation, data curation, writing – review and editing, and supervision; and Wisman Hadi contributed to conceptualization, methodology, validation, investigation, data curation, writing – review and editing, and supervision. All authors reviewed and approved the final manuscript.

Acknowledgements

The authors would like to thank the faculty members and students who participated in this study, as well as the experts and practitioners who contributed to the evaluation and refinement of the Heutagogy Learning Model. Their participation and feedback greatly supported the conduct of this study.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

References

1. Şengel S, Özyurt M. Investigation of the learning and teaching processes of the primary school pre-service teachers with high and low 21st century teaching skills. Kuramsal Eğitimbilim. 2025;18(3):509–35. https://doi.org/10.30831/akukeg.1621272.

2. Yedigöz Kara Z, Baysal H, Ünver G. Pre-service teacher education programs with 21st-century skills: Teacher educators' experiences. J Teacher Educ Lifelong Learn. 2025;7(1):53–72. https://doi.org/10.51535/tell.1623580.
3. Yurt E. 21st-century skills as predictors of pre-service teachers' professional qualifications: A cross-sectional study. Int J Educ Math Sci Technol. 2023;11(5):1328–45. https://doi.org/10.46328/ijemst.3291.
4. Phan TTH, Nguyen DTT, Ly TTT, Duong TDP, Mai TV. Pre-service teachers' perceptions and practices of learner autonomy: A case study in Vietnam. Int J Learn Teach Educational Res. 2024;23(2):421–35. https://doi.org/10.26803/ijlter.23.2.20.
5. Hase S, Kenyon C. Heutagogy fundamental. In: Hase S, Kenyon C, editors. Self-determined learning: Heutagogy in action. Bloomsbury Academic; 2013. pp. 7–18.
6. Handayani S, Peddell L, Yeigh T. Participants' experiences in heutagogy teacher professional education in Indonesia. Australian J Teacher Educ. 2023;48(6):1–15. https://doi.org/10.14221/1835-517X.5739.
7. Mwinkaar L, Lonibe JFY. Heutagogy as an alternative in teacher education: conceptions of lecturers and pre-service teachers of school of education and life-long learning, SDD-UBIDS. Front Educ. 2024;9. https://doi.org/10.3389/feduc.2024.1389661.
8. Beer T. It's not my safe zone: Student-teachers' perspectives on readiness and facilitator practices in heutagogy-inspired courses. Front Educ. 2026;11. https://doi.org/10.3389/feduc.2026.1860322.
9. Agonács N, Matos JF. Heutagogy and self-determined learning: A review of the published literature on the application and implementation of the theory. Open Learn. 2019;34(3):223–40. https://doi.org/10.1080/02680513.2018.1562329.
10. Ramas S, Yasin RM, Adnan NH. Benefits and challenges of the heutagogy approach in education: A systematic review. Cypriot J Educational Sci. 2024;19(2):198–217. https://doi.org/10.18844/cjes.v19i2.7604.
11. Jacobsen M, McKenney S. Educational design research: Grappling with methodological fit. Education Tech Research Dev. 2024;72(5):2743–62. https://doi.org/10.1007/s11423-023-10282-5.
12. McKenney S, Reeves TC. Educational design research for relevant & robust scholarship. J Comput High Educ. 2025;37(2):614–38. https://doi.org/10.1007/s12528-025-09456-2.
13. Nieveen N, Folmer E. Formative evaluation in educational design research. In: Plomp T, Nieveen N, editors. Educational design research – Part A: An introduction. Netherlands Institute for Curriculum Development (SLO); 2013. pp. 152–69.
14. Hase S, Kenyon C. From andragogy to heutagogy. Ultibase Articles. 2000;5:1–10.
15. Blaschke LM, Hase S, Heutagogy. A holistic framework for creating 21st century self-determined learners. In: Gros B, Maina K M, editors. The future of ubiquitous learning: Learning designs for emerging pedagogies. Springer; 2015. pp. 25–40. https://doi.org/10.1007/978-3-662-47724-3.
16. Blaschke LM, Marín VI. Applications of heutagogy in the educational use of e-portfolios. Revista de Educación Distancia. 2020;20(64). https://doi.org/10.6018/red.407831.

17. Blaschke LM. Heutagogy and lifelong learning: A review of heutagogical practice and self-determined learning. Int Rev Res Open Distrib Learn. 2012;13(1):56–71. https://doi.org/10.19173/irrodl.v13i1.1076.
18. Plomp T. Educational design research: An introduction. In: Nieveen N, Plomp T, editors. Educational design research – Part A: An introduction. Netherlands Institute for Curriculum Development (SLO); 2013. pp. 10–51.
19. Landis JR, Koch GG. The measurement of observer agreement for categorical data. Biometrics. 1977;33(1):159–74. https://doi.org/10.2307/2529310.
20. Panta R, Heutagogy. A comprehensive review of self-determined learning in contemporary education. Cureus. 2025;17(1). https://doi.org/10.7759/cureus.89731.

Figures

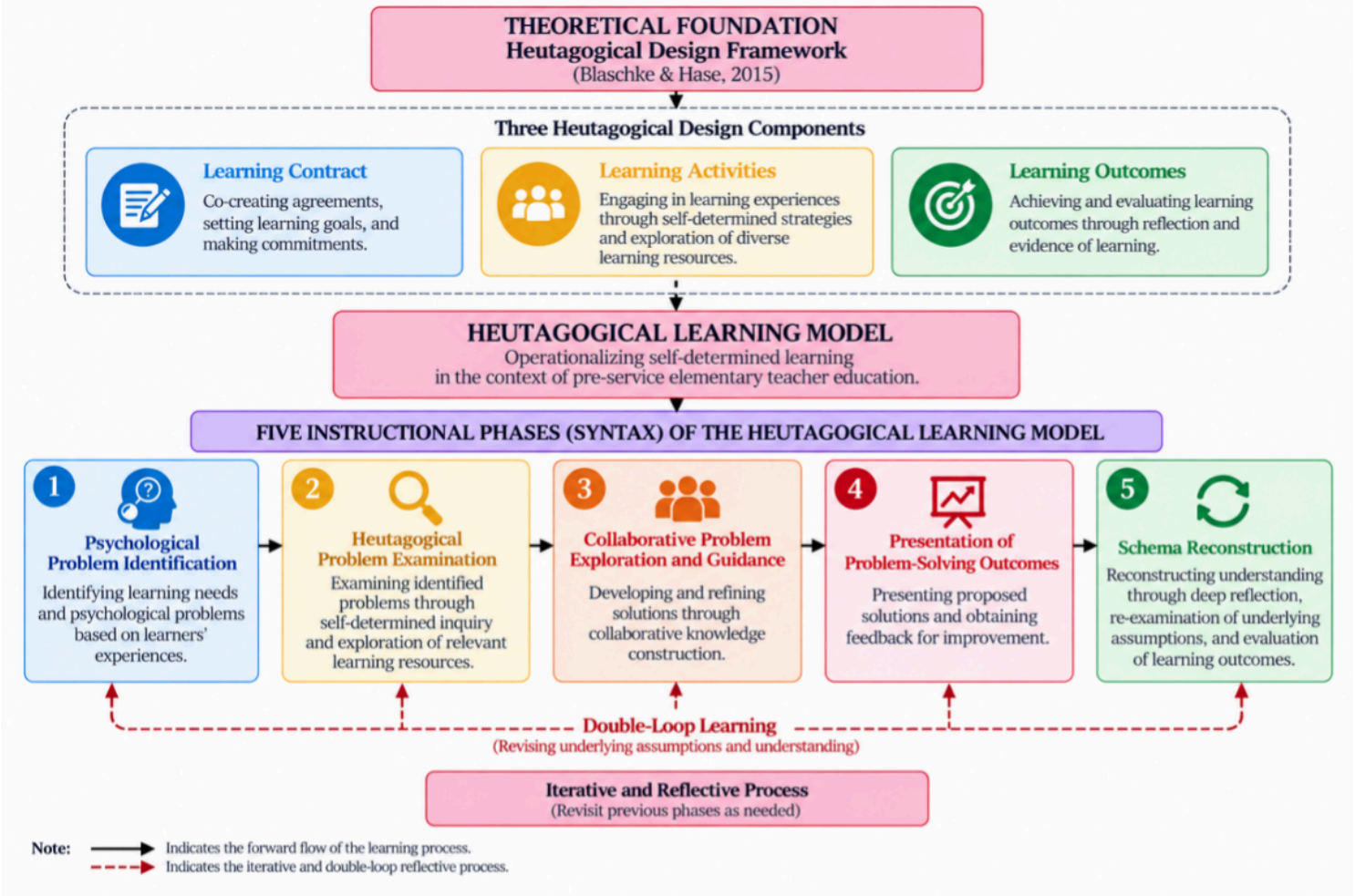


Figure 1

Conceptual Framework of the Heutagogical Learning Model