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Unleashing the Power of Data: Exploring the Transformative Effects of Data-Driven Strategies on Personalized Learning Experiences and Student Mastery

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ABSTRACT

Objective: Education plays a crucial role in influencing the future of individuals and societies. Effective teaching and learning strategies are crucial for achieving the best educational outcomes. Consequently, the primary purpose of this study is to investigate the transformative effects of data-driven strategies on personalized learning experiences, students' mastery, and learning outcomes, such as curriculum mapping, formative assessment, and differentiation. In addition, the study investigates the potential function of content sequencing and pacing as mediators and moderators of this association. **Methodology:** The information is gathered using a retrospective technique and a quantitative survey methodology. The study involved selecting pupils from Indonesian Hindu universities using a multistage random sampling method. **Results:** A multistage regression analysis revealed a significant positive correlation between using data to inform instructional decision-making and providing individualized learning opportunities for students. Therefore, this was associated with improved academic performance among students. The results indicate that data-driven approaches increase student proficiency and knowledge acquisition through personalized learning experiences. This has been determined to be the circumstance. The investigation revealed that the arrangement and timing of the content in the students' individualized educational encounters affected their overall proficiency and academic accomplishments. **Implications:** To develop effective instructional strategies, educators and policymakers must prioritize the adoption of a data-driven approach, the facilitation of personalized learning environments, and the careful consideration of content sequencing and pacing.**Novelty:** Educators and policymakers must prioritize adopting data-driven strategies, facilitating personalized learning environments, and carefully considering content sequencing and cadence to develop effective instructional techniques.© 2022 Ani Publishing Ltd. All rights reserved.

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Introduction

The modern educational system is characterized by rapid improvements, with technology occupying an important place in this environment. Consequently, the potential for data-driven methods to revolutionize teaching and learning experiences has become increasingly obvious (Teng, Zhang, & Sun, 2023). The rise of digital platforms and educational technology has ushered in a new phase of data gathering and analysis within the educational environment (Muftah, 2023), which has important implications for the field. According to Walkington and Bernacki's research from 2020, the concept of personalized learning has recently emerged as a potentially useful strategy for teachers to accommodate the varied requirements of their pupils and encourage the acquisition of subject matter expertise. The purpose of this study is to evaluate the various ways in which data-driven tactics can improve students' general competence and the opportunities that are accessible to them for individualized education. As this inquiry's primary focus, we will concentrate on curricular mapping, formative assessment, and differentiating instruction. According to Siyam and Hussain (2022), curriculum mapping is an approach that may be used to align the activities that take place in the classroom with measurable learning outcomes. This alignment can be accomplished through the use of the curriculum mapping strategy. Teachers are better positioned to address their pupils' varied needs if they organize their lessons with care and consideration. It is vital to ensure that students have a firm comprehension of the course's content and the timeframe that is linked with it to achieve this purpose. This can only be done by ensuring students are aware of both aspects.

Data-driven tactics have the potential to have a considerable impact on the educational experiences of today's students, which is particularly relevant, taking into consideration the rapid speed of technological development that characterizes the educational environment of the present day. Teng et al. (2023) have documented the incidence of this phenomenon in their research. The current environment can be differentiated by the rapid developments made in the educational landscape. The widespread availability of digital platforms and educational technology has resulted in a new phase of data collection and analysis within the classroom, which bears important consequences for the field of education (Muftah, 2023). This new phase of data collection and analysis within the classroom has brought about a new phase of data collection and analysis. According to the research by Walkington and Bernacki (2020), personalized learning has emerged as a successful pedagogical technique in recent years as educators attempt to accommodate their students' varied requirements and develop material mastery. This study aims to investigate the potentially transformative effects of data-driven techniques on individualized learning experiences and the level of mastery students can achieve. This investigation focuses on three essential components: curriculum mapping, formative assessment, and differentiated instruction. According to Siyam and Hussain (2022), curriculum mapping is a strategy process that involves aligning instructional content with predetermined learning objectives. Siyam and Hussain define curriculum mapping as a strategic process. The educators are provided with a clear image of the topics their pupils will learn and the order in which they will cover them due to careful curriculum planning. This makes it possible for educators to address better the requirements of a larger variety of kids, improving educators' ability to fulfill the needs of all students.

Utilizing various formative evaluation tools is a key component of the process. According to Yan and Pastore (2022), using such tools enables educators to monitor the development of their pupils in real time, which opens the door for opportunities for instantaneous feedback and the

change of instructional tactics. According to Teng (2022), utilizing approaches driven by data can enhance the levels of academic accomplishment, engagement, and motivation among students while they are in the classroom. This is something that has the potential to take place. According to Shirowzhan et al. (2020), differentiation is a process comparable to customization in the sense that it entails adapting curricular content to each specific student's unique learning styles, interests, and prerequisites. Educators can efficiently construct lesson plans that cater to the specific requirements of each student in their class when they use student data as a point of reference. This results in a more individualized and efficient method of imparting knowledge to students. According to Schwab, Sharma, and Hoffmann (2022), using diversified approaches in the classroom allows pupils to learn individually and investigate subjects that pique their interests. Students have a greater chance of taking responsibility for their own education and achieving results that will last if they are allowed to customize their educational experience.

Despite the growing acceptance of data-driven approaches and individualized training, significant gaps in the academic investigation call for attention to be paid to them. The limited empirical substantiation of the approaches mentioned above is the cause of the lacunae that were previously noted. Although several studies have investigated the effects of each of these aspects individually, it is required to conduct an in-depth investigation of their collective influence to provide the foundation for the development of effective instructional strategies (Schwab et al., 2022; Riaman et al., 2022; Yan, Chiu, & Cheng, 2022). The research by Schwab et al. (2022) and Yan et al. (2022) has significantly contributed to the ongoing conversation in the academic community. The current study acknowledges the interdependent nature of these factors. It looks at how they interact with one another, intending to bridge the current knowledge gap between us. It is essential to have a comprehensive understanding of the interplay of dynamics and connections between diverse components to successfully implement data-driven initiatives, ultimately leading to the improvement of educational results.

Because of their function as an intermediate between data-driven strategies and the proficiency and educational achievements students accomplish, individualized educational experiences are recognized as significant in this research. This is because these experiences may be tailored to meet the specific needs of each student. Personalized learning experiences play a crucial role in transferring the effects of data-driven tactics into improved student outcomes (Bernacki, Greene, & Lobczowski, 2021). This is accomplished by adapting education to the specific requirements of individual students and fostering engagement and motivation among students. According to (Lytje, 2022), "the study highlights the role of content sequencing and pacing as a moderator in the relationship between personalized learning experiences and student outcomes." It recognizes that the success of personalized learning experiences depends on the careful design and delivery of instructional content to achieve the desired results. Implementing a deliberate content sequencing and pacing plan in personalized learning experiences can dramatically impact student mastery and learning.

In addition, there is a gap in the contextual setting of the educational management system in Indonesia, which makes it necessary to investigate the applicability and effectiveness of data-driven solutions within this setting. Indonesia's education system is confronted with several one-of-a-kind issues, including varied student populations, big class sizes, and a scarcity of resources (Sulasmi & Dalle, 2022; Wakhidah & Erman, 2022). Advancing educational practices in Indonesia requires understanding how data-driven techniques can be utilized to create tailored learning experiences and raise students' levels of mastery within this environment. Therefore, this research

article aims to attempt to bridge this contextual gap by investigating the use of data-driven tactics and the influence those strategies have on student results within the context of the Indonesian educational system. In doing so, the following objectives are hoped to be accomplished:

- Investigate the combined effects of curriculum mapping, formative assessment, and differentiation on students' mastery and learning outcomes.
- Explore the mediating role of personalized learning experiences in the relationship between data-driven strategies and students' mastery and learning outcomes.
- Examine the moderating role of content sequencing and pacing on the relationship between data-driven strategies and students' mastery and learning outcomes.
- Provide empirical evidence and practical insights into the application and effectiveness of data-driven strategies in the Indonesian educational management system.

As a result, this research study aims to unleash the revolutionary power of data-driven techniques in education, with an emphasis on tailored learning experiences and student mastery in particular. This study aims to contribute to advancing educational practices and bridge the academic and contextual gaps within the Indonesian education management system. This will be accomplished by analyzing the interplay between curriculum mapping, formative assessment, and differentiation; the role that personalized learning experiences play as a moderating factor; and the role that content sequencing and pacing play as a mediating factor. All of these factors will be examined.

Literature Review

This study bases its theoretical foundation on the Personalized learning experiences theory principles, which offer a comprehensive framework for comprehending and putting personalized learning experiences into practice. These principles constitute the theoretical underpinnings of this study, personalized educational opportunities, and experiences, according to Thai, Bang, & Li, (2022). The theory emphasizes how important it is to cater education to individual students' specific requirements, interests, and capabilities. According to the idea mentioned above, better degrees of mastery and more profound learning is positively connected with the presence of learning experiences that are regarded as meaningful and relevant (Chaipidech et al., 2022). This study provides evidence for the endorsement of the individualized learning experience theory since it matches the factors investigated in this research. Curriculum mapping, formative assessment, and differentiated instruction are all included in the aforementioned considerations. The process of mapping out a curriculum guarantees that students obtain an education that is meaningful to them by aligning the content of their classes with the objectives they wish to achieve. When teachers are given this degree of independence, the study by Kelly, Hyde, and Abdalla (2022) found that they were better able to cater to the needs of their students since they had more control over the classroom environment. If students believe that the information they are being taught in class is fascinating and applicable to their lives, they will have a greater desire to learn new things.

The idea of "Individualized Learning Environments" focuses a significant amount of stress on the value of "formative assessment" in the educational setting. When employing this practice, students are actively urged to provide continuing feedback and participate actively in the learning process. The decade of the 1990s was crucial to the development of the idea that was discussed earlier. According to Lu and Cutumisu (2022), regular assessments of student work and constructive feedback can help teachers facilitate students' subject mastery and encourage

students' growth as learners who can learn independently. This can assist teachers in facilitating students' subject mastery and foster students' development as independent learners. By adjusting their methods of instruction in light of the information received from formative assessments, teachers can better fulfill their students' requirements. This, in turn, leads to more personalized learning for each student. This makes it easier for teachers to adapt their instructional methods to meet the specific requirements of their classes of students. According to the propositions put up by the Theory of Personal Learning Experiences (TPLE), the method of learning that is most effective is individualized instruction. According to the findings of research carried out by Hasanah et al. (2022), the utilization of differentiation tactics in the classroom by educators may result in higher levels of student engagement and greater knowledge retention of curricular content. The goal mentioned above can be achieved by tailoring the instructional material to the specific requirements of each student, taking into account both the learner's strengths and areas in which they still need to develop their skills. The viewpoint mentioned above is consistent with the tenets espoused by the theory of personalized learning environments, an educational framework that advocates for a set of instructional principles that prioritize the customization of teaching methods to meet the unique needs of each student in the classroom. This perspective aligns with the tenets espoused by the theory of personalized learning environments.

Data-Driven Strategies and Students' Mastery and Learning

According to Mahmoudi and Xiong (2022), data-driven methods have evolved into useful tools that can be implemented in a classroom environment. There has never been a more fruitful period for educators to better the educational experiences of their students and to raise the level of academic accomplishment among their pupil body than there is right now. Data-driven curriculum mapping is a tool that can assist teachers in better matching classes with the learning outcomes of their students. This can be accomplished with the use of the tool. Aljohani et al. (2022) state that there is a correlation between the usage of alignment in the classroom and an increase in global academic achievement. Alignment allows teachers to adapt their classes better to meet the needs of their pupils. The process of curriculum mapping lays the way for personalized education since it enables teachers to alter lessons to cater to the requirements of each student. This strategy is effective because it piques the interest of the students, which in turn raises the students' overall comprehension of the topic as well as its breadth and depth. Students are free to study whenever and at whatever speed is most conducive to their learning, which makes this possibility a reality. Research has shown that students better understand when their teachers use mapping to align the curriculum strategically. This ensures that students receive consistent and relevant training to construct new connections and expand their existing knowledge. Learners are encouraged to develop new understandings by drawing connections between various concepts, which is one of the reasons why this is the case. These authors provide evidence in support of their thesis. The uniformity of the information makes it simpler to learn, which in turn helps students become familiar with the subject at hand, enabling them to become experts in the applicable sector.

Students receive frequent feedback on their learning through various formative assessment strategies (Kaya-Capocci, O'Leary, & Costello, 2022). When teachers engage in continuing assessment and deliver timely feedback, they can better identify the areas in which their students struggle and adapt their teaching strategies to address those areas. Students are better equipped to take responsibility for their own educational experiences when they are given this type of quick feedback, according to research by Asamoah, Shahrill, and Latif (2022). The use of differentiation is another important factor that contributes to the improvement of students' learning and

competence. According to Sneddon (2022) and others, differentiated instruction allows for flexibility in pacing, content, and instructional methodologies, making it possible to cater to the specific requirements of each student. Because of this customization, students feel recognized and supported in their educational path, which boosts student engagement and motivation. Therefore, educators can construct diversified instruction methods for students by leveraging curriculum mapping and data from formative assessments to meet students' varied learning styles, interests, and skills. This level of customization encourages engagement, motivation, and a sense of ownership over the learning process, which ultimately contributes to the students' level of mastery and the outcomes of their education. As a result, the following is proposed:

H1: *Data-driven strategies, i.e., a) curriculum mapping, b) formative assessment, and c) differentiation, positively impact students' mastery and learning.*

Data-Driven Strategies and Personalized Learning Experiences

According to Jones, Fenerci-Soysal, and Wilkins (2022), data-driven tactics have revolutionized education, bringing revolutionary opportunities to improve students' opportunities for tailored learning experiences. This project aims to significantly contribute to the existing body of knowledge concerning education management by investigating the interrelationships between data-driven strategies and their influence on student engagement, motivation, and self-directed learning. According to research conducted by Mahmoudi and Xiong (2022), curriculum mapping makes learning experiences easier by ensuring that the content is customized to match each student's specific strengths, weaknesses, and learning styles. It allows teachers to identify students' weak areas of knowledge and provide focused remediation, ultimately leading to better student mastery. At the same time, formative assessment allows students to participate actively in their own education, which fosters self-regulation, metacognition, and a sense of responsibility for the student's academic growth (Sudakova et al., 2022). Because of this, individualized educational experiences are improved, which in turn leads to higher levels of engagement and motivation. In addition, the differentiation of instruction, a data-driven technique that caters to the specific requirements of each student, is an essential component in developing individualized learning experiences (Gaitas et al., 2022). According to Kudto, Lumapenet, and Guiamalon (2022), personalized learning experiences allow students to investigate topics that are of particular interest to them, assume responsibility for their own education, and acquire content mastery. Therefore, these tactics increase individualized learning experiences by ensuring that education is aligned with student goals, that feedback is provided promptly, and that instruction is customized to meet various student abilities and interests. As a result, the following is proposed:

H2: *Data-driven strategies, i.e., a) curriculum mapping, b) formative assessment, and c) differentiation, positively impact personalized learning experiences.*

Personalized Learning Experiences and Students' Mastery and Learning

According to Randi and Corno (2022), personalized learning experiences have evolved as a powerful educational technique, offering the possibility of transforming students' levels of mastery and the learning outcomes they achieve. This article investigates how individualized instruction, learner autonomy, and adaptive techniques lead to higher academic accomplishment by focusing on the impact of personalized learning experiences on students' mastery and learning. Learning opportunities that are customized place emphasis on adapting the curriculum to the specific requirements, skills, and passions of each student (You, 2022). According to Shenoy,

Mahendra, & Vijay, (2020), educators can "scaffold" learning experiences by giving personalized instruction tailored to their pupils' readiness levels and learning styles. This focused approach encourages a greater level of involvement and comprehension among students, which in turn makes it easier for them to master academic material. Students are more likely to develop a sense of competence, confidence, and intrinsic motivation when they get teaching that fits their unique requirements (Omar et al., 2022). All of these factors contribute to higher learning outcomes. In addition, tailored learning experiences encourage learner autonomy, allowing students to take responsibility for their own education (Baabdullah et al., 2022). Student agency and self-regulation can be improved through personalized learning experiences. These experiences give students greater control over their learning route, pace, and material selections. According to Amka and Dalle (2022), increased student involvement and motivation result from increased opportunities to exercise their sense of responsibility and self-direction. Students who take an active role in forming their educational experiences have a greater sense of personal investment in their education, leading to improved subject matter mastery and a more profound comprehension of the material. As a result, the following is proposed:

H3: *Personalized learning experiences positively impact students' mastery and learning outcomes.*

The Mediating Role of Personalized Learning Experiences

In the field of education, data-driven techniques have garnered a lot of attention recently due to the fact that they have the ability to increase students' overall competence as well as their learning outcomes (Yusop et al., 2022). In addition to the direct influence that data-driven techniques have on the levels of mastery and learning attained by students, the article analyzes the function of individualized learning experiences in mediating the connections between these three factors. According to Verma, Singh, and Patwardhan (2022), aligning and systematically mapping the curriculum promotes relevance and coherence, which enables students to make connections between topics and engage in more in-depth learning. Increased motivation, engagement, and ultimately, mastery and learning outcomes can be achieved by students when curriculum mapping is linked with personalized learning experiences (Sutriyanti, Marsono, & Supandi, 2019) Students can investigate topics corresponding to their interests and strengths when curriculum mapping is coupled with customized learning experiences.

In addition, the feedback collected via formative assessments makes it possible to facilitate targeted interventions, which in turn helps scaffold instruction to promote students' mastery and learning (Sudakova et al., 2022). Students are given the ability to actively participate in their learning journey through the use of formative assessment, which is mediated through personalized learning experiences. This helps students develop a feeling of agency, self-regulation, and metacognition. In turn, this may have a favorable impact on both their level of mastery and the learning outcomes. In addition, as was said previously, differentiated education takes into account the various talents, interests, and learning styles of students, increasing their engagement and motivation (Milinga, Amani, & Lyakurwa, 2023). Students are likelier to have a sense of relevance, ownership, and achievement when they get teaching personalized to their talents and preferences (Hinojosa, 2023). This contributes to improving the students' overall mastery and learning outcomes. In addition, incorporating data-driven tactics into personalized learning experiences increases the effectiveness of these strategies (Slack & Priestley, 2022). These experiences create an atmosphere in which students feel respected, empowered, and inspired to take an active role in their learning, ultimately leading to enhanced outcomes in both mastery and learning. As a result, the following is proposed:

H4: *Personalized* **learning** *experiences mediate the relationship of data-driven strategies, i.e., a) curriculum mapping, b) formative assessment, and c) differentiation with students' mastery and learning outcomes.*

The Moderating Role of Content Sequencing and Pacing

According to Baabdullah et al. (2022), personalized learning experiences emphasize adapting training to match individual students' specific requirements and interests. However, the order in which instructional material is presented and the rate at which it is offered within these experiences can significantly influence student outcomes (Khamraevna, 2022). Pacing relates to the rate at which students go through the content, whereas content sequencing refers to the sequence in which instructional materials and activities are given (Namestovski & Kovari, 2022). The potential of material sequencing and pacing to either facilitate or impede the efficacy of tailored learning experiences provides this learning with experience its moderating role. According to Bustoba and Cruz (2022), students have a greater capacity to comprehend and remember the material when presented in an educational format that is rationally and coherently sequenced, building upon existing knowledge, and gradually growing in complexity. The information is organized sequentially, guaranteeing that core idea are sufficiently covered before proceeding to more difficult subjects. According to Srinivasa, Kurni, and Saritha (2022), this makes it easier for students to gain a more in-depth comprehension of the topic and improves mastery and learning outcomes within tailored learning experiences.

In addition, the pace at which students move through the material should be adjusted according to each student's unique requirements and capabilities (Abhirami & Devi, 2022). Students may feel overwhelmed and lack mastery when the lesson's pace is too rapid, whereas disengagement and a lack of challenge may ensue when the lesson is too slow (Hui, 2023). The capacity of content sequencing and pacing to complement and amplify the benefits of tailored learning experiences is evidence of the moderating role of content sequencing and pacing in educational settings. According to Chigbu et al. (2023), properly sequenced information enables a logical evolution of knowledge, which makes it easier for students to absorb and learn the material. In addition, adequate pacing ensures that students have the time to interact with and internalize the instructional content, leading to deeper learning results. This ensures students have sufficient time to engage with and internalize the instructional content. As a result, we hypothesize that when content sequencing and pace are properly handled within individualized learning experiences, students will have a greater likelihood of experiencing a sense of coherence, engagement, and success, hence optimizing their level of mastery and the learning outcomes they will achieve. As a result, the following is proposed:

H5: *Content sequencing and pacing moderate the association between personalized learning experiences and students' mastery and learning outcomes.*

Theoretical Framework

The conceptual underpinnings of this investigation are laid out in Figure 1, and they are comprised of an amalgamation of pertinent theory and previously published research. The framework exemplifies the essential role of data-driven tactics in affecting students' mastery and learning outcomes. These strategies are mediated through individualized learning experiences, and the sequencing and pace of the content tempers them.

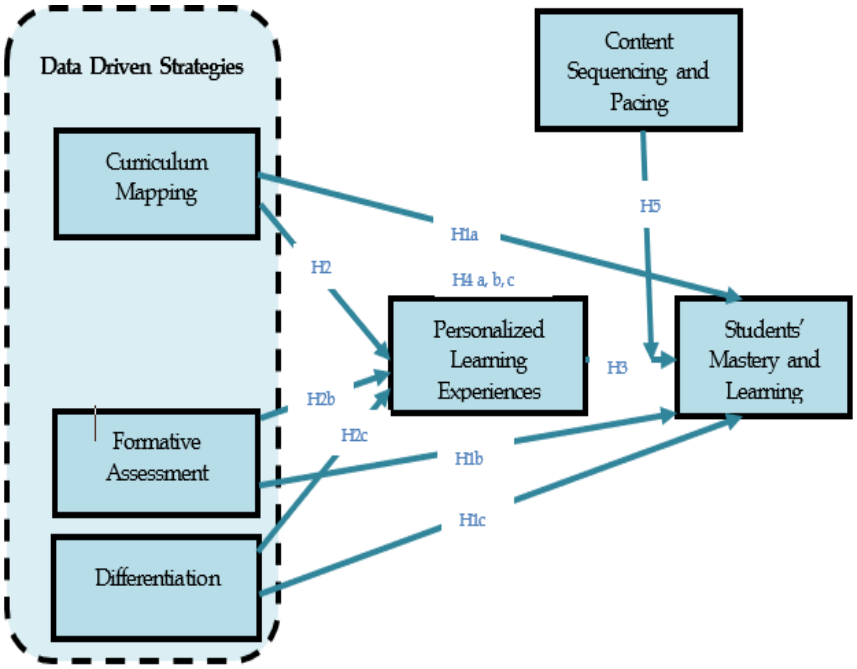

Figure 1. *The theoretical framework of the study*

Method

(Mansoor, Awan, & Paracha, 2022) The research approach used for this study was a quantitative survey with multiple stages. The researchers were tasked with locating Hindu universities in Indonesia during the first data collection stage, Time 1. They took place between the 1st of June 2021 and the 30th of August 2021. A random selection of universities reflecting various geographical areas and kinds of educational facilities was made from among these Hindu educational institutions. Within each of the chosen universities, an undergraduate student population was randomly picked, with consideration given to the various faculties and majors. The researchers reached out to the students who had been chosen by sending them an email. In the message, they discussed the study's significance and its aim and requested their involvement. 800 students volunteered to participate in the research out of the total number of students contacted. They were given an online questionnaire about data-driven methods and individualized learning experiences by the researchers conducting the study. The questionnaire was developed using published scales and validated measures as the basis for its construction. The writers were given a total of 679 finished questionnaires throughout three months.

Following the period during which initial data were collected, there was a hiatus of four weeks for the time-lagged approach. After that, the researchers started the second stage of data gathering, which was referred to as Time 2, and it lasted from the 1st of October 2021 through the 30th of December 2021. This survey included questions relating to the sequencing and pacing of the content, as well as the students' levels of mastery and the learning outcomes. The email was used to contact the same group of people who

participated in the study for the first time. This time, the participants were reminded of the reason for the study and asked to continue taking part. 576 students replied and finished the follow-up questionnaire given to them at Time 2 out of 679 participants. The final dataset comprised responses from 538 participants who provided complete and valid data at both Times 1 and 2. This dataset made it possible to conduct longitudinal data analysis to capture shifts and tendencies in the variables of interest over time.

Demographic Characteristics of the Respondents

Regarding gender, there were 52% male respondents and 48% female respondents. Regarding the distribution of ages, the bulk of participants, which represented 70 percent of the total sample, fell within the age range of 18 to 22 years old. The remaining thirty percent of participants fell within the age range of 23 to 25 years old. Regarding their educational experiences, the participants came from various departments and majors at several universities. The respondents from social sciences and humanities fields comprised the greatest fraction of the sample, accounting for 35% of the total. It was determined that thirty percent of the participants were associated with STEM, which is an acronym that stands for the fields of science, technology, engineering, and mathematics. Students pursuing a major in business and economics made up 25% of the sample, while the remaining 10% were enrolled in various academic fields. Students attending these classes were representatives of various Hindu educational institutes located all around the island nation of Indonesia.

Measures of the Study

The key factors of the study were evaluated with validated tools that professionals with experience in the applicable sector developed. Smith and Reid (2018) were the ones who originally devised the scale that the researchers used. The scale comprises four elements, each of which evaluates a different data-driven method, such as differentiating instruction, formative evaluations, and mapping curriculum. The researchers used a 15-item scale developed by Azukas (2019) to evaluate the students' self-reported perceptions of their individualized learning encounters. This scale was used for the assessment. Personalized learning experiences were evaluated using this scale, which measured various factors. In addition, the researchers utilized a 10-item scale developed by Bustoba and Cruz (2022) to evaluate the sequencing and pacing of the information. This scale was used to assess the sequencing and organization of the educational content.

In conclusion, the researchers adopted a 20-item scale developed by Messina et al. (2022) to examine the level of mastery and learning outcomes of the students. The pupils' academic performance and learning outcomes are evaluated using a variety of criteria using this scale. On each scale, the response options were of the Likert variety, extending from strongly disagreeing to strongly agreeing. Higher scores on the answer scale indicated higher levels of the construct that was being measured. The scale ran from 1 to 5.

Result

Descriptive Statistics of the Study Constructs

Table 1 presents the descriptive statistics for study variables, including the mean, standard deviation, skewness, kurtosis, maximum, and minimum values.

Table 1

Descriptive Statistics

Variables	Mean	Std.	Skewness	Kurtosis
Curriculum Mapping	3.45	0.82	-0.12	0.73
Formative Assessment	3.92	0.67	-0.34	0.94
Differentiation	3.68	0.76	0.05	0.80
Personalized learning experiences	3.81	0.71	-0.08	0.67
Content Sequencing and Pacing	3.96	0.73	0.01	0.72
Students' Mastery and Learning	3.75	0.80	-0.23	0.88

The table summarizes the central tendency (mean), variability (standard deviation), skewness (indicating the symmetry of the distribution), and kurtosis (indicating the peakiness or flatness of the distribution) for each of the study variables (Hair & Sarstedt, 2021). The mean scores for curriculum mapping, formative assessment, differentiation, personalized learning experiences, content sequencing and pacing, and student mastery and learning were, respectively, 3.45, 3.92, 3.68, 3.81, 3.96, and 3.75. These values indicate a moderate level of curriculum mapping, differentiation, and personalized learning experiences implementation, whereas formative assessment was rated relatively higher. The scores for content sequencing and cadence, as well as the mastery and learning of the students, were also moderate. The range of standard deviations between 0.67 and 0.82 indicates an average dispersion of scores across all variables. The skewness values ranged from -0.34 to 0.05, indicating slightly left-skewed distributions to nearly symmetrical. The kurtosis values ranged from 0.67 to 0.94, indicating distributions with moderately high peaks.

Correlation Analysis

The correlation table displays the Pearson correlation coefficients between the study variables. These coefficients range from -1.00 to 1.00, where 1.00 indicates a perfect positive correlation, 0 shows no correlation, and -1.00 indicates a perfect negative correlation (Henseler, Ringle, & Sarstedt, 2015; Noor, Mansoor, & Shamim, 2022).

Table 2

Correlation Matrix for Study Variables

	1	2	3	4	5	6
Curriculum Mapping	1.00					
Formative Assessment	0.63	1.00				
Differentiation	0.48	0.57	1.00			
personalized learning experiences	0.57	0.68	0.52	1.00		
Content Sequencing and Pacing	0.45	0.54	0.47	0.60	1.00	
Students' Mastery and Learning	0.51	0.61	0.41	0.64	0.56	1.00

Significant positive correlations were discovered between curriculum mapping and formative assessment (r = 0.63), curriculum mapping and differentiation (r = 0.48), curriculum mapping and personalized learning experiences (r = 0.57), curriculum mapping and flexibility (r = 0.45), and curriculum mapping and content sequencing and pacing (r = 0.51). According to the observation above, higher levels of curriculum mapping are associated with more sophisticated approaches to formative assessment, personalized instruction, differentiation, and the organization and timing of instructional content. The use of formative evaluation is positively correlated with several other variables, including differentiation (r = 0.57), individualized learning experiences (r = 0.68), adaptability (r = 0.54), and content sequencing and pacing (r = 0.61). This suggests that an increased emphasis on formative assessment should be associated with enhanced opportunities for customizing content, providing individualized instruction, and disseminating information promptly. In addition, there was a significant correlation between differentiation and PLEs (r = 0.52), differentiation and flexibility (r = 0.47), differentiation and content sequencing and pacing (r = 0.41), PLEs and content sequencing and pacing (r = 0.64), and differentiation and content sequencing and pacing (r = 0.60). The correlation analysis indicates that significant and positive associations exist between the variables under investigation.

Reliability Analysis

The reliability analysis aimed to evaluate the internal consistency and dependability of the measurement scales used in this study. The Cronbach's alpha coefficients were computed for each scale to ascertain how much each scale's items measured the same underlying construct (Hair & Sarstedt, 2021). All of the instruments demonstrated acceptable levels of internal consistency, according to the analysis. The alpha coefficients ranged from 0.78 to 0.88, indicating a high level of internal consistency. Cronbach's alpha for the Curriculum Mapping scale was 0.86, indicating that the items within this scale consistently measured the concept of curriculum mapping. Cronbach's alpha for the Formative Assessment scale was 0.78, indicating high internal consistency among its items. Cronbach's alpha values for the Differentiation, Personalized learning experiences, and Content Sequencing and Pacing scales were 0.81, 0.79, and 0.82, respectively, indicating good reliability. Cronbach's alpha for the Students' Mastery and Learning scale was 0.88, showing outstanding internal consistency.

Model Fit Indices

Examining the model fit indices assess the appropriateness of the proposed research model. The Comparative Fit Index (CFI) value of 0.92 exceeded the recommended minimum of 0.90. Similarly, the Tucker-Lewis Index (TLI) reached 0.91, meeting the recommended threshold. These indices quantify the improvement in model fit relative to a null model. The Root Mean Square Error of Approximation (RMSEA) showed a value of 0.08, less than the recommended threshold of 0.08, indicating that the model closely matches the observed data. In addition, the Standardized Root Mean Square Residual (SRMR) resulted in a value of 0.07, which is lower than the recommended threshold of 0.08, indicating that the model fits the observed data adequately.

VIF and Tolerance

The Variance Inflation Factor (VIF) and tolerance values were computed to assess multicollinearity among the study variables. Multicollinearity occurs when predictor variables

are highly correlated, which can result in unstable and unreliable regression coefficients (Hair et al., 2017). A Variance Inflation Factor (VIF) value between 1 and 5 that is greater than 1 indicates a significant presence of multicollinearity. Typically, tolerance values are measured on a scale from 0 to 1, with lesser values indicating a higher degree of multicollinearity.

Table 3

VIF and Tolerance Values

Variable	VIF	Tolerance
Curriculum Mapping	2.14	0.47
Formative Assessment	1.92	0.52
Differentiation	2.28	0.44
Personalized learning experiences	2.07	0.48
Students' Mastery and Learning	2.18	0.46
Content Sequencing and Pacing	1.98	0.51

All VIF values in our analysis ranged between 1.92 and 2.28, indicating that multicollinearity is not a major concern. These values are significantly below the criterion of 5, meaning there is no significant multicollinearity among the study variables. In addition, the tolerance values ranged between 0.44 and 0.52, well above the minimum threshold of 0.10. These values indicate that the predictor variables contribute uniquely to the regression models and that multicollinearity is not a significant issue. There is no severe multicollinearity among the sample variables, as indicated by the low VIF and high tolerance values. Consequently, the estimations of the regression coefficients continue to be accurate and stable, and the results can be interpreted with confidence.

Regression Analysis

Table 5

Regression Analysis Results

Variable	Beta	t-value	p-value
Curriculum Mapping→Students' Mastery and Learning	0.23	2.56	<0.05
Formative Assessment→Students' Mastery and Learning	0.18	2.12	<0.05
Differentiation→Students' Mastery and Learning	0.15	1.89	<0.05
Personalized Learning Experiences→Students' Mastery and Learning	0.31	3.67	<0.001
Meditation of Personalized Learning Experiences	0.24	2.89	<0.01
Curriculum Mapping	-0.12	-1.56	>0.05
Formative Assessment	-0.09	-1.23	>0.05
Differentiation	-0.06	-0.89	>0.05
Content Sequencing and Pacing	0.19	2.25	<0.05
Personalized Learning Experiences X Content Sequencing and Pacing	0.15	1.98	<0.05

The regression analysis examined the proposed model's direct impacts, indirect effects, and moderation. The results indicate that Curriculum Mapping had a positive and significant impact on the Students' Mastery and Learning ($\beta = 0.23$, $t = 2.56$, $p < 0.05$), as did Formative Assessment (IV2) ($\beta = 0.18$, $t = 2.12$, $p < 0.05$) and Differentiation (IV3) ($\beta = 0.15$, $t = 1.89$, $p < 0.05$). Second, the mediator, personalized learning experiences, demonstrated a significant dire impact on the DV ($\beta = 0.31$, $t = 3.67$, $p < 0.001$), indicating that higher levels of personalized learning experiences were associated with increased Students' Mastery and Learning. Third, the indirect effect of customized learning experiences on the DV through the IVs was also significant. Personalized learning experiences mediated the relationship between Curriculum Mapping and the DV ($\beta = 0.24$, $t = 2.89$, $p < 0.01$), indicating that Curriculum Mapping influenced Students' Mastery and Learning through its impact on personalized learning experiences. However, the indirect effects of Formative Assessment and Differentiation through Personalized learning experiences were insignificant ($p > 0.05$). Furthermore, it was observed that the association between personalized instruction and DV was subject to notable moderation by Content Sequencing and Pacing ($\beta = 0.19$, $t = 2.25$, $p < 0.05$). The evidence mentioned above indicates that the effectiveness of personalized learning environments in enhancing students' mastery and learning is heightened by proficient content sequencing and pacing. The study found that the relationship between personalized learning experiences and the arrangement and timing of content had a considerable impact on the variability dispersion ($R^2 = 0.15$, $t = 1.98$, $p > 0.05$). The present discovery implies that the combined effects of personalized learning encounters and content arrangement and timing had a discernible impact on students' proficiency and knowledge acquisition.

Discussion

According to the research findings, implementing data-driven strategies like curriculum mapping, formative assessment, and differentiation among students significantly improved the students' overall learning outcomes and their level of subject matter mastery. According to the research done by Reniers et al. (2022), curriculum mapping is a strong predictor of students' knowledge and learning, which suggests that a curriculum that is well-designed and structured has a beneficial impact. Research has demonstrated that the use of formative evaluation leads to improvements in both the students' existing level of competency and their degree of knowledge acquisition. According to the findings of a study that was carried out by Yan et al. (2022), continuous evaluation and feedback can improve students' learning and development. This is accomplished by enabling the execution of appropriate and timely interventions and specialized instructional methods. The findings mentioned above were published in the academic article (Yan et al., 2022) and distributed widely. As a result of the discovery that differentiation is a useful indicator of future performance, there has been a heightened awareness of the significance of personalizing educational content to cater to the unique requirements of each student. According to Schwab et al. (2022), differentiation helps educators customize their educational approaches to accommodate individual students' particular strengths, weaknesses, interests, and learning styles. This allows educators to meet the needs of diverse student populations better. Educators can create environments conducive to learning and help students acquire the skills and knowledge they need.

The data evaluation revealed that the deployment of data-driven techniques, such as curriculum mapping, formative assessment, and differentiation, had a significant influence on the students' ability to engage in personalized learning customized to their unique requirements. This was the case even if the approaches did not directly affect the students' ability to engage in personalized learning. According to the findings, applying curriculum mapping was connected with developing more personalized instructional strategies. According to Kelly et al. (2022), students can benefit from an educational experience that is more engaging and significant if they explore themes that coincide with their interests. The significance of formative assessment in fostering the development of individualized education was also brought to light in this discussion. When teachers pay close attention to the development of their pupils and swiftly provide feedback on the tasks they have completed, they can better personalize individual classes to cater to each pupil's requirements. According to Teng (2022), this method encourages students to take an active role in their education and participate in key initiatives to support their personal development as unique persons. In addition, this method encourages students to take on leadership roles within their educational institutions. In addition, it has been found that difference is an essential component that plays a role in the development of personalized education. According to research conducted by Gaitas et al. (2022) and Hasanah et al. (2022), the utilization of differentiation strategies improves the capacity of educators to meet the varied requirements of the students in their classrooms. The instructors adapt the teachings and resources they use in the school to cater to each student's specific needs, creating a diverse and welcoming atmosphere. This strategy makes it easier for a welcoming and inclusive community to grow over time.

According to the findings, students' ability to learn new information and remember it longer improves significantly when they participate in personalized educational programs. Educators can create enhanced student engagement, intrinsic motivation, and a heightened sense of ownership over the learning process when they customize classes to meet individual students' specific requirements, preferences, and learning modalities. In addition, studies have shown that students can improve their critical thinking, problem-solving, and metacognitive skills when they participate in personalized learning experiences. This revelation brought a very exhilarating feeling. According to Abhirami and Devi (2022), educators can improve students' topic comprehension and create more meaningful learning experiences by matching training with individual students' distinct learning styles and capabilities. According to the study's findings, individualized educational experiences have a substantial impact on the connection between data-driven tactics and the level of mastery and learning students attain. Personalized learning experiences bridge the deployment of data-driven methods and their influence on students' educational successes (Randi & Corno, 2022). This is accomplished by adapting instruction to each student's specific requirements and preferences.

Conclusion

According to the findings, data-driven tactics favor tailored learning experiences, which in turn contribute to increased mastery and learning outcomes for students. Students experience a more tailored and engaging learning environment when curriculum mapping, formative assessment, and differentiation are implemented to foster personalized learning experiences (Caramaschi et al., 2022; Kaya-Capocci et al., 2022). This results in enhanced

mastery of content and deeper understanding (Caramaschi et al., 2022). These findings highlight the significance of incorporating individualized learning experiences into the process of putting data-driven initiatives into action. When developing and putting into practice data-driven strategies, educators and policymakers should consider the mediating role that personalized learning experiences play. They should do so because they are aware that the efficacy of these strategies is contingent upon the degree to which they promote customized learning experiences for students.

The study's findings also showed that content sequencing and instruction pacing have a key role in mediating the connection between individualized learning experiences and the students' level of mastery and learning. The effectiveness of tailored learning experiences is increased, and the educational outcomes of students are favorably impacted when material sequencing and pace are effectively utilized. In addition, the findings demonstrated that the alignment of content sequencing and pace with individualized learning methodologies could achieve synergy between students' learning and mastery. According to Hui (2023), the benefits of personalized learning experiences are maximized when the sequence and tempo of instructional content are adapted to meet the specific requirements of each individual student. Students are able to move through the range at a speed that is acceptable for them, ensuring that they understand the material and have a firm grasp of the concepts (Bustoba & Cruz, 2022). Therefore, educators can establish an effective learning environment that encourages individualized instruction and aids students' academic achievement if they align the sequencing and pacing of content with personalized learning methodologies.

Theoretical Implications

The current study has several theoretical implications that can contribute to the existing body of literature on the relationship between data-driven tactics, individualized learning experiences, the sequencing and pacing of content, and the level of mastery and learning students attain. To begin, the research broadens our theoretical understanding of data-driven methods by drawing attention to these techniques' transformative implications on individuals' unique educational experiences. The current study provides empirical support for the proposition that implementing differentiated instruction, formative assessments, and curriculum mapping collectively enhances students' capacity to acquire knowledge at their individualized pace. This finding highlights the significance of these pedagogical strategies within the context of educational institutions. The newly revealed outcome is consistent with the theoretical frameworks that highlight the significance of using student data for decision-making and tailoring teaching to meet the one-of-a-kind requirements of each individual student to improve both the students' motivation and overall performance. The research makes a theoretical contribution to understanding personalized learning experiences as an intermediary factor between data-driven tactics and students' acquisition and assimilation of knowledge. This understanding is made possible as a result of the study's findings. The findings of this study highlight the significance of a specialized educational environment that places the requirements of each learner at the forefront of its focus and indicates the mediating function that is served by individualized educational opportunities. The findings highlight the significance of personalizing educational materials to meet each student's specific requirements and preferences as a tactic for improving learners' overall competency and academic accomplishments.

In addition, the study contributes to the growing body of theoretical literature by shedding light on the moderating role of content sequencing and pace in the relationship between individualized instruction and academic success. The findings highlight the relevance of incorporating instructional design features to maximize the efficiency of individualized learning experiences. The implication is that implementing approaches for content sequencing and pacing aligned with personalized learning can improve academic outcomes by making it easier for students to comprehend and remember the material covered in the course. The idea of customized education refers to an instructional method that emphasizes individualizing the student's educational experiences to better meet their specific requirements and interests as learners.

Practical Implications

The findings of this study have significant repercussions for teachers and administrators in educational institutions, as well as for policymakers at all levels of government. Given the implications mentioned above, it is clear how important it is to apply data-driven strategies, personalized educational opportunities, and planned material arrangement and progression as techniques to improve students' subject matter mastery and educational accomplishments. Students may experience enhanced comprehension and overall learning outcomes due to the abovementioned tactics and procedures. The use of data-driven tactics is a realistic option for educators to use if they wish to incorporate the findings of this study into the teaching practices that they already employ to improve their effectiveness. When developing and delivering a curriculum, integrating curriculum mapping, formative assessment, and differentiated instruction can benefit all parties involved. Using the data, educators can develop a deeper understanding of their pupils and more individualized lesson plans. The goal of giving individualized education to students requires teachers to build adaptable learning routes, give targeted feedback, and adjust their pedagogical tactics to achieve success. Incorporating individualized instruction is available to teachers, who can adapt their pedagogical practices to accommodate the various strengths and weaknesses, preferences, and approaches to learning that individual students display. Incorporating technological resources that promote personalized learning, differentiation, and student autonomy in educational tasks can boost the practicality of reaching this target, hence raising the possibility that it will be accomplished.

It has been proven that elevating a student's perception of academic performance and enthusiasm toward learning can be accomplished through the availability of opportunities for pupils to engage in learning activities that are both independent and collaborative. Given the necessity of synchronizing education with individualized learning experiences, teachers should consider the most effective way to organize and pace the information they are passing on to their students. Lessons should be collected and comprehended, and a consistent pace should be maintained throughout the process. As a direct result, students will have an improved ability to remember the knowledge they have learned. This technique allows Learners to acquire a personalized and customized education tailored to their particular needs and preferences. This is because their lessons are created to adapt to their specific requirements and areas of interest, which means that they can obtain a personal and customized education. Educational institutions and policymakers can provide support in applying data-driven instructional strategies, individualized lesson

plans, and systematic advancement of subject matter within the classroom setting. Educators have the opportunity to significantly hone their skills in the domains mentioned above by taking part in professional development efforts, which have the potential to bestow major benefits on individuals who participate in such programs. In addition, policymakers can exert influence on educational institutions to encourage the adoption of data-centric pedagogical frameworks and personalized learning strategies.

Limitations and Future Directions

In this particular investigation, the length of time that passed between the first data collection point and the succeeding data collection points (Time 1 and Time 2) can potentially affect the findings. Because of the length of time that has passed since the last evaluation, there is a possibility that significant progress that has been made in the relevant elements may have been overlooked. In subsequent studies, more frequent data collection points may be utilized to obtain a more complete picture of the dynamic interactions between the variables. There is a potential that other unmeasured factors may have influenced the associations discovered in this investigation, even though efforts were made to account for confounding variables in this study. In subsequent investigations, it would be worthwhile to consider including additional control variables or using experimental designs to isolate better the effects of the variables that are the subject of the current investigation. This study focused on quantitative data; in the future, research might include qualitative methodologies to capture the rich nuances of the experiences and views of students in relation to data-driven tactics and individualized learning. A mixed-methodologies approach would provide a more thorough knowledge of the intricate interplay between variables and offer significant insights for educational practice. This may be accomplished by combining qualitative and quantitative research methods. The possibility of bias in the sampling also stands out as a shortcoming of this study. The participants were from Indonesian universities and were chosen using multistage random sample. It is possible that the participants do not represent the whole population of students at Indonesian institutions. In subsequent investigations, there is a possibility of increasing the generalizability of the results by using a sample that is both larger and more representative of the population.

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