

Examining Faculty Instructional Practices Through the Lens of Universal Design for Learning (UDL): Implications for Addressing Learner Variability in Multicultural Higher Education: A Mixed-Methods Study at the Asian University for Women

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MA in Education, Asian University for Women

EDUC5999: MA Thesis

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05 May, 2026

Acknowledgement

I would like to express my sincere gratitude to my family and friends for their continuous support, patience, and encouragement throughout this journey. I am deeply thankful to my supervisor, Dr. Abu Nowshed Chy, for his guidance, insights, and support in shaping this research. I would also like to extend my appreciation to the faculty members who generously gave their time and participated in this study. Their contributions were invaluable to the completion of this research. I am equally grateful to the Asian University for Women (AUW) for granting me the opportunity to conduct this study within the institution.

Finally, I am profoundly grateful to Almighty Allah for granting me the strength, perseverance, and ability to complete this research.

Declaration of AI

During the preparation of this thesis, I used ChatGPT, Gemini, and Grammarly for language-related support. These tools were used to improve clarity, organization, grammar, and punctuation of the written text. ChatGPT and Gemini were also used to obtain general suggestions for structuring the flow of information. Also, Gemini was used to seek suggestions for generating graphs in the demographic section.

AI tools were not used to generate original research findings, conduct data analysis, or develop interpretations. All research design, analysis, and conclusions presented in this study are entirely my own, and all external sources have been appropriately cited. The ideas, arguments, and intellectual contributions in this thesis are original and developed independently by the author. AI tools were used solely to refine the expression of these ideas, rather than to generate them. This study reflects my own critical thinking, interpretation, and academic effort throughout the research process.

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Abstract

This study investigates the implementation of Universal Design for Learning (UDL) in higher education within the Global South, focusing on the Asian University for Women (AUW) in Bangladesh. Although UDL is widely recognized as a framework for inclusive pedagogy, its practical application and measurable impact in diverse higher education contexts remain insufficiently examined. To address this gap, the study employs a convergent mixed-method design to assess both the extent of UDL implementation and its enactment in classroom practice. Quantitative data were collected from 67 faculty members using a structured survey grounded in UDL 3.0 considerations, capturing instructional practices across multiple academic programs and levels. The analysis included descriptive statistics, reliability testing, correlation analysis, principal component analysis (PCA), clustering, and regression modeling to identify patterns and key predictors of UDL implementation. Qualitative data from classroom observations and semi-structured interviews provided contextual insight into teaching practices and faculty responses to learner variability. The findings indicate a high prevalence of UDL-aligned practices, particularly in engagement and representation, while action and expression remain comparatively underdeveloped. Structural constraints, including limited resources and assessment practices, further shape implementation. By integrating quantitative and qualitative evidence, the study highlights the uneven yet meaningful presence of UDL in practice and proposes a more systematic approach to its assessment. It contributes methodologically and extends empirical evidence from an underrepresented context, while emphasizing the need for holistic institutional strategies to support inclusive teaching.

Keywords: Universal Design for Learning (UDL), UDL 3.0; Inclusive Pedagogy, Higher Education, Mixed-Method Research, Learner Variability, Global South, Instructional Design; Faculty Practices, Educational Equity

1 Introduction

1.1 Background of the Study

The concept of Universal Design (UD) originated in the field of architecture, where the primary concern was to design environments that could be accessed and used by the widest possible range of individuals. The term was formally introduced in 1988 by architect Ron Mace, who defined Universal Design (UD) as the design of products and environments usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. A commonly cited example is the curb cut in sidewalks, originally designed for individuals with mobility impairments but later recognized as beneficial for a broader population, including parents with strollers and cyclists. This example illustrates a core principle of Universal Design: when systems are designed with accessibility in mind from the outset, they tend to benefit a wider range of users beyond the initially targeted group.

This design philosophy was later extended into education through the work of the Center for Applied Special Technology (CAST), established in 1984. Initially, CAST focused on using assistive technology to support students with disabilities in K–12 settings. Over time, this work led to a broader rethinking of how learning environments themselves could be designed. Rather than relying on individual disability accommodations, CAST proposed that barriers to learning often arise from the way instruction is designed. This shift led to the development of Universal Design for Learning (UDL), a framework that emphasizes proactive design of curriculum and instruction to support diverse learners (Basham et al., 2020; Bracken & Novak, 2019).

While UDL was initially developed within K–12 education, its relevance to higher education became increasingly apparent as universities began to serve more heterogeneous student populations. The expansion of access to higher education has brought significant

variation in language proficiency, prior educational experience, and learning needs. In contemporary higher education, heterogeneity among learners is no longer an exception but the norm. Classrooms now include first-generation university students, learners from conflict-affected regions and refugee contexts, and students from historically marginalized communities. In addition, there is a growing presence of neurodivergent learners, including students on the autism spectrum and those with attention-related differences. Many students also enter higher education with disrupted or non-linear educational trajectories, shaped by unequal or interrupted access to schooling. Furthermore, contemporary classrooms increasingly include non-traditional students whose age and life experiences differ from those of typical undergraduate cohorts.

Learner diversity is also reflected in differences in cultural background, learning preferences, cognitive processing, digital literacy, and familiarity with academic expectations. These differences influence not only how students access and interpret content, but also how they participate in learning activities and demonstrate their understanding. As a result, instructional approaches that assume homogeneity among learners are increasingly insufficient in addressing the realities of higher education classrooms. Educators are therefore engaging with students who differ not only in academic preparedness but also in their approaches to learning, participation, and knowledge demonstration. In such contexts, conventional instructional models that rely on traditional one-size-fits-all teaching approaches often struggle to accommodate the full range of learner variability (Sanger & Gleason, 2020). It is within this evolving educational landscape that the application of Universal Design principles to learning environments has gained increasing relevance.

Universal Design for Learning (UDL), developed by CAST, builds on the principles of Universal Design but translates them into the domain of teaching and learning. While Universal Design focuses on physical accessibility, UDL shifts attention toward the design of

learning experiences. It is grounded in the recognition that variability among learners is the norm rather than the exception. To address this, UDL proposes that instruction should be intentionally flexible from the outset. This is reflected in its three core principles: multiple means of engagement, multiple means of representation, and multiple means of action and expression. These principles are further elaborated through a structured set of guidelines and associated considerations, which provide a framework for identifying and reducing potential barriers in teaching and learning processes. Rather than functioning as a prescriptive model, these considerations support instructors in designing flexible learning environments that accommodate diverse learner needs (Fornauf & Erickson, 2020).

In recent years, the UDL framework has undergone further refinement, resulting in the development of UDL 3.0 by CAST (CAST, 2024). This updated version retains the three core principles but expands and reorganizes the associated guidelines and considerations to better reflect contemporary learning environments, including digital learning, learner agency, and complex forms of variability. UDL 3.0 emphasizes a more interconnected view of learning, where engagement, representation, and action and expression operate in relation to one another rather than as separate components. Given its updated structure and relevance to current higher education contexts, this study adopts UDL 3.0 as the analytical framework for examining instructional practices.

To provide a visual overview of the UDL 3.0 framework, the following figure presents its three core principles along with their associated guidelines and considerations.

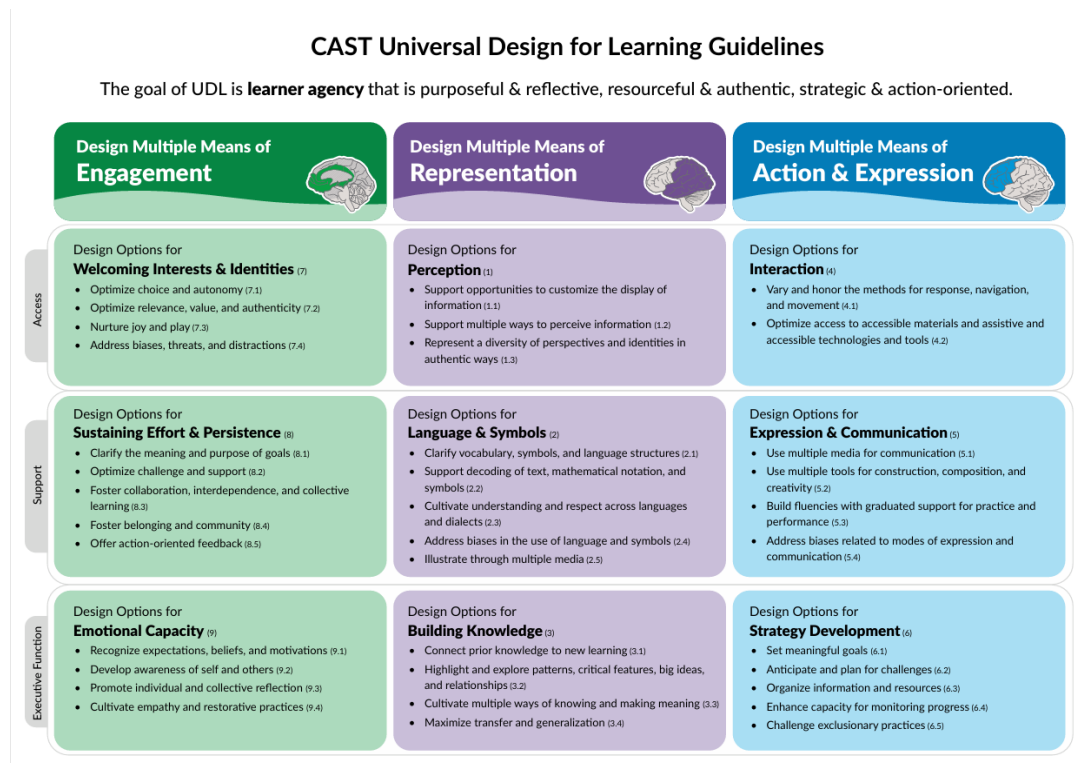


Figure 1 UDL 3.0 Framework Showing Principles, Guidelines, and Considerations (Adapted from CAST, 2024)

As illustrated in Figure 1, the UDL 3.0 framework organizes learning design around three interconnected principles, each supported by a set of guidelines and considerations that together address different dimensions of learner variability.

In response to increasing learner heterogeneity in higher education, related frameworks such as Universal Design for Instruction (UDI) and Universal Instructional Design (UID) were developed to support more inclusive teaching practices in postsecondary settings. UDI primarily focuses on adapting instructional delivery and classroom practices to improve accessibility for students, while UID places greater emphasis on course-level design,

including learning materials, assessments, and overall instructional planning. While these frameworks share a common goal of reducing barriers to learning, they differ from UDL in scope and structure. UDL provides a more comprehensive and systematically developed framework, supported by clearly defined principles, guidelines, and considerations that address engagement, representation, and action and expression in an integrated way. In contrast, UDI and UID tend to offer broader design recommendations without the same level of structured alignment across different aspects of learning. For this reason, UDL has emerged as the most comprehensive and widely adopted framework in higher education, particularly in contexts where learner variability is complex and requires a more holistic instructional approach (Bracken & Novak, 2019). Accordingly, the present study adopts UDL as its primary analytical framework.

Although UDL has strong roots in disability education, it is not limited to supporting students with diagnosed disabilities. Instead, it is grounded in the concept of learner variability, which recognizes that all students differ in how they access, process, and express learning. Research suggests that instructional approaches designed using UDL principles benefit not only students with disabilities but also a broader student population, as they provide multiple pathways for access and participation (Fornauf & Erickson, 2020).

Despite its strong conceptual foundation, the application of UDL in higher education remains an emerging area. Much of the research on UDL has been conducted in K–12 settings, and empirical studies in postsecondary education remain relatively limited. Existing studies often focus on specific interventions or course redesigns rather than routine teaching practices. Reviews of the literature indicate that only a small number of empirical studies have examined UDL implementation in higher education (Schreffler et al., 2019; Kirsch & Luo, 2023). This shows that while UDL is conceptually well established, its integration into higher education teaching practices is still developing and requires further investigation.

1.2 Statement of the Problem

Although Universal Design for Learning has been widely discussed as a framework for inclusive teaching, its presence in higher education remains limited in actual practice. Much of the existing literature highlights what UDL, as a framework, aims to achieve; however, there is still limited clarity on how these principles are interpreted and implemented by faculty in everyday classroom settings. As a result, a gap persists between the conceptual understanding of UDL and its consistent application in routine instructional practice.

One of the central challenges lies in how UDL guidelines are understood and adopted by faculty members. In many higher education contexts, educators are trained primarily within their disciplines and may not receive formal preparation in inclusive pedagogical approaches or advanced instructional design practices. While educators often recognize the importance of addressing diverse learner needs, the strategies they employ are frequently shaped by their prior teaching experience rather than guided by a structured or standardized framework. This can result in the use of inclusive practices in fragmented or inconsistent ways, without a clear alignment with UDL principles (Kirsch & Luo, 2023; Hills et al., 2022).

Another significant challenge relates to the evaluation of UDL implementation. Empirical studies examining the impact of UDL in higher education remain limited in number, and many focus on specific interventions, such as designing UDL-based courses for first-year students or conducting training workshops for disability-focused educators. These studies often emphasize targeted or short-term applications rather than examining how UDL is integrated into everyday teaching practices across courses and disciplines. As a result, there is limited evidence on how UDL functions as a comprehensive instructional design framework within routine higher education teaching (Schreffler et al., 2019; Dell'Anna et al., 2024).

In addition, there is a lack of widely accepted and standardized tools for assessing UDL implementation. Existing instruments, such as the UDL Observation Measurement Tool (UDL-OMT), are primarily designed for classroom observation and are based on earlier versions of the UDL framework (UDL 2.0). With the recent evolution of UDL guidelines to version 3.0, the applicability of such tools becomes limited, particularly for studies that aim to examine instructional practices aligned with the updated framework. This creates a methodological challenge, as researchers lack tools that fully capture the breadth and depth of UDL implementation in its current form. Without consistent and comprehensive measurement approaches, it remains difficult to evaluate the extent and effectiveness of UDL integration in higher education.

These challenges become particularly evident in contexts where learner diversity is highly complex, institutional resources are limited, and pedagogical support structures are uneven. In multilingual and multicultural classrooms, differences in language proficiency, prior educational experience, and learning expectations significantly shape how students engage with instruction. In such environments, understanding how faculty interpret and implement inclusive instructional practices becomes especially important (McKenzie et al., 2021).

Despite these realities, there is limited empirical research that examines UDL implementation from the perspective of faculty while also observing classroom practices in real instructional settings. Much of the existing research on UDL is concentrated in Western, developed countries such as the United States, the United Kingdom, Canada, and Australia, where the framework is more widely discussed and actively implemented. In contrast, research from low- and middle-income countries and broader Global South contexts remains limited. While some studies have begun to explore UDL in developing regions, including

parts of Africa, South America, and the Middle East, the overall evidence base remains small and fragmented (McKenzie et al., 2021).

This gap is particularly evident in the context of Bangladesh. To date, there is very limited research that specifically examines the implementation, evaluation, or potential of UDL within higher education institutions in Bangladesh. There is also a lack of studies that explore how inclusive instructional practices are designed and enacted in response to the complex learner heterogeneity present in such contexts. This absence of context-specific research makes it difficult to understand how UDL can be meaningfully applied within higher education systems that differ significantly from those in which the framework was originally developed and most extensively studied.

In this regard, the present study is situated within a multicultural higher education context in the Global South, specifically at the Asian University for Women in Chattogram, Bangladesh, where learner diversity is particularly pronounced. By examining faculty instructional practices through both self-assessment and classroom observation, the study seeks to provide a more grounded understanding of how UDL-informed inclusive pedagogy is interpreted and implemented in real-world teaching environments.

1.3 Objectives of the Study

The primary objective of this study is to examine the extent to which the three core principles of Universal Design for Learning (UDL): engagement, representation, and action and expression, are reflected within existing instructional practices in higher education classrooms in a Global South context. Rather than focusing on intentionally designed UDL-based interventions, the study seeks to investigate how far current teaching and learning practices align with UDL principles, regardless of whether faculty members explicitly adopt or are aware of the UDL framework.

In multilingual and multicultural higher education environments, where learner heterogeneity is particularly pronounced, this study aims to provide a systematic assessment of how inclusive instructional practices are naturally embedded within everyday teaching. By drawing on a mixed-method approach that integrates quantitative and qualitative data through triangulation, the study evaluates the presence and extent of UDL-aligned practices as they occur in real classroom settings. To guide this investigation, the study is structured around the following research questions:

- **RQ1:** To what extent do faculty instructional practices at AUW reflect the principles of Universal Design for Learning (UDL)?
- **RQ2:** How do learner variability and institutional context shape faculty approaches to inclusive instructional practices at AUW?
- **RQ3:** What implications do the findings suggest for the future implementation of UDL-informed instructional practices in multicultural higher education environments?

In alignment with these research questions, the study aims to:

- Examine the extent to which faculty instructional practices reflect the three core principles of Universal Design for Learning (UDL) in addressing learner variability within multilingual and multicultural classroom contexts.
- Explore how institutional context, particularly within Global South higher education settings, shapes faculty approaches to inclusive instructional practices.
- Identify which UDL guidelines and associated considerations are most and least frequently represented in existing teaching practices.
- Draw implications for strengthening the implementation of UDL-informed instructional practices in multicultural higher education contexts.

1.4 Significance of the Study

This study is significant in several ways, particularly in relation to the increasing demand for inclusive instructional practices in higher education. While Universal Design for Learning (UDL) has been widely discussed as a framework for addressing learner heterogeneity, much of the existing literature remains focused on theoretical discussions or specific, short-term interventions rather than everyday teaching practices. By focusing on faculty instructional practices, this study contributes to a more grounded understanding of how inclusive pedagogy is interpreted and enacted in real classroom settings, where instructional decisions are shaped by practical constraints, institutional context, and diverse learner needs.

The study also makes an important empirical and methodological contribution. By integrating a mixed-method approach; faculty self-assessment, classroom observation, and semi-structured interviews, the research moves beyond reliance on a single data source and offers a more comprehensive and triangulated evidence of inclusive instructional practices. This approach is particularly valuable in examining UDL, as it allows for the identification of both intentional and unintentional alignment with UDL principles within existing teaching practices. In doing so, the study addresses a methodological gap in current research, where the implementation of UDL is often examined through self-reported perceptions or small-scale intervention studies, with limited use of structured and integrated methodological approaches.

From a pedagogical perspective, the findings of this study may inform faculty members, higher education institutions, and curriculum designers who are seeking to strengthen inclusive teaching practices. By identifying patterns in how UDL principles and guidelines are reflected in existing instructional practices, including which aspects are more frequently evident and which are less represented, the study provides insights that can support

more intentional, structured, and context-sensitive instructional design. These insights may also inform professional development initiatives aimed at enhancing faculty capacity to address learner heterogeneity in diverse classroom environments.

Finally, the study makes an important contextual contribution. Although UDL has been explored in several low- and middle-income Global South contexts, particularly in parts of Africa and South America, and a very limited extent in the Middle East, the extent and nature of its application remain constrained when compared to Western higher education settings, where UDL is more extensively discussed even in their national education policies, government priority, and more deliberately implemented. Existing literature suggests that while elements of inclusive teaching may be present in developing country contexts, there is relatively little empirical evidence examining UDL as a structured and standardized framework for instructional design.

This gap is even more evident in the context of Bangladesh. To date, there is a noticeable absence of research that specifically examines the implementation, evaluation, or potential of UDL for inclusive teaching within higher education institutions in Bangladesh. There is also limited understanding of how inclusive instructional practices are shaped by the unique sociocultural and institutional conditions of this context. By situating this study within a multilingual and multicultural higher education environment at the Asian University for Women in Chattogram, Bangladesh, the research provides context-specific insights that are currently missing from the existing literature and contributes to a more geographically and culturally inclusive understanding of UDL in practice.

2 Literature Review

2.1 Framing the Review

The increasing heterogeneity of higher education classrooms has intensified the need to examine how instructional practices respond to variation in students' prior knowledge, linguistic backgrounds, learning preferences, and educational trajectories. Although inclusive pedagogy is now widely positioned as a central objective of contemporary higher education, its integration into routine instructional practice remains uneven and, in many cases, superficial (Fovet, 2021; Sanger & Gleason, 2020). Within this landscape, Universal Design for Learning has been advanced as a structured framework for addressing learner variability, as outlined by CAST (2024). However, existing research presents an incomplete and at times disjointed account of how UDL is interpreted, enacted, and evaluated in practice (Dell'Anna et al., 2024; Schreffler et al., 2019; Craig et al., 2025; Morettini et al., 2025).

Given that the conceptual foundations and historical development of UDL have already been outlined in the preceding chapter, this review shifts its focus toward the empirical and methodological dimensions of the literature. Specifically, it examines how UDL has been operationalized in higher education, how faculty interpret and enact its principles, the extent to which institutional and contextual conditions shape its application, and the methodological challenges associated with evaluating its implementation and outcomes (Kirsch & Luo, 2023; Basham et al., 2020; McKenzie et al., 2021; Soicher et al., 2024). By examining the literature across these interconnected dimensions, this chapter moves beyond individual study findings to present a clearer picture of recurring patterns and key arguments emerging from existing research, as well as the important gaps that guide the present study.

2.2 Evidence of UDL in Higher Education Practice

Existing research on UDL in higher education has largely focused on evaluating its effectiveness in improving student learning experiences. Across multiple empirical and review-based studies, there is broad agreement that UDL-informed instructional approaches can strengthen accessibility, engagement, and participation among diverse learners (Seok et al., 2018; Evmenova et al., 2024; Dell’Anna et al., 2024; Guo & Wang, 2025). Systematic reviews further indicate that students exposed to UDL-aligned instructional designs frequently report increased confidence, improved interaction with course material, and higher levels of satisfaction with their learning environments (Seok et al., 2018; Schreffler et al., 2019).

These reported outcomes are commonly associated with pedagogical strategies that diversify both the delivery and demonstration of learning. Such strategies include presenting content through multiple modalities, such as text, visual media, case-based examples, and interactive resources, as well as offering flexibility in assessment formats and incorporating opportunities for active engagement. Evmenova et al. (2024) and Kirsch and Luo (2023) show that when instructors move beyond singular modes of instruction and use a range of teaching and assessment approaches, students demonstrate higher levels of engagement and improved academic performance.

Despite these promising findings, the existing body of research also presents some important limitations. Much of the literature is based on intentionally designed interventions, where courses are systematically restructured in alignment with UDL principles and evaluated under controlled conditions. While such studies are valuable in showing what UDL can achieve under these conditions, they provide limited insight into how instructional practices unfold in routine, non-intervention settings. In other words, they show what UDL can achieve when deliberately implemented, but offer less clarity on whether and how its

principles are reflected in everyday teaching practice (Schreffler et al., 2019; Dell’Anna et al., 2024; Craig et al., 2025).

2.3 From Designed Intervention to Everyday Teaching

One of the most significant shifts in recent UDL research is the growing recognition that the framework should not be understood solely through planned interventions. Instead, attention has begun to move toward examining how inclusive practices emerge within everyday teaching (Schreffler et al., 2019; Dell’Anna et al., 2024; Gronseth et al., 2025).

This shift reflects a broader critique of the literature. Many studies treat UDL as something that is introduced into a classroom, rather than something that may already exist in partial or implicit forms. As Izzo et al. (2008) and Kirsch and Luo (2023) suggest, this perspective may overlook the ways in which instructors naturally adapt their teaching to accommodate diverse learners.

Research focusing on faculty practices provides important insight into this issue. Survey-based studies reveal that instructors often implement strategies aligned with UDL principles without consciously identifying them as part of a formal framework. Practices such as varying instructional methods, allowing flexibility in assignments, and encouraging student participation are frequently described by faculty as elements of effective teaching rather than as components of UDL (Kirsch & Luo, 2023; Hills et al., 2022; Morettini et al., 2025).

This suggests that UDL may function less as a distinct intervention and more as a lens through which existing practices can be interpreted. However, the absence of intentional design can also lead to inconsistency. When inclusive strategies are applied intuitively rather than systematically, their effectiveness may depend on individual teaching styles rather than

on a coherent pedagogical approach (Fovet, 2021; Dell’Anna et al., 2024; Basham et al., 2020).

2.4 Faculty Interpretation and Pedagogical Decision-Making

The role of faculty in shaping instructional practices is a central theme across UDL research. While institutional policies and frameworks provide guidance, it is ultimately instructors who interpret and implement these ideas in the classroom (Fovet, 2021; Dell’Anna et al., 2024; Soicher et al., 2024).

Studies examining faculty perspectives reveal a complex relationship between awareness, belief, and practice. Many instructors express support for inclusive teaching and recognize the importance of addressing diverse learner needs. However, this recognition does not always translate into consistent application of UDL principles (Izzo et al., 2008; Hills et al., 2022; Morettini et al., 2025).

One key factor influencing this gap is the way faculty conceptualize teaching itself. For many instructors, inclusive practices are understood as extensions of good teaching rather than as elements of a specific framework. This perspective can be both enabling and limiting (Kirsch & Luo, 2023; Fovet, 2021).

2.5 Professional Development and Its Limitations

Given the central role of faculty, professional development has been widely identified as a key mechanism for promoting UDL implementation. Research consistently shows that training programs can improve instructors’ understanding of inclusive pedagogy and increase their confidence in applying UDL strategies (Rusconi & Squillaci, 2023; Moriña et al., 2025).

However, the effectiveness of professional development is not uniform across all aspects of teaching. While training can influence planning and design, its impact on actual classroom practice is less consistent (Moriña et al., 2025; Izzo et al., 2008). Dell’Anna et al.

(2024) further emphasize that short-term interventions often fail to produce sustained implementation without institutional support.

2.6 Methodological Challenges in Measuring UDL Implementation

One of the most persistent challenges in UDL research is the question of how to measure its implementation. Unlike traditional teaching models, UDL does not prescribe a fixed set of practices, thus making it difficult to define clear indicators of success (Basham et al., 2020; Dell'Anna et al., 2024; Guo & Wang, 2025).

Recent research suggests that combining multiple methods offers a more comprehensive approach. Surveys can capture faculty perceptions and reported practices, while observations provide insight into actual classroom behavior. Craig et al. (2025) and Soicher et al. (2024) highlight the value of mixed-method approaches in capturing both measurable patterns and contextual depth.

2.7 UDL in Global and Context-Specific Settings

A critical limitation of existing UDL research is its concentration in Western contexts. Most empirical studies have been conducted in North America and Europe, where institutional resources and educational systems differ significantly from those in other regions (Schreffler et al., 2019; Dell'Anna et al., 2024).

Research in low- and middle-income countries highlights additional challenges, including limited infrastructure, large class sizes, and resource constraints. At the same time, these studies demonstrate that UDL principles can be adapted to local contexts using low-cost and innovative strategies (McKenzie et al., 2021).

In the South Asian higher education context, diversity is shaped by multiple factors, including language, culture, and socio-economic conditions. Sanger and Gleason (2020)

emphasize that diversity alone does not guarantee meaningful learning and may lead to disengagement if not supported by inclusive practices.

2.8 Synthesis and Research Gap

The literature reviewed in this chapter reveals a number of important patterns. UDL is widely recognized as a valuable framework for inclusive education, supported by both theoretical and empirical research (Fornauf & Erickson, 2020; Evmenova et al., 2024; Gronseth et al., 2025). However, its implementation in higher education remains uneven and context-dependent (Schreffler et al., 2019; Dell’Anna et al., 2024; Guo & Wang, 2025).

Faculty play a central role in shaping instructional practices, yet their application of UDL is influenced by varying levels of awareness, training, and institutional support (Izzo et al., 2008; Hills et al., 2022; Morettini et al., 2025). Inclusive strategies are often present in classrooms but are applied inconsistently and without a systematic framework (Kirsch & Luo, 2023).

At the same time, significant gaps remain in the literature. Empirical research is limited, particularly in non-Western contexts (McKenzie et al., 2021; Dell’Anna et al., 2024). Measurement approaches lack consistency, reflecting the complexity of operationalizing UDL (Basham et al., 2020). Most importantly, there is a lack of studies examining how UDL principles are reflected in everyday teaching practices rather than in designed interventions (Schreffler et al., 2019; Kirsch & Luo, 2023; Craig et al., 2025).

3 Materials and Methodology

3.1 Research Materials

This study employs a mixed-methods approach guided by the Universal Design for Learning (UDL) 3.0 framework. The research materials were developed around the three core UDL principles: multiple means of engagement, multiple means of representation, and multiple means of action and expression. Each principle includes a set of 36 specific considerations. Together, these considerations provide a comprehensive way to evaluate inclusive instructional practices of faculty participants. To ensure consistency, all three data collection tools; the survey instrument, classroom observation checklist, and interview protocol, were designed to align with the UDL framework. Quantitative data were collected using the survey instrument, whereas qualitative data were obtained through the classroom observation checklist and interview protocol.

3.1.1 Survey Instrument

The survey instrument used in this study was developed from the ground up. This approach was adopted because no existing survey was found that matched the core objectives of the research. A similar study by Izzo, Murray, and Novak (2008) did use a survey based on UDL guidelines. However, significant changes have taken place in UDL guidelines and in higher education contexts worldwide, including Bangladesh, over the past 18 years. As a result, it was not appropriate to adopt that instrument directly. Most previous UDL studies developed their tools using older versions of the UDL guidelines.

Several other studies offered survey instruments, but the majority included many open-ended questions. These types of tools require considerable time and effort from participants. Faculty members often have work-intensive schedules. Therefore, this study aimed to create a structured self-assessment survey that participants could complete within a short time frame.

At the same time, the survey was designed to collect the broad range of information required to ensure valid and reliable findings.

As mentioned earlier, the survey instrument was built on the UDL 3.0 guidelines. The 36 UDL considerations, spread across the three core design principles, were converted into items. Each UDL consideration includes a detailed description (total 36) with measurable, actionable objectives. These descriptions were carefully read, analyzed, and interpreted to transform each consideration into a survey item. A total of 36 items were constructed across the three domains: multiple means of engagement (13 items), representation (12 items), and action and expression (11 items). The goal was to capture the nuance of each consideration by expressing it in a concise statement. This process was iterative and involved multiple revisions. The aim was to ensure that each item accurately reflected the intent of the original guideline and could measure what it was meant to measure.

The final survey was organized into six distinct sections:

- **Section 1:** Introduction to the study.
- **Section 2:** Demographic information (12 items).
- **Section 3:** Engagement (13 items).
- **Section 4:** Representation (12 items).
- **Section 5:** Action and Expression (11 items).
- **Section 6:** Consent for classroom observation and follow-up interview.

The online survey was administered using a Google Form, while the onsite survey was distributed as a printed copy. Sections 3, 4, and 5 included self-assessment items based on Universal Design for Learning (UDL), each utilizing a Likert scale ranging from 1 to 5.

Given that participants may not have been familiar with UDL, brief explanations of the three principles were provided at the beginning of Sections 3 to 5.

3.1.2 Classroom Observation Checklist

The UDL 3.0 guidelines were used as a classroom observation checklist. Observation notes were recorded in a notebook during each session. The template used in this study for classroom observation notes was adapted from *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research* by John W. Creswell (2012, p. 216).

Classroom observation was included to capture instructional practices as they occurred in real time. This made it possible to examine how UDL principles were applied in actual teaching contexts.

3.1.3 Interview Protocol

A semi-structured interview protocol was developed to gain deeper insights into faculty members' instructional practices, perceptions, and contextual constraints related to UDL implementation. It was designed in alignment with the UDL framework and informed by the survey instrument and classroom observation findings. Similar to the classroom observation template discussed earlier, the interview protocol used in this study was also adapted from

Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research by John W. Creswell (2012, p. 226). The interview guide included open-ended questions organized into the following sections:

- Introductory script
- Section 1: Teaching context and learner variability (3 questions)
- Section 2: Instructional practices and assessment (2 questions)
- Section 3: Reflection on classroom practices (4 questions)

- Section 4: Awareness of inclusive teaching and UDL (4 questions)
- Section 5: Institutional context and constraints (4 questions)
- Section 6: Future directions and recommendations (1 question)
- Closing question (1 question)

Since interviews were conducted after the survey and classroom observations, the interview guide was partially informed by the survey and observational data. During classroom observations, elements related to multiple means of engagement and representation were more readily identifiable in instructional practices. However, comparatively fewer observable indicators of multiple means of action and expression were evident within the observed sessions.

To complement the survey and observational data, greater emphasis was placed on exploring aspects of instructional practice that were less visible during classroom observation, particularly practices related to assessment and opportunities for students to demonstrate their learning. As a result, the interview guide included targeted questions on action and expression within Section 2 on instructional practices and assessment, while avoiding redundancy in areas that were already sufficiently captured through classroom observation.

3.2 Research location

The research took place at the Asian University for Women (AUW), an international liberal arts university in Chattogram, Bangladesh. AUW has several campuses, including the M. M. Ali campus and the Mahsa Amini campus, as well as facilities in the Korean Export Processing Zone (KEPZ). A permanent campus is also being built on Baizid Bostami Road.

This study selected AUW as the research site using purposive sampling, as it represents a higher education setting where students come from diverse linguistic, cultural, and

educational backgrounds. AUW students come from across Asia, from the rural highlands of India and the deltas of Vietnam and Bangladesh to the urban centers of Malaysia and Indonesia, as well as from countries such as Afghanistan, Myanmar, Yemen, and Syria. They represent over 35 ethnicities, speak over 25 different languages, and hold different religious beliefs.

Many students at AUW come from rural and under-resourced regions, and a significant number are first-generation university attendees. For some, access to education has been shaped by disruption, whether due to conflict, displacement, or limited schooling opportunities in countries such as Afghanistan, Myanmar, Syria, and Yemen. As a result, students do not arrive with a uniform educational background. Instead, they bring with them very different levels of academic preparation, language proficiency, cognitive abilities, learning preferences, and familiarity with a liberal arts curriculum.

These differences become visible in the classroom. Students differ in how they engage with course content, how comfortable they are participating in class discussions, and how they express their understanding. What works well for one group of students may not be equally effective for another. This creates a learning environment where variation is not occasional but a constant feature. At the same time, instruction at AUW is delivered in English within a liberal arts curriculum that places strong emphasis on discussion, problem solving, critical thinking, and active participation in the learning process.

While these expectations support deep learning, they can also be demanding for students whose prior educational experiences have not fully prepared them for such approaches. In response to such concerns, the university has developed preparatory programs, such as Pathways for Promise (formerly known as Pre-Undergraduate and Access Academy), to support students as they transition into undergraduate study. These programs focus on

building academic English proficiency, strengthening critical thinking, and developing foundational knowledge to prepare students for the undergraduate level. The presence of such preparatory programs conveys an important message: students do not enter tertiary education with the same level of readiness, and additional support programs are sometimes necessary.

This kind of unconventional academic context also shapes the role of faculty. The faculty body at AUW is internationally diverse, and instructors bring a wide range of disciplinary backgrounds and teaching experiences. Teaching in such an environment often requires continuous adjustment, as faculty work with students whose learning needs, expectations, and communication styles differ in ways that directly shape pedagogical decisions.

Therefore, all these factors combined make AUW a suitable and highly relevant site for conducting this study. The combination of linguistic diversity, varied academic preparation, and multicultural classroom dynamics creates a context where learner variability is predominantly visible. In fact, diversity is what sets AUW apart from other higher education institutions in Bangladesh, especially in Chattogram.

This diversity makes AUW a particularly suitable context for examining instructional practices through the lens of Universal Design for Learning (UDL).

The setting provides an opportunity to explore how faculty respond to learner variability in practice, and to what extent inclusive instructional approaches are reflected in everyday teaching.

3.3 Participants

The population for this study consists of faculty members teaching at the tertiary education level across Bangladesh. However, this study focuses specifically on examining

how Universal Design for Learning (UDL) is reflected in existing instructional practices that include elements of inclusivity. Since instructional practices are shaped and enacted by faculty members, they form the most relevant group for examining the extent to which UDL is present in everyday teaching. For this reason, the study focuses specifically on faculty members. More precisely, the sample was drawn from faculty members at the Asian University for Women (AUW), where learner variability is particularly complex and visible, making it a suitable context for examining how inclusive instructional practices are currently implemented.

AUW faculty members engage with a highly diverse student body representing a wide range of linguistic, cultural, and educational backgrounds. At the same time, the faculty body itself is internationally diverse, including instructors from Bangladesh, the United States, the United Kingdom, India, Hong Kong, and other regions. They bring a broad range of disciplinary expertise and pedagogical experiences. Such expertise and experience are important in a context where learner variability is complex and ongoing. Given the nature of AUW's institutional environment, inclusive instructional practices are not optional but are often expected as part of everyday teaching.

While elements of inclusive practice are already present, these practices can be further strengthened through the adoption and implementation of UDL. However, before doing so, it is necessary to understand the extent to which UDL principles are already reflected in existing instructional practices. Taking together, these conditions make AUW faculty members an appropriate and relevant sample for this study.

Within this context, it was important to identify participants who are directly engaged in instructional practice. Following the selection of the research site, the study adopted a purposive sampling strategy to recruit participants. Faculty members across all disciplines

and academic levels were invited to participate. In addition, elements of snowball sampling were used where needed, particularly to identify adjunct or part-time contractual faculty participants whose information was not publicly available. In such cases, permanent or full-time faculty participants helped connect the researcher with other eligible participants.

An initial list of 119 faculty members was compiled using publicly available information from the AUW website, which primarily included full-time instructors. To ensure broader representation, additional faculty members, particularly adjunct instructors, were identified through in-person visits to faculty offices and through faculty networks. This approach helped capture a wider range of teaching experiences that may not have been visible through official records alone.

The study included faculty members teaching across multiple levels, including preparatory programs (Pathways/Pre-UG), undergraduate courses (UG1, UG2, and UG3), and graduate-level programs (MA and MS). In addition to faculty physically present on campus, instructors teaching in hybrid or online formats, particularly in graduate programs such as the Master of Arts in Education, were also included. These faculty members were contacted through their institutional email addresses.

Participation in the study was voluntary. While some faculty members holding short-term contractual roles, such as Teaching Fellows and Andrew Mellon Fellows for 2024 - 2025, did not participate during the initial phase of data collection, their absence or departure from the institution did not significantly affect the overall dataset. Faculty members in similar roles during the subsequent semester (2025 - 2026) participated in the study.

In one instance, a participant who held a senior administrative role but was actively involved in teaching a graduate-level course was also included. Although this individual was

not listed in the official faculty directory, they met the inclusion criteria of being directly engaged in instructional practice and was therefore considered relevant to the study.

Overall, the participant group reflects a wide range of disciplinary backgrounds, teaching experiences, and instructional contexts. This diversity strengthens the study by providing a more grounded understanding of faculty practices in relation to UDL.

3.4 Data Collection

This study adopted a mixed-method approach. As suggested by Fornauf and Erickson (2020), quantitative and mixed-method studies are more appropriate for research on measuring UDL implementation in higher education. For this reason, a mixed-method design was selected. It combines quantitative and qualitative approaches to examine both the extent and the context of UDL-informed instructional practices at AUW. In this study, the survey was used to collect quantitative data, while classroom observations and interviews were used to collect qualitative data. The use of multiple data sources enabled triangulation by integrating both quantitative and qualitative insights. This approach provided a more comprehensive understanding of how UDL principles are interpreted and implemented in practice.

Data collection was carried out in two stages. In the first stage, survey responses and classroom observations were conducted simultaneously. In the second stage, interviews were conducted after reviewing the findings from the survey and classroom observations.

3.4.1 Survey Data Collection

All faculty members at AUW were invited to participate in the study. Participants were approached through email (sent to their AUW email addresses), as well as through in-person visits during office hours and individual meetings. A total of 67 faculty members participated in the survey, including part-time and full-time instructors across different

disciplines and academic levels. 42 (62.69%) responses were collected through an online Google Form and 25 (37.31%) through hardcopy submissions. The total number of faculty members at AUW is not specified, as it changes frequently and may lead to inconsistencies in reporting.

Initially, the survey required participants to provide their email addresses to facilitate follow-up classroom observations and interviews. However, several participants expressed concerns about data privacy and requested an alternative to online submission.

In response to their request, the survey was modified to allow anonymous participation, and printed copies were distributed. This adjustment significantly improved participation rates. The survey collected self-assessment data on UDL-aligned instructional practices using Likert-scale items. The 36 UDL considerations were designed as self-assessment items, allowing faculty members to evaluate their own instructional practices.

This design choice was guided by both methodological and contextual considerations. Faculty members at AUW typically teach a course over a full semester of approximately four months. Many instructors conduct more than 40 class sessions per course. However, classroom observations in this study covered only three to five sessions within a semester. As a result, the observations represent only a snapshot of broader instructional practice.

Relying solely on these observed sessions could lead to an incomplete understanding of teaching practices, as instruction evolves over time in response to course content, student needs, and classroom interaction.

Self-assessment, therefore, allowed faculty members to reflect on their instructional decisions across the entire course rather than within a limited number of observed sessions. It also captured aspects of teaching that are not always visible during observation, such as lesson planning, assessment design, and strategies used outside the classroom.

Classroom observations were used to provide contextual understanding of how instructional practices were enacted, rather than as the sole basis for evaluation. The combination of self-assessment, observation, and interview data helped build a more complete picture of instructional practices.

At the same time, it is important to acknowledge that self-assessment may introduce bias if participants overestimate their practices. This limitation is considered in interpreting the findings.

3.4.2 Classroom Observation

Classroom observations were conducted to understand how instructional practices were enacted in real teaching contexts. A total of 31 faculty members were observed across multiple courses and academic levels. Faculty members who taught more than one course or at more than one academic level were observed separately in each course and at each level. All observations were conducted during the Fall 2025 and Spring 2026 semesters.

For most participants, between three and five class sessions were observed, with each session lasting approximately 1.5 to 3 hours. In two cases, fewer than three sessions were observed due to the researcher's prior familiarity with the instructional practices, as both faculty members were from the same program (MA in Education) as the researcher.

The observations were conducted in a non-participant role, where the researcher did not engage in teaching or classroom activities. Faculty members were aware of the observation and had provided consent prior to the sessions. Observations included in-person, online, and hybrid classes. The researcher remained present for the full duration of most sessions and recorded observations using the UDL 3.0 guidelines as a structured observation framework. No audio, video, or photographic recordings were taken; all observations were documented through written notes. For example, under multiple means of representation,

when the consideration “support multiple ways to perceive information” (1.2) was examined, the researcher noted the different ways this was implemented in each class, such as the use of smart boards, projectors, visually engaging presentation slides, infographics, illustrations, white boards, along with printed learning materials. Both the variety and frequency of these practices were recorded. Similar observations were made across all 36 UDL considerations under the three core principles.

The purpose of classroom observation was not to evaluate teaching performance but to develop a contextual understanding of instructional practices, particularly how faculty members used available resources within existing classroom conditions.

Given that a full course may include more than 40 sessions, the observed classes were treated as indicative of instructional patterns rather than a complete representation of teaching practice.

3.4.3 Interview Data Collection

Semi-structured interviews were conducted with 10 faculty members to gain deeper insight into their instructional practices and experiences. Participants were selected purposively to ensure representation across disciplines and teaching levels. Interviews were conducted in multiple formats: eight were conducted in person and two were conducted via Zoom. Each interview lasted approximately 40 minutes. In-person interviews were conducted in faculty members’ office rooms.

Due to participant preference, no interviews were audio recorded. Several participants expressed concerns that their responses might be identifiable or could lead to institutional consequences. To maintain consistency and address these concerns, none of the interviews were recorded. Instead, detailed notes were taken during each session. Pseudonyms were used to maintain confidentiality.

The selection of interview participants followed specific criteria. All participants had at least three years of teaching experience at AUW. This criterion was used to ensure that participants had sufficient familiarity with learner variability, the AUW curriculum, and institutional practices related to teaching.

Participants were drawn from different academic levels: one faculty member was from the MA in Education program, five were from undergraduate programs (UG1, UG2, UG3), and four were from preparatory (Pathways/Pre-UG) programs.

Faculty from the MS in Apparel Science program did not participate in interviews due to lack of permission. Interview questions were informed by survey responses, classroom observations, and broader themes related to learner variability and instructional challenges.

3.5 Data Analysis

3.5.1 Analytical Framework and Design

This study employed a mixed-method analytical approach to examine the implementation of Universal Design for Learning (UDL) in higher education. The analysis followed a convergent mixed-method design with a follow-up qualitative phase (Creswell, 2012). In this approach, quantitative and qualitative data were collected concurrently, analyzed separately, and then integrated to provide a comprehensive understanding of the research problem.

The quantitative component focused on measuring the extent of UDL implementation, while the qualitative component explored how instructional practices are enacted in real classroom contexts. A follow-up interview phase was included to further interpret and explain patterns observed in both datasets.

In order to structure this analytical process in a clear and systematic manner, a review of existing UDL-related literature was conducted. This review indicated that while many studies employ quantitative or mixed-method approaches, the data analysis procedures are often presented in a summarized form within the methodology section, with limited explicit detailing of analytical steps.

In contrast, this study adopts a more structured and transparent approach to data analysis, drawing on established mixed-method research guidelines outlined by Creswell (2014). This framework provides a systematic way to organize both quantitative and qualitative analysis, as well as their integration, ensuring clarity, replicability, and methodological rigor throughout the study.

3.5.2 Quantitative Data Analysis

Quantitative data were analyzed using SPSS. The survey instrument consisted of 36 items aligned with UDL 3.0 guidelines, organized into three domains: Engagement (E1 to E13), Representation (R1 to R12), and Action and Expression (AE1 to AE11).

The analysis began with data cleaning and preparation, including checking for completeness and consistency. Domain-level scores were computed by calculating the mean of items within each domain. An overall UDL score (UDL_mean) was then derived as the average of the three-domain means.

Descriptive statistics were used to examine the distribution of scores and to classify respondents into implementation levels. UDL_mean scores were categorized into implementation levels (e.g., Moderate, High, Very High) based on predefined threshold ranges to facilitate group-based comparison. Reliability analysis using Cronbach's alpha was conducted to assess internal consistency.

Further analysis included correlation analysis to examine relationships among items and domains, and analysis of variance (ANOVA) to identify differences across groups. Principal Component Analysis (PCA) was used to explore the underlying structure of the data, followed by K-means clustering to identify natural groupings.

To examine predictors of UDL implementation, regression analysis and random forest models were applied. Feature importance measures were used to identify key variables influencing UDL scores. Model performance was evaluated by comparing predicted and actual values.

It is important to note that, the demographic characteristics presented in this study are intended to provide an overview of the participant profile and the broader institutional context in which the study is conducted. These variables are included for descriptive purposes only and are not examined in relation to the 36 UDL-related items. This is because the primary objective of the study is to understand the overall extent and nature of Universal Design for Learning implementation across the full faculty sample at AUW, rather than to investigate differences between demographic groups. Accordingly, no comparative or correlational analyses were conducted between demographic variables and UDL measures. This approach ensures that the findings reflect institution-wide patterns of instructional practice, providing a holistic view of UDL implementation within a diverse higher education context, without narrowing the focus to subgroup-level variations.

3.5.3 Qualitative Data Analysis

Qualitative data from classroom observations and semi-structured interviews were analyzed using a thematic analysis approach.

Observation data were collected using the UDL 3.0 guidelines as a structured checklist, along with detailed field notes documenting instructional practices. Interview data were recorded through written notes during each session, as participants did not permit audio recording. Qualitative analysis was conducted manually through systematic coding and theme development without the use of specialized qualitative analysis software.

The analysis followed a systematic coding process. First, all observation and interview notes were read multiple times to develop familiarity with the data. During this stage, recurring patterns related to instructional strategies, learner variability, and classroom interaction were identified.

Second, initial codes were generated by labeling meaningful segments of data. These codes captured specific practices such as use of multiple instructional tools, levels of student participation, adaptation to learner needs, and constraints in classroom environments.

Third, related codes were grouped into broader categories. These categories were then organized into themes aligned with the UDL framework, including multiple means of engagement, representation, and action and expression.

Additional themes were developed inductively to capture contextual factors such as institutional constraints and differences across academic levels.

Finally, themes were reviewed and refined iteratively to ensure consistency across data sources and to minimize potential bias in interpretation. The use of both observation and interview data allowed triangulation, strengthening the credibility of the qualitative findings.

3.5.4 Integration of Quantitative and Qualitative Data

After completing separate analyses, the findings from quantitative and qualitative data were integrated. This integration aimed to connect numerical patterns with contextual explanations.

Quantitative results provided an overall measure of UDL implementation, while qualitative findings explained how these practices were enacted and why variations occurred across academic levels. For example, patterns observed in survey data were compared with classroom observations to identify consistencies and differences.

Points of convergence and divergence between quantitative results and qualitative themes were examined to identify areas of alignment as well as discrepancies across data sources.

The follow-up interview phase played a key role in this process by providing deeper insight into faculty perspectives. It helped explain findings that were not fully visible in classroom observations, particularly those related to assessment practices and instructional decision-making.

This integrative approach allowed the study to move beyond measurement and develop a more nuanced understanding of UDL implementation within the AUW context.

To provide a clearer representation of the analytical process, a comprehensive framework is presented below.

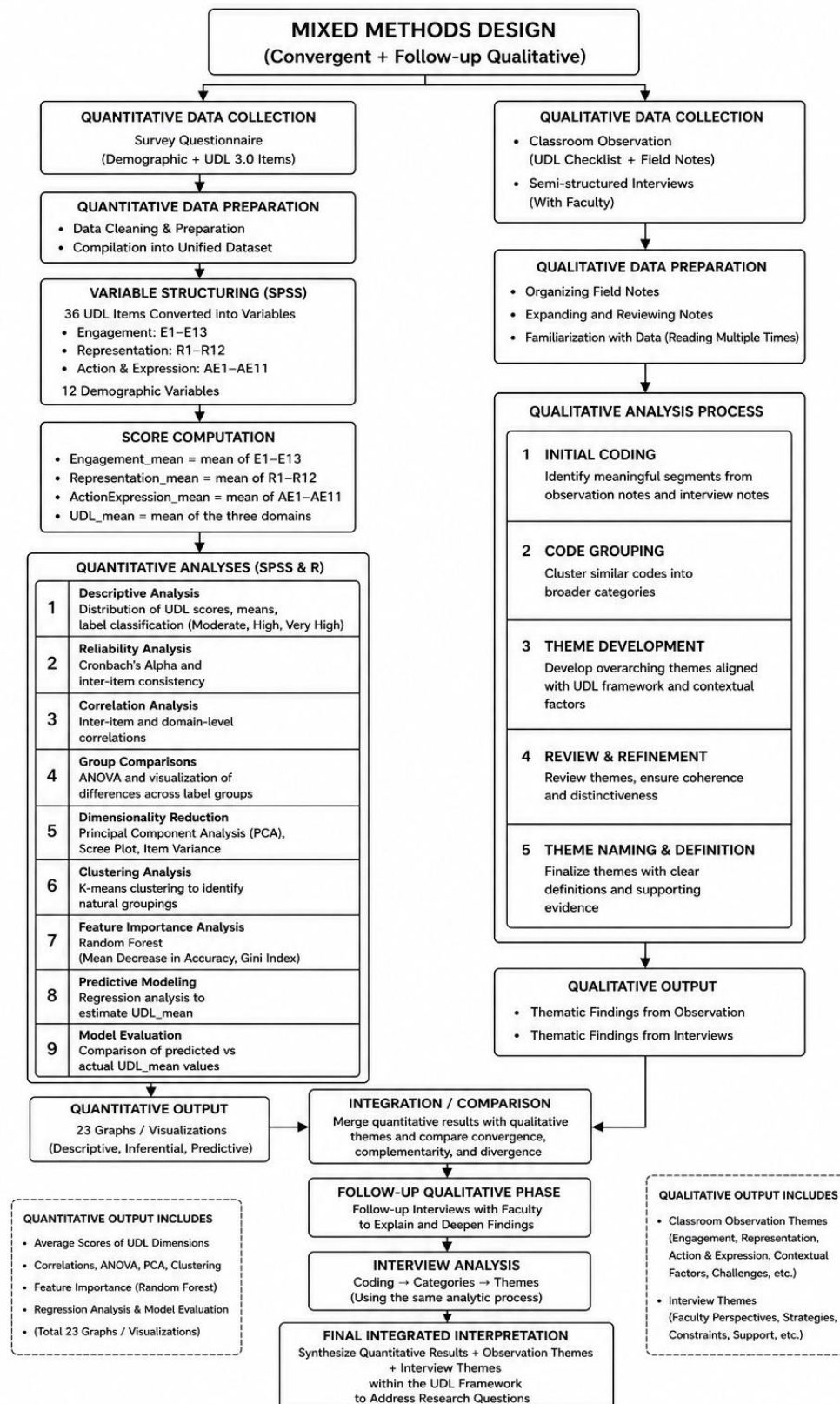


Figure 2 Overview Flowchart of the Data Analysis Process

Figure 2 represents a comprehensive overview of the mixed-methods design used in this study. It outlines the main steps involved in both the quantitative and qualitative strands,

starting from data collection and moving through preparation and analysis. The quantitative side includes survey data processing and statistical analyses, while the qualitative side shows the progression from classroom observations and interviews to coding and theme development.

The two strands are brought together at the integration stage, where findings are compared to identify areas of alignment and difference. This is followed by a brief qualitative follow-up to further explain key results. Overall, the figure helps clarify how different sources of data were combined to develop a more complete understanding of UDL implementation in this study.

4 Results

This chapter presents the results of the study based on both quantitative and qualitative analyses. It begins with an overview of the demographic characteristics of the faculty participants, followed by the quantitative findings derived from the 36 UDL-related

items. These include descriptive patterns, reliability and correlation analyses, dimensionality reduction, clustering, and regression-based modeling. The chapter then presents the qualitative findings from classroom observations and interviews, focusing on how UDL-aligned instructional practices are enacted in real teaching contexts.

4.1 Quantitative Findings (Survey Data)

4.1.1 Demographic Characteristics

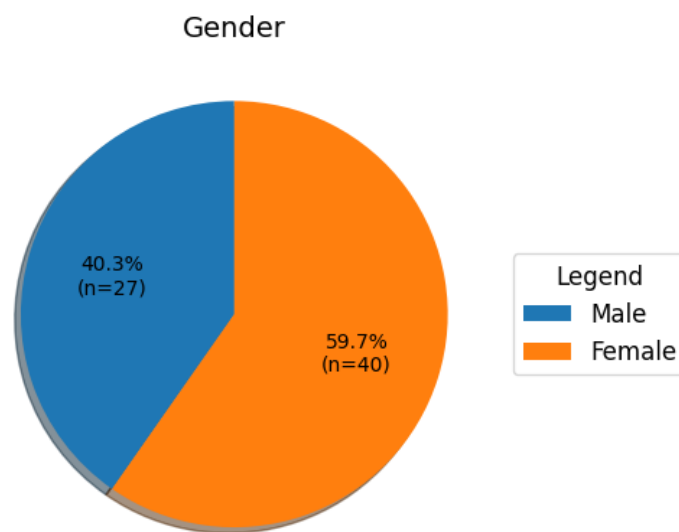


Figure 3 Gender Distribution of Total Participants (N = 67)

Figure 3 represents the gender distribution of the participating faculty members. There is a higher representation of female participants compared to male participants. Out of the total sample ($n = 67$), 40 participants (59.7%) identified as female, while 27 participants (40.3%) identified as male. This shows that more female faculty participated in the study than male faculty. The difference in representation is noticeable but not extreme, reflecting a reasonably balanced sample with a slight predominance of female participants.

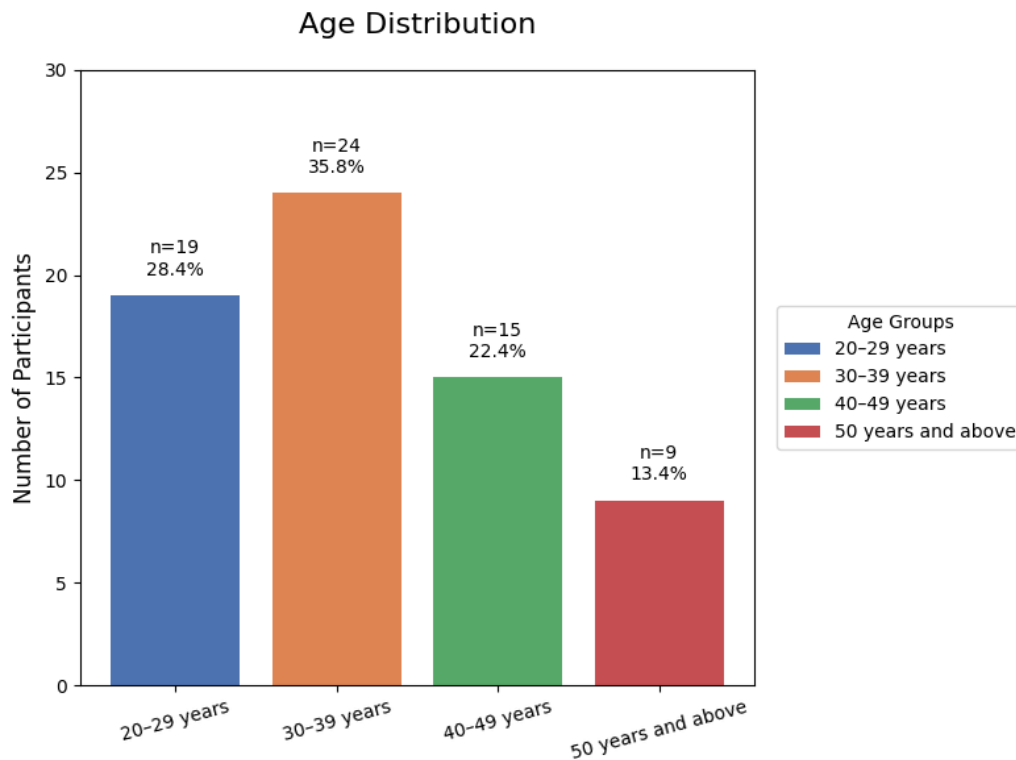


Figure 4 Age Distribution of Participants Across Four Age Groups (N = 67)

Figure 4 presents the age distribution of the participating faculty members. The largest proportion of participants falls within the 30–39 years age group, comprising 24 individuals (35.8%). This is followed by the 20–29 years group, which includes 19 participants (28.4%). Faculty members aged 40–49 years account for 15 participants (22.4%), while the smallest group consists of those aged 50 years and above, with 9 participants (13.4%).

Overall, the sample is concentrated in the younger to mid-career age ranges, with relatively fewer participants in the older age group.

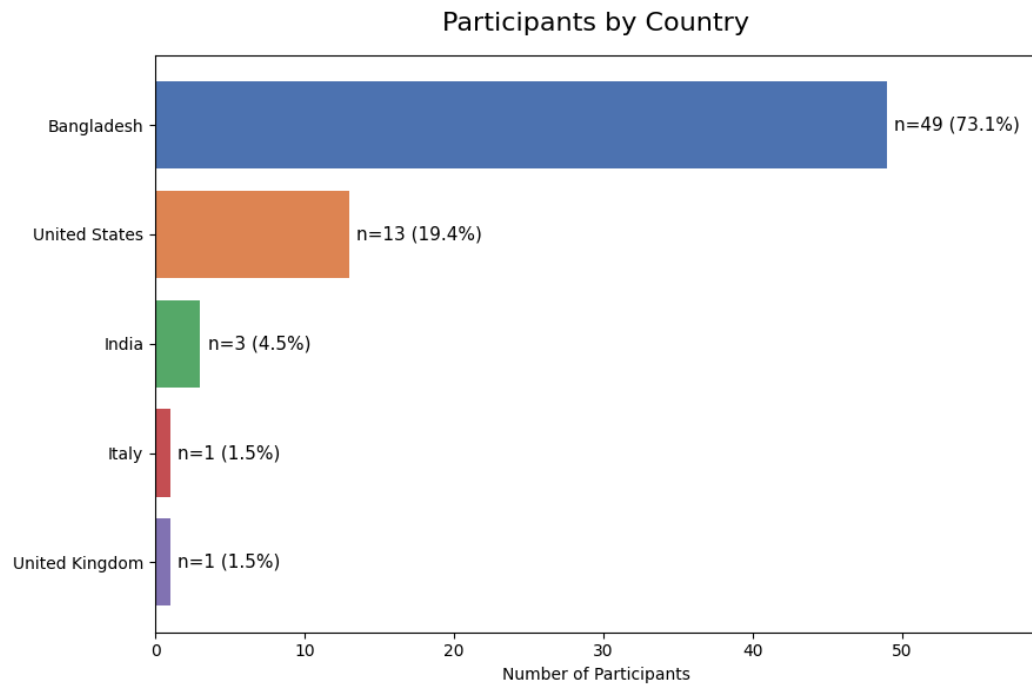


Figure 5 Distribution of Participants by Country (N = 67)

Figure 5 presents the distribution of participants by country. The majority of the faculty members are from Bangladesh, accounting for 49 participants (73.1%). A smaller proportion of participants are from the United States, with 13 individuals (19.4%). Representation from other countries is limited, with 3 participants (4.5%) from India and 1 participant each (1.5%) from Italy and the United Kingdom.

Overall, the sample is heavily concentrated in Bangladesh, with relatively limited international representation.

Academic Position Profile of Faculty Participants (n = 67)

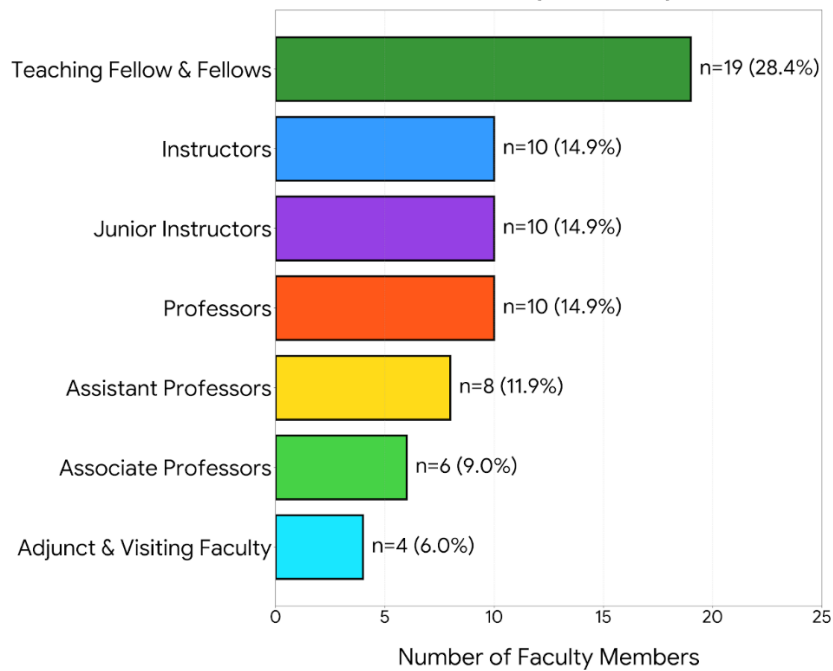


Figure 6 Academic position profile of faculty participants (N = 67)

Figure 6 presents the distribution of participants by academic position. The largest group consists of Teaching Fellows and Fellows, with 19 participants (28.4%). Instructors, Junior Instructors, and Professors each represent an equal proportion of the sample, with 10 participants in each category (14.9%). Assistant Professors account for 8 participants (11.9%), followed by Associate Professors with 6 participants (9.0%). The smallest group is Adjunct and Visiting Faculty, comprising 4 participants (6.0%).

Overall, the sample includes participants across a range of academic positions, with a stronger representation in early-career and non-tenure-track roles.

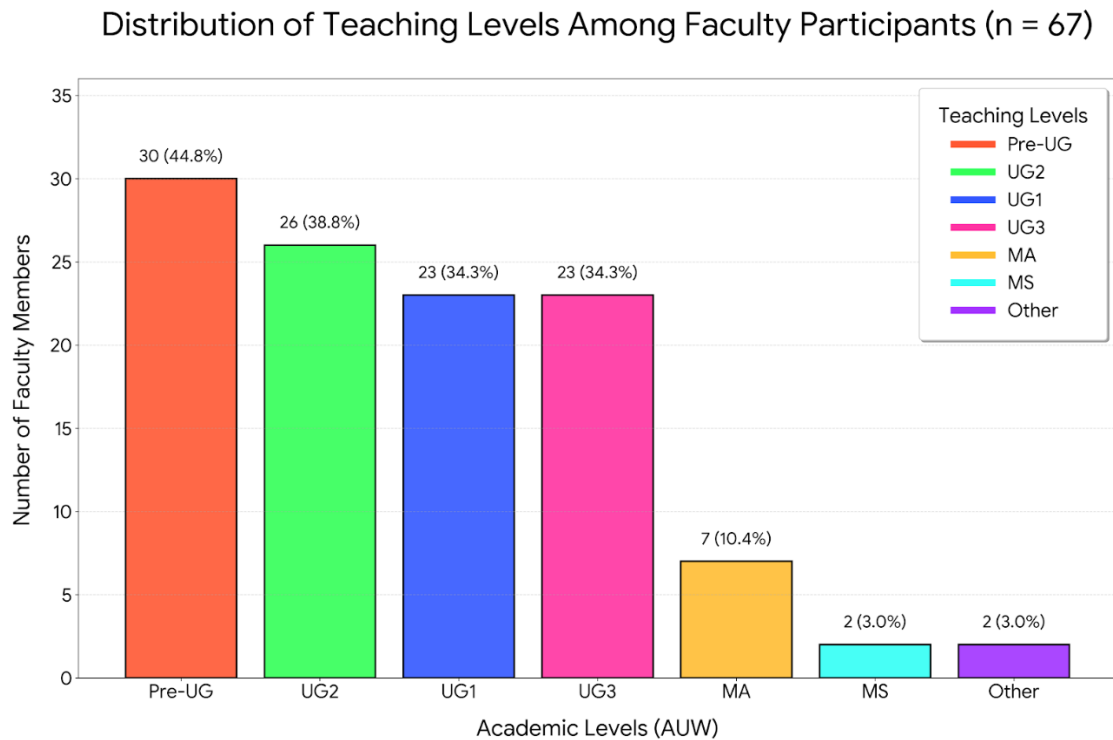


Figure 7 Distribution of teaching levels among faculty participants (N = 67)

Figure 7 shows the distribution of teaching levels at AUW by the participating faculty members. Pre-UG classes are the most commonly reported, with 30 responses (44.8%). This is followed by UG2, reported by 26 participants (38.8%). UG1 and UG3 are equally represented, each with 23 responses (34.3%). A smaller proportion of faculty report teaching at the postgraduate level, with 7 participants (10.4%) teaching at the MA level and 2 participants (3.0%) at the MS level. A small number of responses (n = 2, 3.0%) fall under other categories.

It is important to note that participants could report teaching at multiple levels; therefore, the total number of responses exceeds the number of participants.

Professional Experience Profile: Years of Teaching Among Faculty (n = 67)

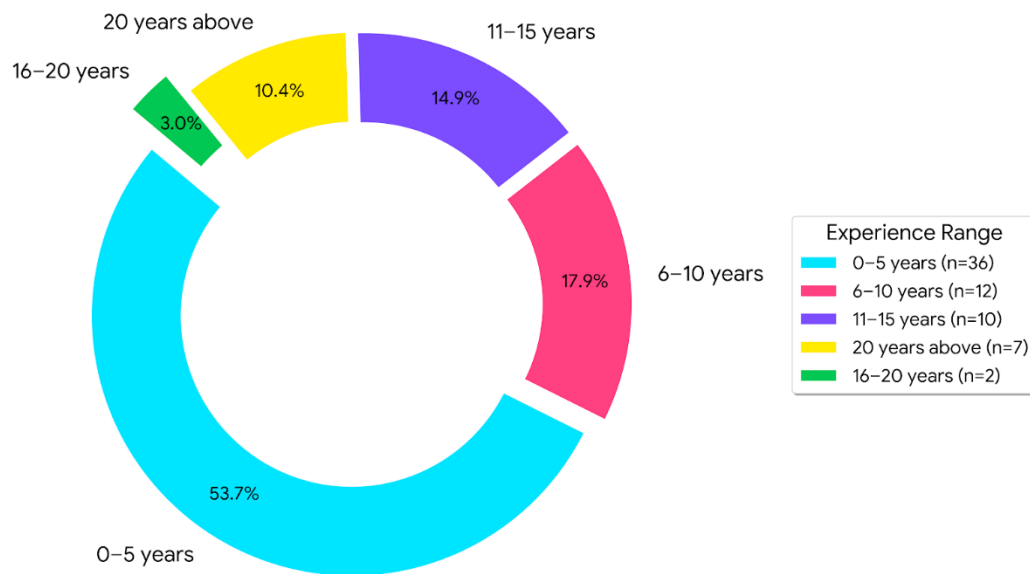


Figure 8 Distribution of faculty participants by years of teaching experience (N = 67)

Figure 8 presents the distribution of teaching experience among the participating faculty members. More than half of the participants fall within the 0–5 years category, accounting for 36 individuals (53.7%). The next largest group includes those with 6–10 years of experience, with 12 participants (17.9%). Faculty with 11–15 years of experience include 10 participants (14.9%). A smaller proportion of participants report longer teaching experience, with 7 individuals (10.4%) having more than 20 years of experience and 2 participants (3.0%) falling within the 16–20 years range.

Overall, the sample is weighted toward faculty with relatively fewer years of teaching experience, with smaller representation in the higher experience brackets.

Highest Academic Qualifications of Faculty Participants (n = 67)

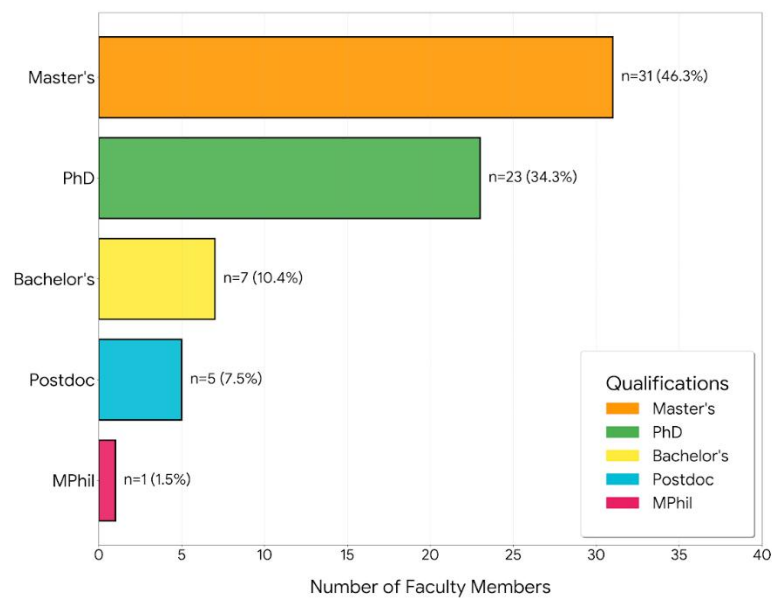


Figure 9 Distribution of faculty participants by highest academic qualification (N = 67)

Figure 9 presents the highest academic qualifications of the participating faculty members. The largest group holds a Master's degree, with 31 participants (46.3%). This is followed by faculty with a PhD, comprising 23 participants (34.3%). A smaller proportion of participants report a Bachelor's degree as their highest qualification, with 7 individuals (10.4%). Postdoctoral experience is reported by 5 participants (7.5%), while only 1 participant (1.5%) holds an MPhil as the highest qualification.

Overall, the sample is largely composed of faculty with postgraduate qualifications, with comparatively fewer participants at the Bachelor's and MPhil levels.

Distribution of Academic Disciplines Taught by Faculty (n = 67)

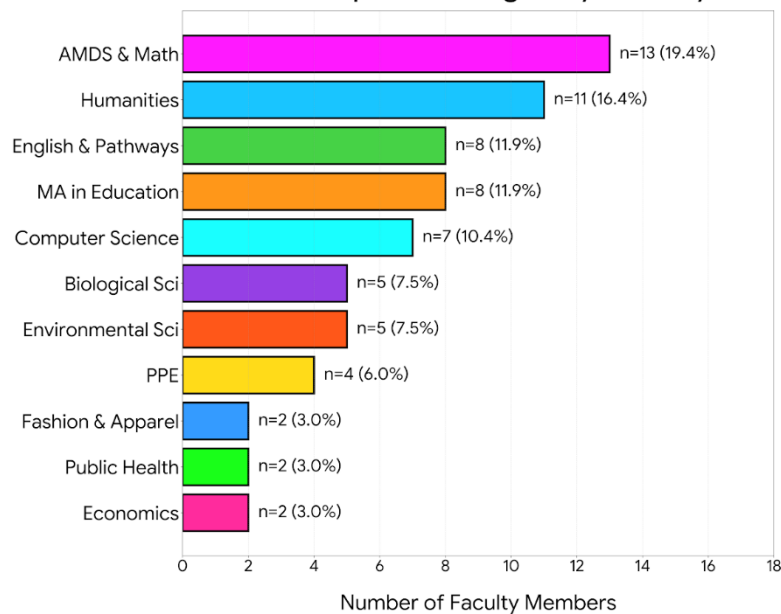


Figure 10 Distribution of academic disciplines taught by faculty participants (N = 67)

Figure 10 presents the distribution of academic disciplines taught by the participating faculty members. The largest representation comes from AMDS and Mathematics, with 13 participants (19.4%). This is followed by the Humanities, comprising 11 participants (16.4%). English and Pathways, as well as MA in Education, each account for 8 participants (11.9%). Computer Science is represented by 7 participants (10.4%). Biological Sciences and Environmental Sciences each include 5 participants (7.5%), while PPE accounts for 4 participants (6.0%). The remaining disciplines, Fashion and Apparel, Public Health, and Economics, are each represented by 2 participants (3.0%).

Overall, the sample reflects a broad range of academic disciplines, with varying levels of representation across fields.

Typical Class Size Handled by Faculty Participants (n = 67)

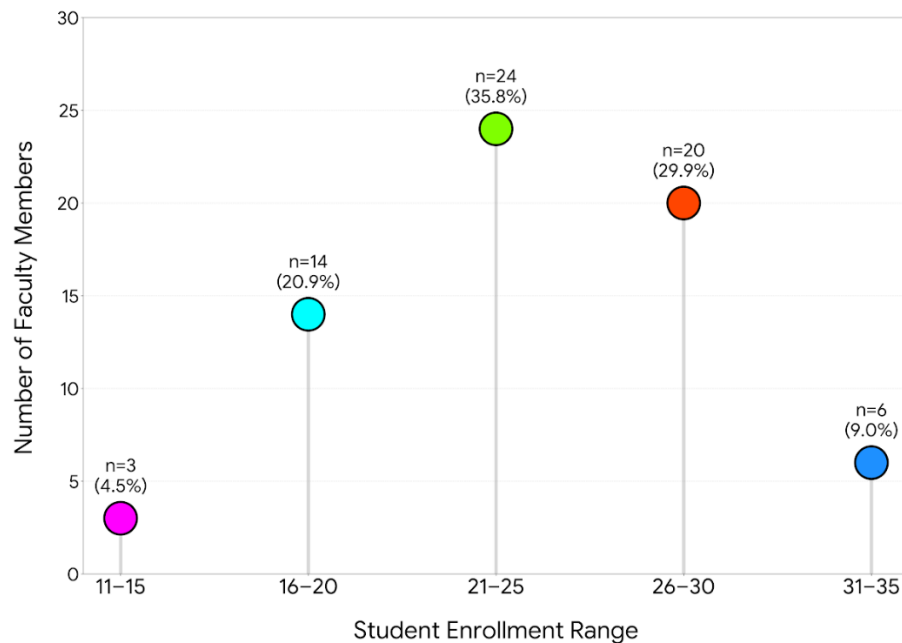


Figure 11 Distribution of typical class sizes handled by faculty participants (N = 67)

Figure 11 presents the distribution of typical class sizes handled by the participating faculty members. The most commonly reported class size falls within the 21–25 student range, with 24 participants (35.8%). This is followed by the 26–30 range, reported by 20 participants (29.9%). A smaller proportion of faculty handle classes of 16–20 students, with 14 participants (20.9%). Fewer participants report class sizes in the 31–35 range, accounting for 6 individuals (9.0%), while the smallest group consists of those handling 11–15 students, with 3 participants (4.5%).

Overall, the distribution indicates that most faculty members teach classes within the mid-range of student enrollment.

Primary Course Delivery Modes of Faculty Participants (n = 67)

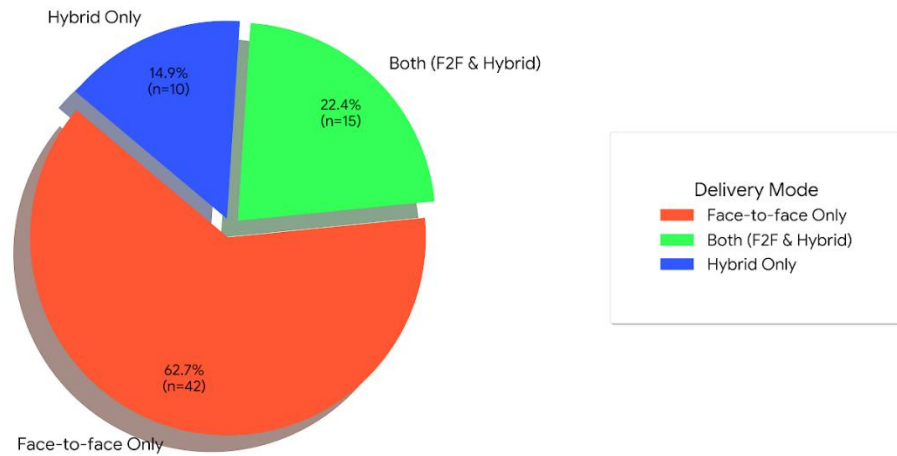


Figure 12 Distribution of primary course delivery modes among faculty participants (N = 67)

Figure 12 presents the primary course delivery modes reported by the participating faculty members. The majority of participants teach exclusively in a face-to-face format, with 42 individuals (62.7%). Another 15 participants (22.4%) report using both face-to-face and hybrid modes. Hybrid-only teaching is reported by 10 participants (14.9%).

Overall, face-to-face delivery remains the most common mode among the participants, with comparatively fewer faculty relying on hybrid or mixed approaches.

4.1.2 Findings from 36 UDL Items

The below section presents comprehensive in-depth findings observed from the items related to the 36 UDL considerations. Major findings include Reliability and Measurement Quality, Descriptive Overview of UDL Implementation, Distribution and Variability Analysis, Relationships and Correlation Structure, Group Differences and Comparative Analysis, Dimensionality Reduction and Structure, Clustering and Pattern Identification, Predictive Modeling and Regression, and Feature Importance and Key Drivers. Reliability and Measurement Quality.

4.1.2.1 Reliability and Measurement Quality

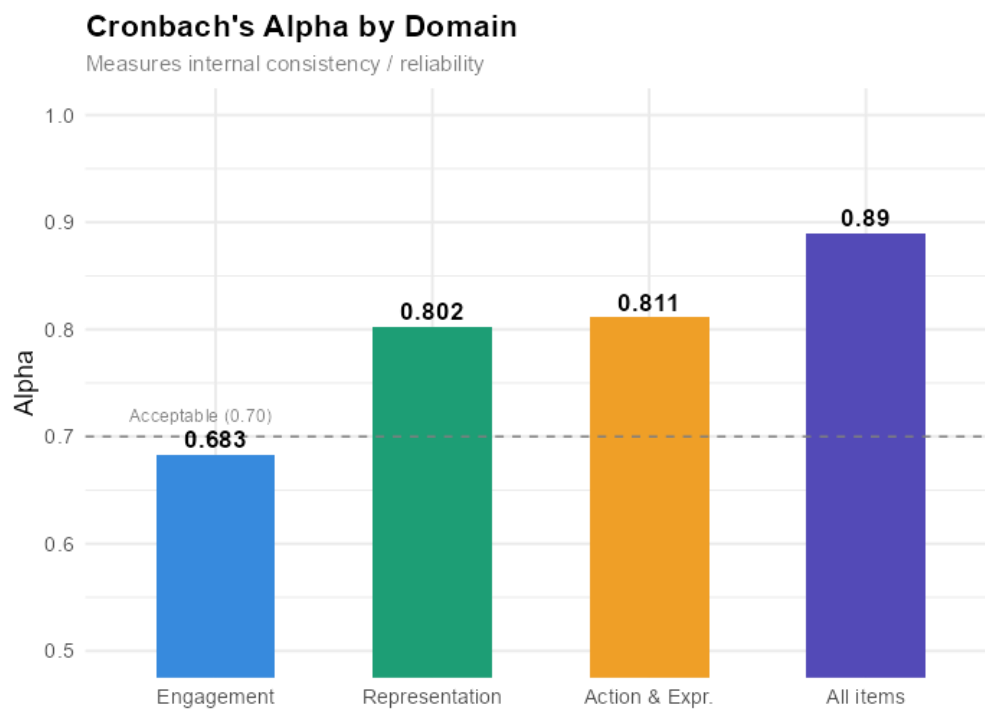


Figure 13 Reliability Analysis (Cronbach's Alpha) by UDL Domain

The internal consistency of the items related to UDL guideline considerations within the survey instrument was tested using Cronbach's Alpha (α) coefficients. This analysis was performed on a 36-item subset ($k = 36$). Although the complete survey instrument included

additional items, the reliability analysis was conducted only on features that directly corresponded to the three UDL domains.

As illustrated in Figure 13, the 36 UDL subset items demonstrated overall high internal consistency ($\alpha = .89$). Domain-specific analysis indicated that Representation ($\alpha = .802$) and Action and Expression ($\alpha = .811$) both exhibited good reliability. The Engagement domain yielded a coefficient of $\alpha = .683$. Although this value is below the standard .70 threshold, it remains adequate for subscale analysis in exploratory educational research (Johnson & Christensen, 2024). This adequacy is further supported by the high cumulative reliability observed across the 36 items.

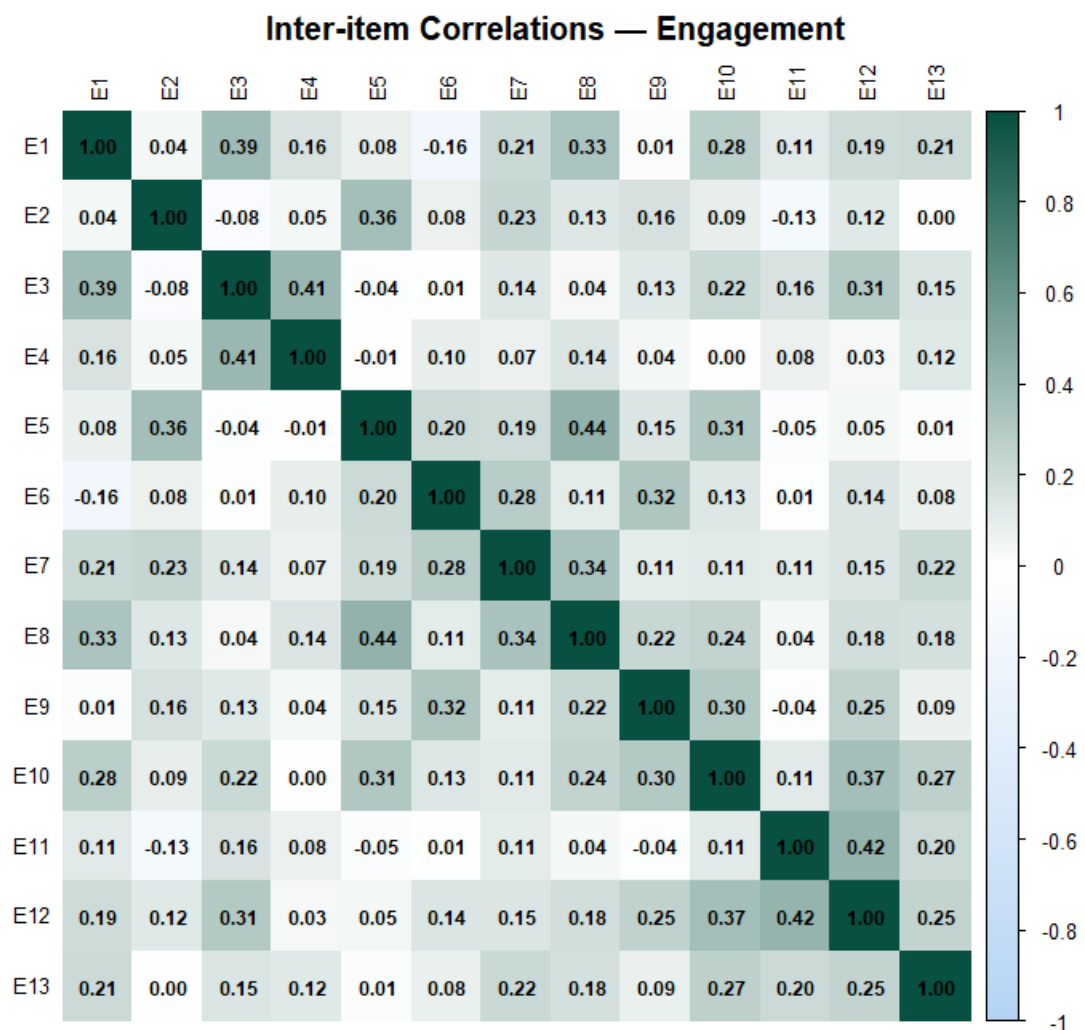


Figure 14 Inter-item Correlation Matrix for the Engagement Domain

Figure 14 displays the Pearson correlation coefficients (r) for the 13 items within the Engagement domain for all participants ($N = 67$). The correlation matrix demonstrates a diverse range of relationships, as most items indicate weak to moderate positive correlations. The highest pairwise internal correlations were observed between E5 and E8 ($r = .44$), E11 and E12 ($r = .42$), and E3 and E4 ($r = .41$). Several item pairs showed near-zero or slightly negative relationships, such as E1 and E6 ($r = -.16$) and E2 and E11 ($r = -.13$). The majority of coefficients are within the .10 to .35 range. In contrast to the overall UDL mean correlations, these inter-item relationships are less uniform. This trend suggests that the Engagement domain consists of relatively independent instructional behaviors.

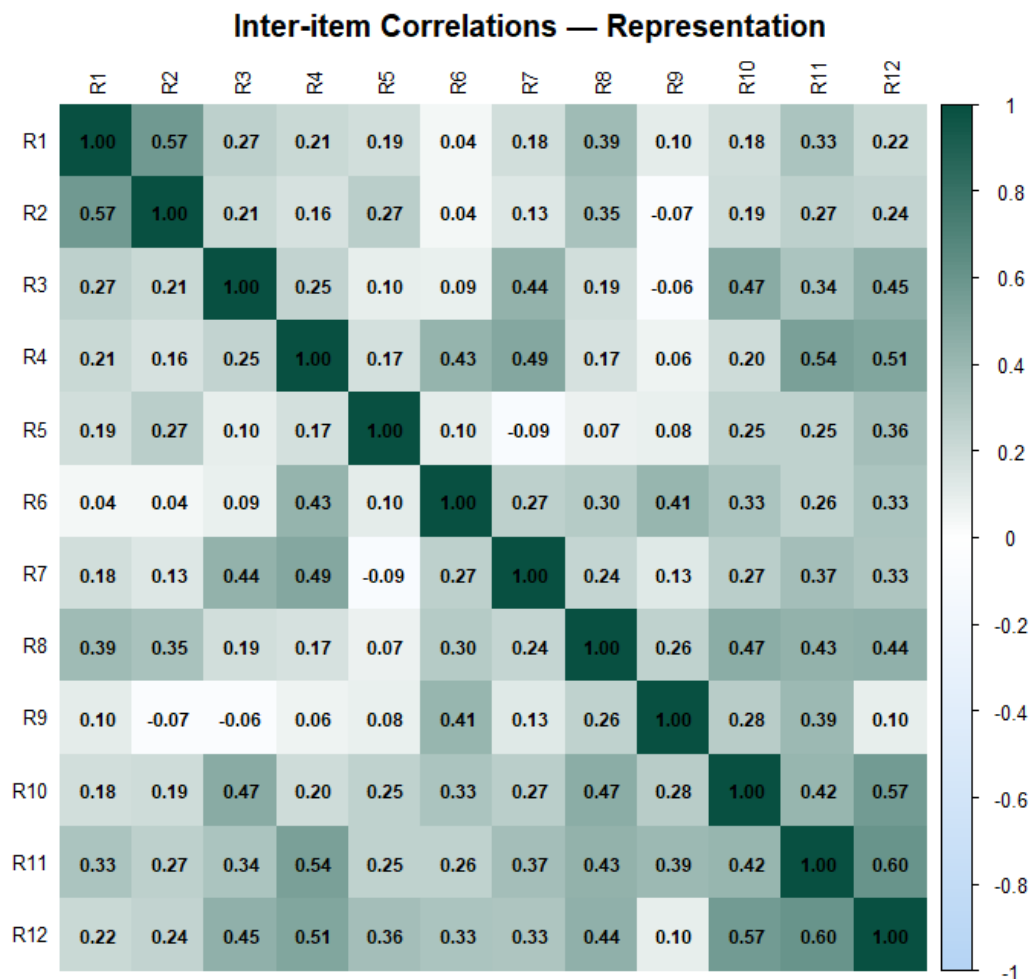


Figure 15 Inter-item Correlation Matrix for the Representation Domain

Figure 15 demonstrates the Pearson correlation coefficients (r) for the 12 items within the Representation domain for all participants ($N = 67$). Compared to the Engagement domain, the Representation domain shows more robust and consistent positive correlations. The strongest pairwise correlations were observed between items R11 and R12 ($r = .60$), followed by R1 and R2 ($r = .57$), and R10 and R12 ($r = .57$). These moderate-to-strong correlations reveal that these UDL considerations are often implemented together.

Item R11 appears as a “central” feature within a highly correlated cluster in this domain. It shows strong correlations with R4 ($r = .54$), R8 ($r = .43$), and R10 ($r = .42$), in addition to its association with R12 ($r = .60$).

The matrix reveals very few negative or near-zero relationships. The weakest correlations were found between R5 and R7 ($r = -.09$) and R2 and R9 ($r = -.07$). The majority of the coefficients fall within the .25 to .50 range, indicating strong internal consistency across the domain.

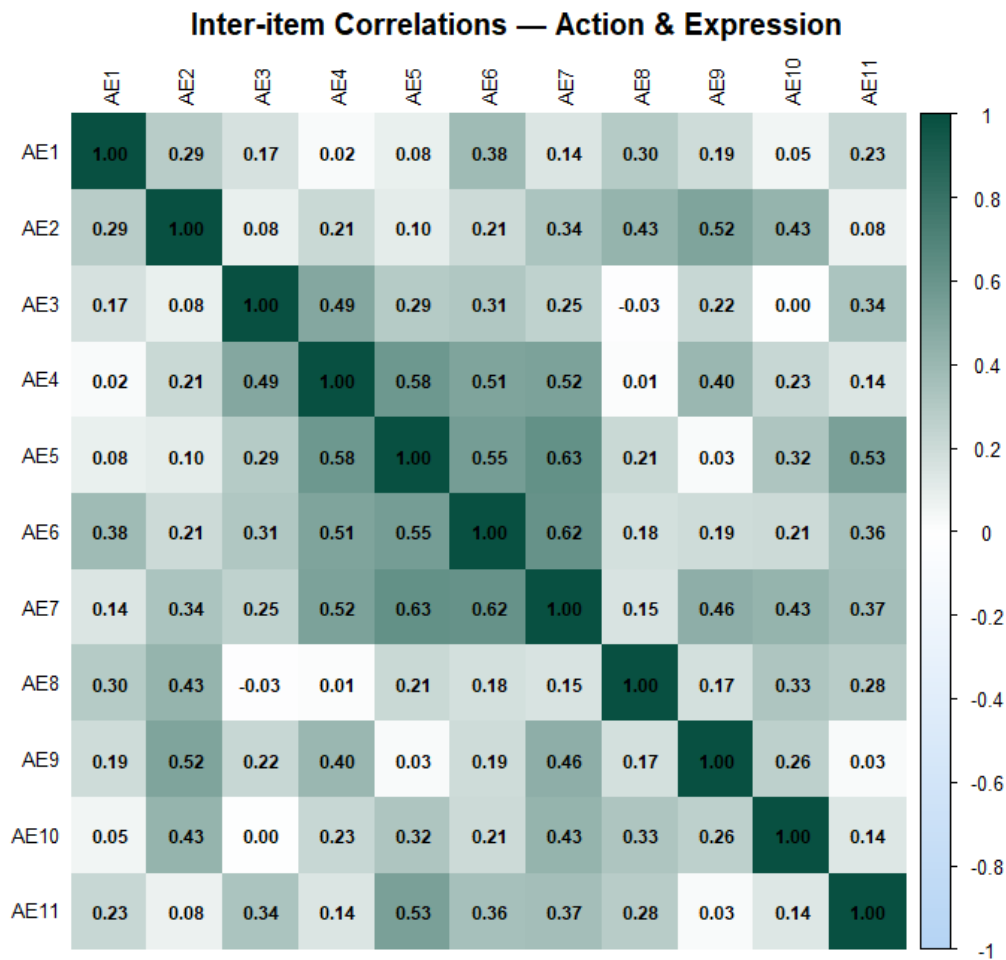


Figure 16 Inter-item Correlation Matrix for the Action and Expression Domain

Figure 16 represents the Pearson correlation coefficients (r) for the 11 items within the Action and Expression domain for all participants ($N = 67$). The correlation matrix shows mostly moderate-to-strong positive associations, particularly among the central items of the scale.

The strongest pairwise internal correlations occurred between AE5 and AE7 ($r = .63$), AE6 and AE7 ($r = .62$), and AE4 and AE5 ($r = .58$). Items AE4, AE5, AE6, and AE7 form a distinct “inter-correlation cluster,” with most pairwise correlations exceeding .50. This pattern indicates a strong interrelationship among these instructional features. Additional notable correlations were observed between AE2 and AE9 ($r = .52$), AE5 and AE11 ($r = .53$),

and AE4 and AE6 ($r = .51$). However, a few items exhibited relative independence, such as AE3 and AE8 ($r = -.03$) and AE1 and AE4 ($r = .02$).

4.1.2.2 Descriptive Overview of UDL Implementation

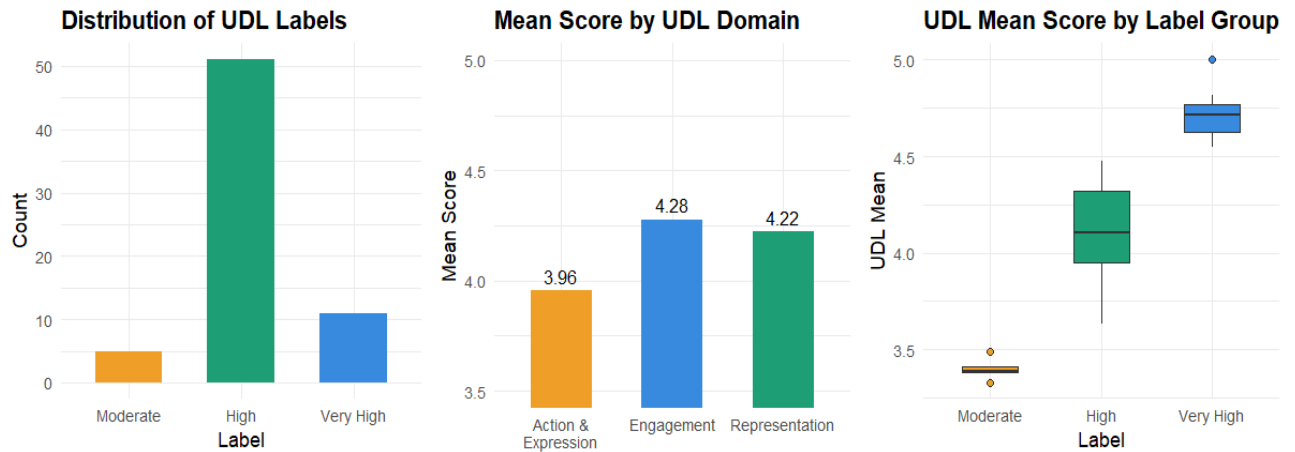


Figure 17 Descriptive Analysis of UDL Implementation

Figure 17 provides an overview of UDL implementation across the study sample ($N = 67$), combining information on implementation levels, domain performance, and variation within each group.

The frequency distribution shows that most participants are classified within the High implementation category ($n = 51$; 76.1%). The Very High group includes 11 participants (16.4%), and the Moderate group is smaller, with 5 participants (7.5%). No participants were classified under the Low category, which indicates an overall high level of UDL implementation across the sample.

Mean scores across the three UDL domains indicate that Engagement has the highest average score ($M = 4.28$), followed closely by Representation ($M = 4.22$), while Action and Expression records the lowest mean ($M = 3.96$). A one-way ANOVA further indicates that these differences are statistically significant ($p < .05$, $N = 67$).

The boxplot on the right provides additional support for the group classification. A clear progression in overall UDL mean scores can be observed across the Moderate, High, and Very High groups, with minimal overlap between them. The High group shows the greatest internal spread, whereas the Very High group is more tightly distributed, aside from a single outlier that reaches the maximum possible score.

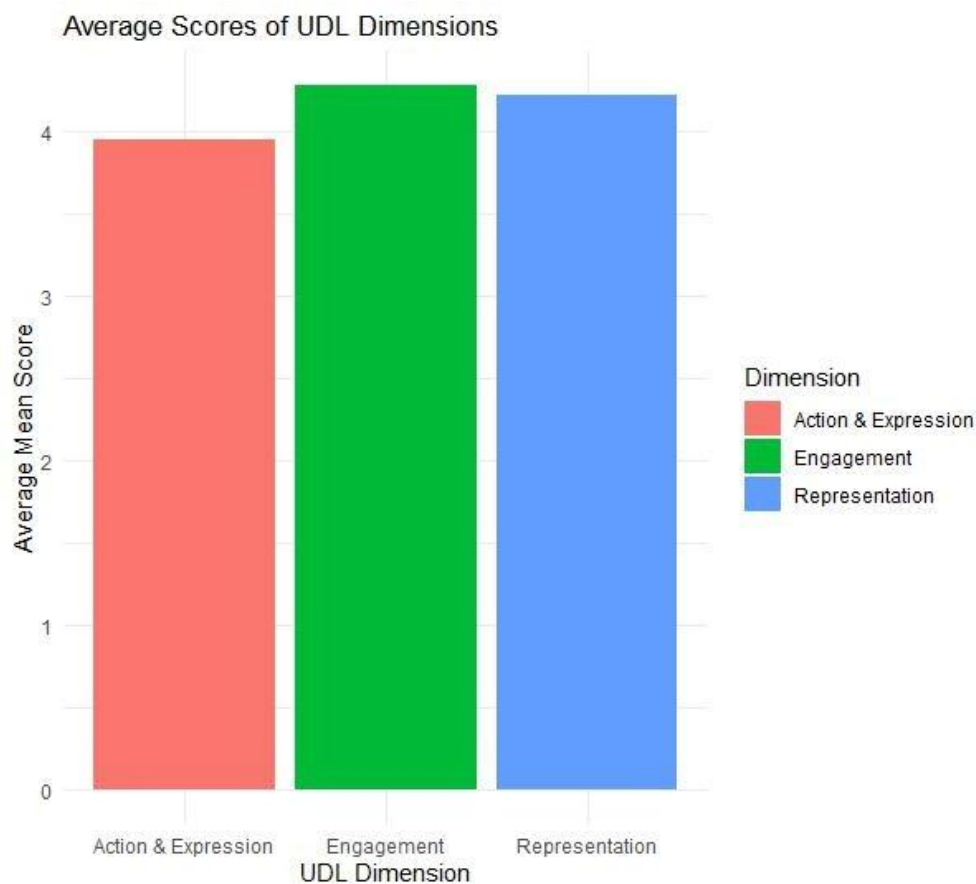


Figure 18 Comparison of Average Scores Across UDL Dimensions

Figure 18 shows the average scores for the three UDL dimensions based on the sample size ($N = 67$). The findings demonstrate a high level of implementation across all three domains, with scores consistently clustering near the upper limit of the scale. Engagement reported the highest average implementation score ($M = 4.28$), followed closely

by Representation ($M = 4.22$). The Action and Expression dimension exhibited the lowest average score ($M = 3.96$). Although all three dimensions demonstrate strong pedagogical integration of UDL, a notable disparity exists between the input-oriented domains (Engagement and Representation) and the output-oriented domain (Action and Expression).

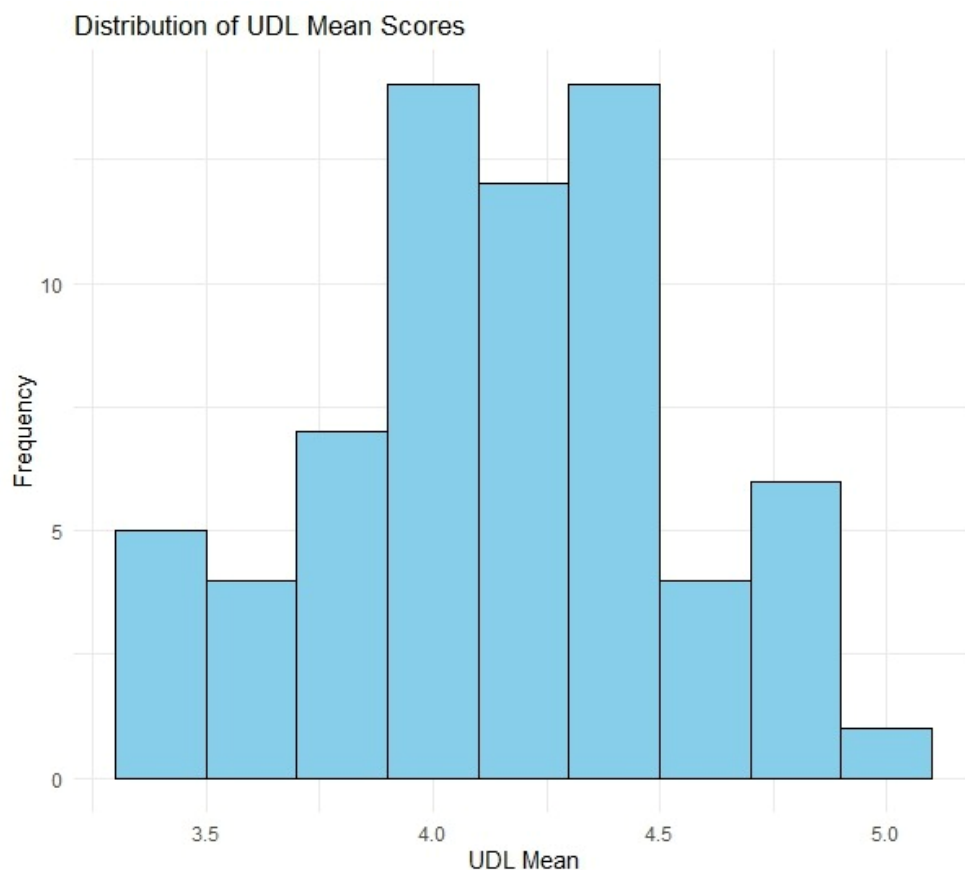


Figure 19 Frequency Distribution of Overall UDL Mean Scores

Figure 19 presents the frequency distribution of overall UDL mean scores for the total sample ($N = 67$). The observed scores range from 3.3 to 5.0. The distribution broadly shows a normal pattern but has a bimodal tendency with two distinct peaks. The primary peak is observed in the 3.9 to 4.1 interval, and the secondary peak appears in the 4.3 to 4.5 interval. The majority of participants ($n = 50$) scored within the 3.8 to 4.6 range. Only one participant

achieved a near-perfect implementation score of 5.0, whereas five participants scored at the lower end of the spectrum (3.3 to 3.5).

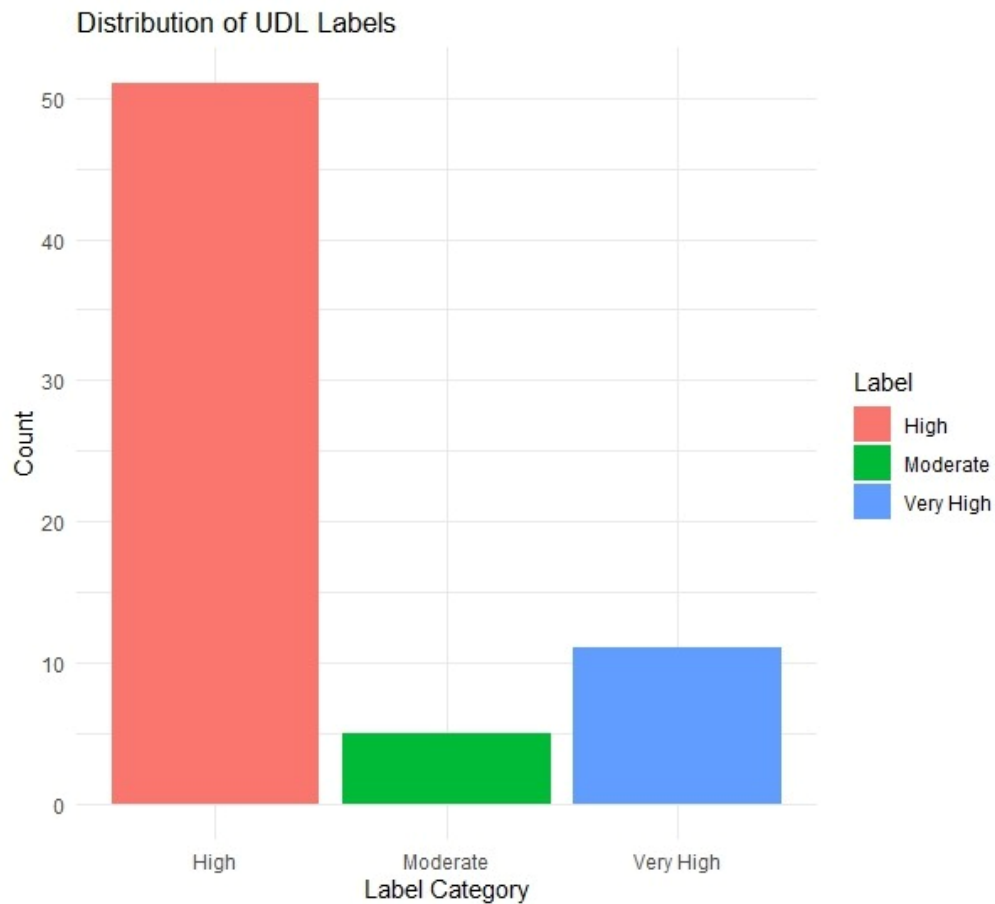


Figure 20 Frequency Distribution of UDL Implementation Labels

Figure 20 presents the distribution of participants ($N = 67$) across three implementation categories: Moderate, High, and Very High. Classification was based on the mean implementation score calculated from 36 UDL guideline considerations.

The majority of participants ($n = 51$, 76.1%) were classified in the High implementation category. The second largest group, the Very High implementation category, included 11 participants (16.4%). Lastly, the Moderate implementation group had the fewest participants, with 5 faculty members (7.5%).

Domain Means by Label Group (Radar Chart)

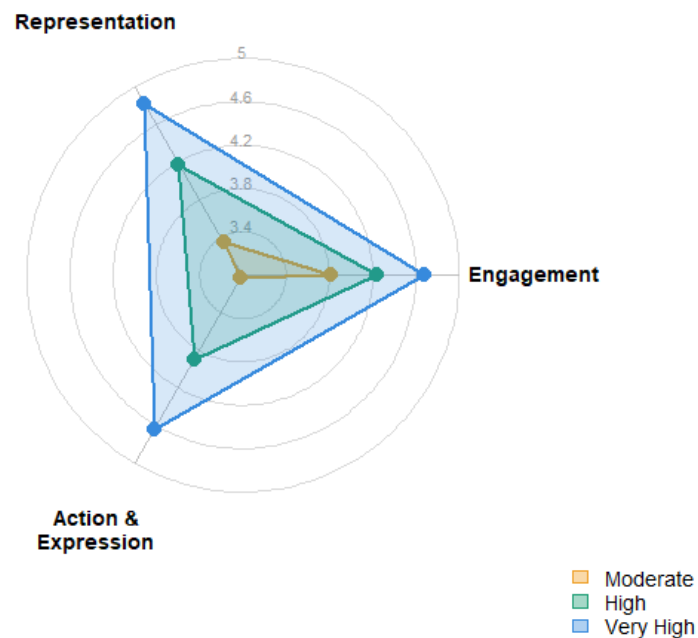


Figure 21 Radar Chart of Domain Means by Implementation Level (Label Group)

Figure 21 presents the mean scores for the three UDL domains across the three implementation levels (Moderate, High, and Very High). The chart uses concentric rings to represent score intervals ranging from 3.4 to 5.0.

A clear nested pattern is visible, with the Very High group (blue) enclosing the High group (green), which in turn surrounds the Moderate group (orange). This pattern reflects a consistent increase in scores across all three domains as implementation level rises.

At the group level, the Moderate group records its highest mean score in Engagement 3.9, while its score in Action and Expression falls below 3.4. The High group shows a more balanced profile, with scores ranging from 4.0 in Action and Expression to 4.3 in

Engagement. The Very High group demonstrates the most expansive and consistent pattern, with all domain scores exceeding 4.6.

Across all three groups, Action and Expression remains comparatively lower than the other two domains, with its values positioned closer to the center of the chart. This difference is more noticeable in the Moderate and High groups.

4.1.2.3 Distribution and Variability Analysis

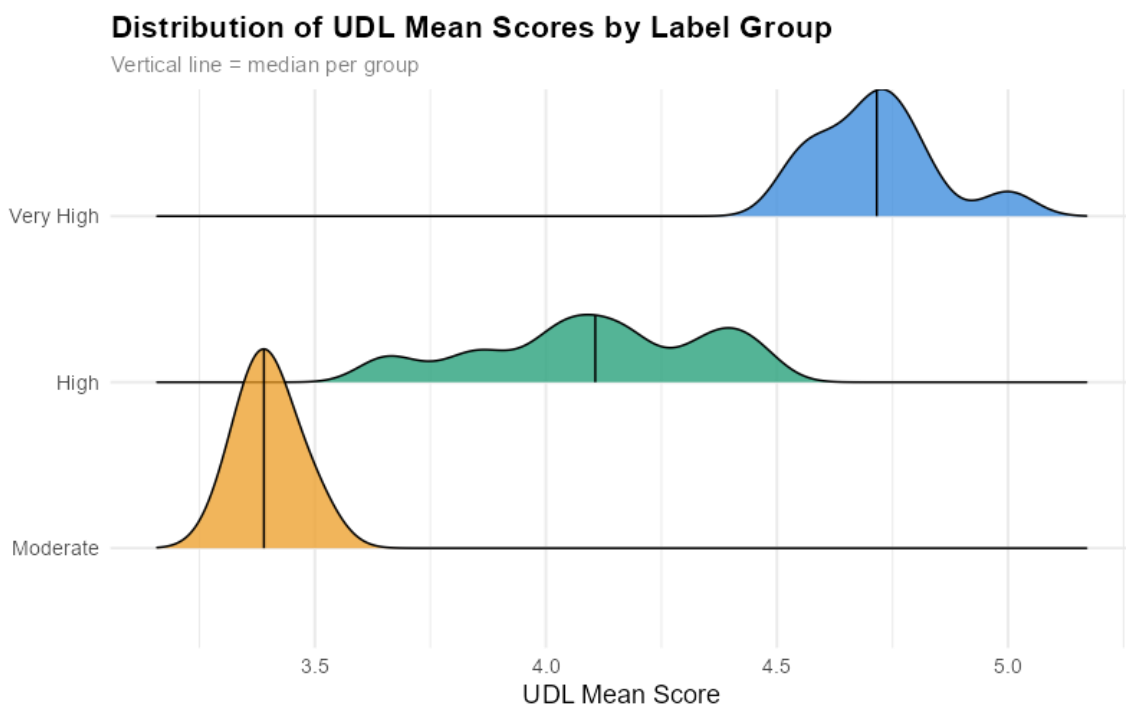


Figure 22 Ridge Plot of UDL Mean Score Distributions by Label Group

Figure 22 presents the density distribution of overall UDL mean scores across three implementation groups ($N = 67$). Vertical black lines indicate the median score for each group.

The Moderate group (orange) demonstrates a highly concentrated, peaked distribution with a median of 3.4. The narrow curve reflects very low variance, indicating that faculty in this group have nearly identical implementation scores.

The High group (green) exhibits the most expansive and multimodal distribution, spanning a range from 3.6 to 4.6 with a median of 4.1. The presence of multiple peaks in the curve suggests several distinct sub-patterns of implementation within this category.

The Very High group (blue) distribution is skewed toward the upper bound of the scale, with a median of 4.7. Most of the density is concentrated between 4.5 and 4.8. A small secondary peak near 5.0 represents faculty with consistently high implementation of UDL guidelines.

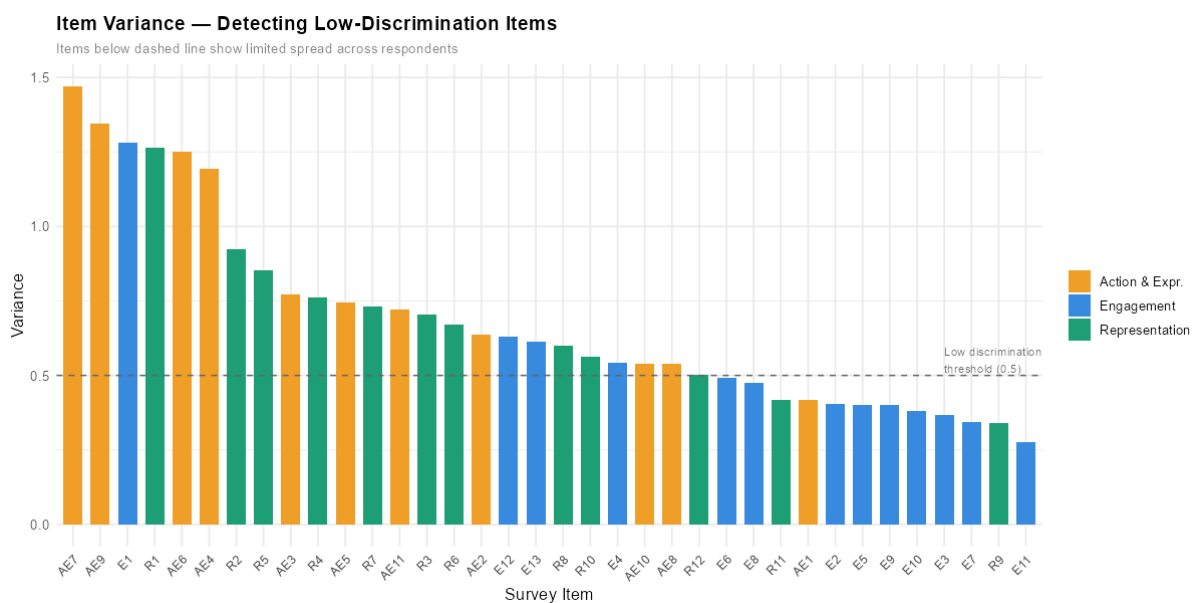


Figure 23 Variance of UDL Guideline Items with Low-Discrimination Threshold

Figure 23 presents the variance (σ^2) for each of the 36 UDL guideline considerations ($N = 67$). The items are arranged from highest to lowest variance, with a dashed horizontal line indicating the 0.5 low-discrimination threshold. Items below this threshold suggest strong agreement among respondents and minimal variation across the sample.

The items with the highest response variability were AE7 ($\sigma^2 = 1.48$), AE9 ($\sigma^2 = 1.35$), and E1 ($\sigma^2 = 1.28$). These items indicate the greatest variation in the implementation of these specific UDL considerations among AUW faculty participants.

A total of 13 items fell below the 0.5 variance threshold. The lowest variances were observed in E11 ($\sigma^2 = 0.28$), R9 ($\sigma^2 = 0.35$), and E7 ($\sigma^2 = 0.35$).

Items from the Action and Expression (orange) and Representation (green) domains are overrepresented among high-variance items. In contrast, the Engagement (blue) domain contains the greatest concentration of low-variance items near the bottom of the ranking.

4.1.2.4 Relationships and Correlation Structure

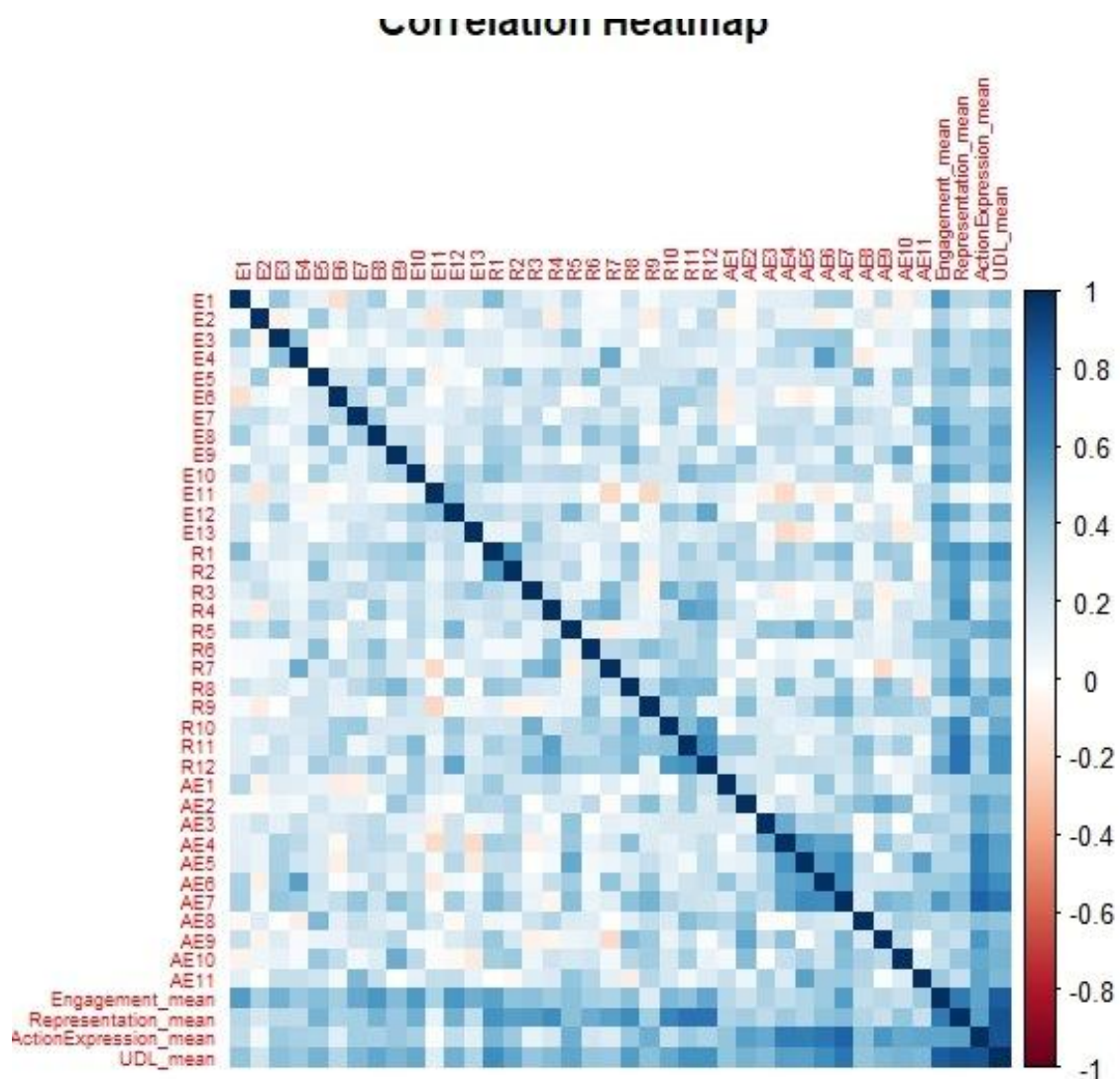


Figure 24 Comprehensive Inter-item and Domain Correlation Heatmap

Figure 24 presents a comprehensive correlation heatmap for all 36 items related to UDL considerations and their respective domain means for all participants ($N = 67$). The color gradient ranges from dark red ($r = -1$) to dark blue ($r = +1$), and the diagonal line indicates perfect self-correlation. The matrix demonstrates an overall trend of positive correlations, as indicated by the widespread presence of blue hues across the grid. The most prominent statistical bands appear at the bottom and far right of the matrix, where individual items (E1 to AE11) are correlated with the Engagement_mean, Representation_mean, ActionExpression_mean, and UDL_mean. These bands consistently show moderate-to-strong positive correlations ($r = .40$ to $.80$), supporting the validity of the items as contributors to their respective domains. Although most relationships are positive, the matrix also includes scattered areas of near-zero or slightly negative correlations, represented by light red or white squares. These occur most frequently within the Engagement (E) domain and in cross-domain pairings between Engagement and Action and Expression.

Correlation Matrix — Domain Means vs UDL Overall

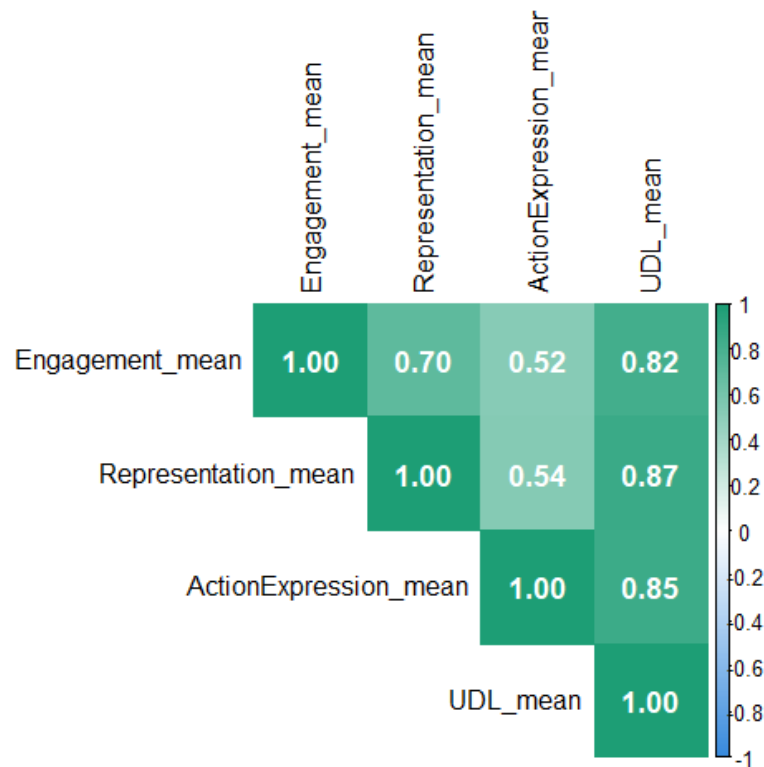


Figure 25 Correlation Matrix of UDL Domain Means and Overall UDL Score

Figure 25 presents a Pearson correlation matrix that illustrates the relationships among the three UDL domains: Engagement, Representation, and Action and Expression, as well as their correlation with the overall UDL mean score. All observed correlations were positive and statistically significant.

A very strong positive correlation was identified between each individual domain and the overall UDL score. Representation exhibited the highest correlation ($r = .87, p < .001, N = 67$), followed by Action and Expression ($r = .85, p < .001, N = 67$) and Engagement ($r = .82, p < .001, N = 67$). A strong inter-domain correlation was observed between Engagement and Representation ($r = .70, p < .001, N = 67$). Action and Expression demonstrated moderate-to-strong inter-domain correlations with both Engagement ($r = .52, p < .001, N = 67$) and Representation ($r = .54, p < .001, N = 67$).

4.1.2.5 Group Differences and Comparative Analysis

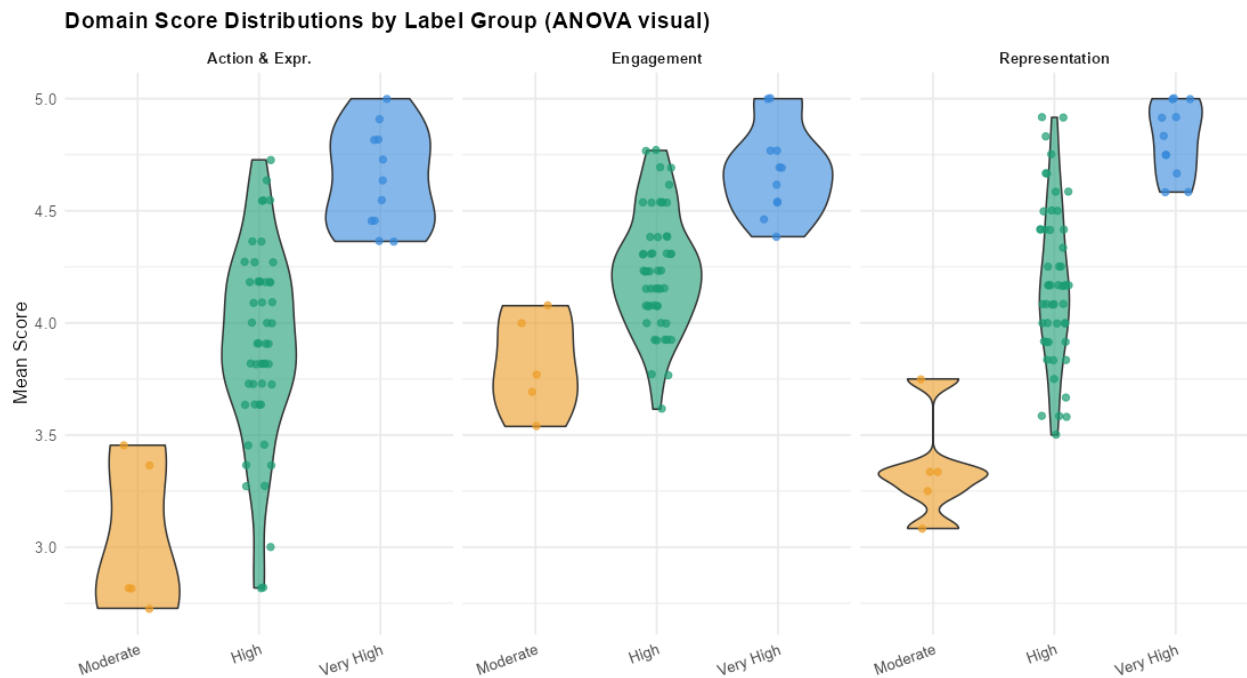


Figure 26 Distribution of Domain Scores by Implementation Level (Label Group)

Figure 26 presents the distribution of mean scores across the three UDL domains (Action and Expression, Engagement, and Representation) grouped by implementation level (Moderate, High, and Very High).

The violin plots show the density of the data, where the width of each shape reflects the concentration of scores. Individual data points ($N = 67$) are slightly spread out to make overlapping values easier to observe. Visual inspection and results from a one-way ANOVA indicate significant differences in mean scores among the three groups across all domains ($p < .001$).

For the Action and Expression domain, the Moderate group's scores were concentrated between 2.7 and 3.5. The High group exhibited the greatest variance, ranging

from 2.8 to 4.7. The Very High group's scores were tightly clustered at the upper threshold (4.4 to 5.0).

For the Engagement domain, the Moderate group demonstrated scores ranging from 3.5 to 4.1. The Very High group showed a high concentration of scores in the 4.7–5.0 range, suggesting a ceiling effect among top performers.

For the Representation domain, the Moderate group exhibited a narrow distribution around 3.2 to 3.4. In contrast, the High group displayed a broad, stretched distribution (3.5 to 4.9). The Very High group was highly consistent, with most scores concentrated between 4.6 and 5.0.

4.1.2.6 Dimensionality Reduction and Structure

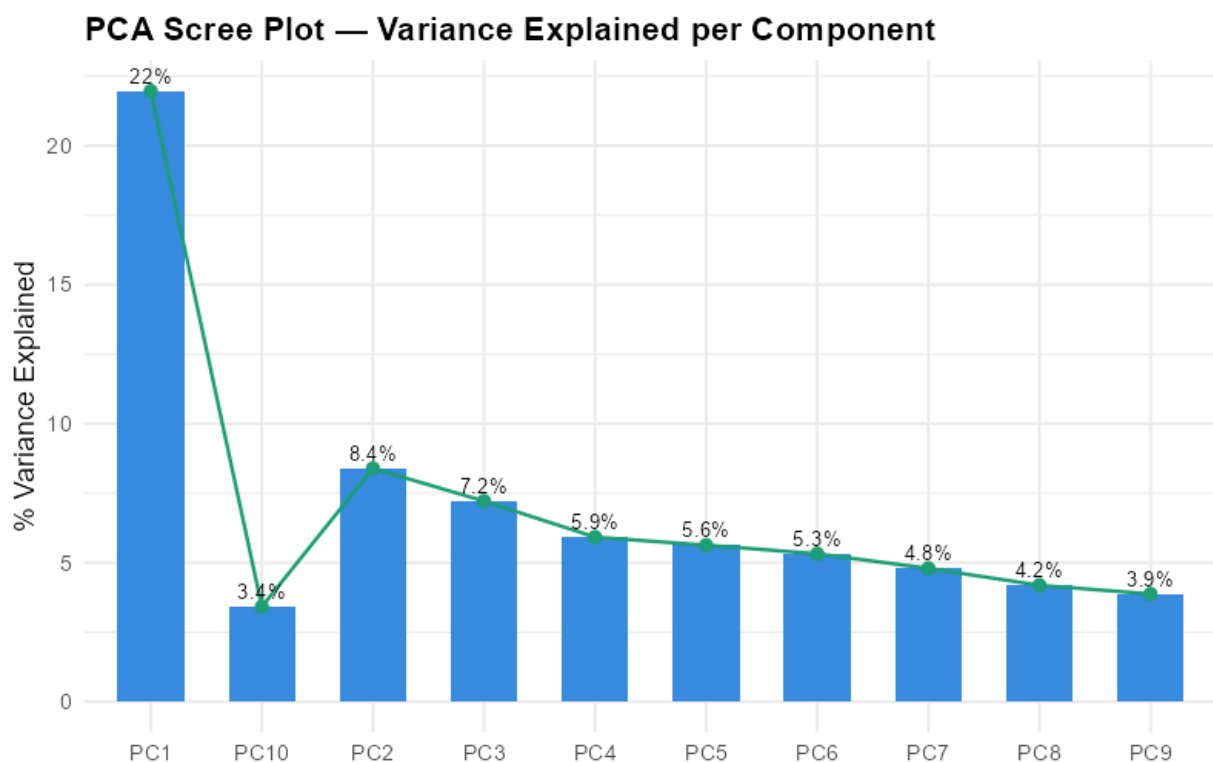


Figure 27 PCA Scree Plot — Variance Explained per Component

Figure 27 displays a principal component analysis (PCA) scree plot showing the percentage of total variance explained by the first ten principal components. This analysis was based on data from the 36-item UDL implementation scale ($N = 67$).

The results demonstrate that the first principal component (PC1) accounts for 22% of the total variance and clearly stands out as the dominant component. After a sharp decline, the second principal component (PC2) explains 8.4% of the variance, and the third principal component (PC3) accounts for 7.2%. The remaining components (PC4 to PC10) each contribute smaller proportions of variance, ranging from 5.9% to 3.4%.

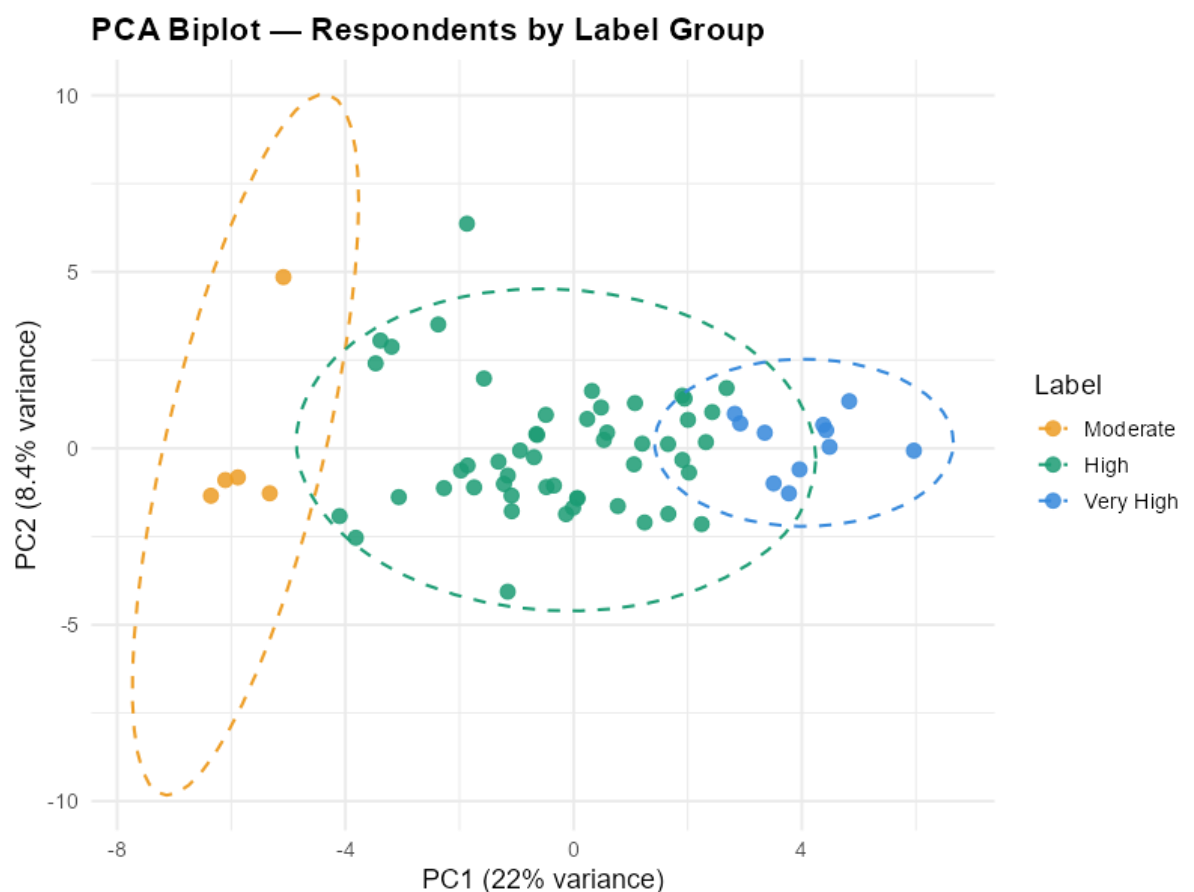


Figure 28 Principal Component Analysis (PCA) Biplot of Respondents by Label Group

Figure 28 illustrates a principal component analysis (PCA) biplot showing the distribution of faculty respondents based on their levels of UDL implementation ($N = 67$).

The first two principal components together account for 30.4% of the total variance, with PC1 explaining 22% and PC2 contributing 8.4%. A clear linear progression is observed along the horizontal axis (PC1). The Moderate group clusters at the negative end (left), the High group occupies the central region, and the Very High group is located at the positive end (right).

The Moderate implementation group (orange) forms a vertically elongated ellipse, indicating greater dispersion along PC2 while remaining relatively constrained along PC1. Although the Moderate group is largely isolated, there is considerable overlap between the High (green) and Very High (blue) ellipses. This suggests that some respondents in the High category exhibit instructional patterns similar to those in the Very High category. The horizontal axis (PC1) serves as the primary dimension of implementation intensity and effectively distinguishes the three groups according to their implementation scores.

4.1.2.7 Clustering and Pattern Identification

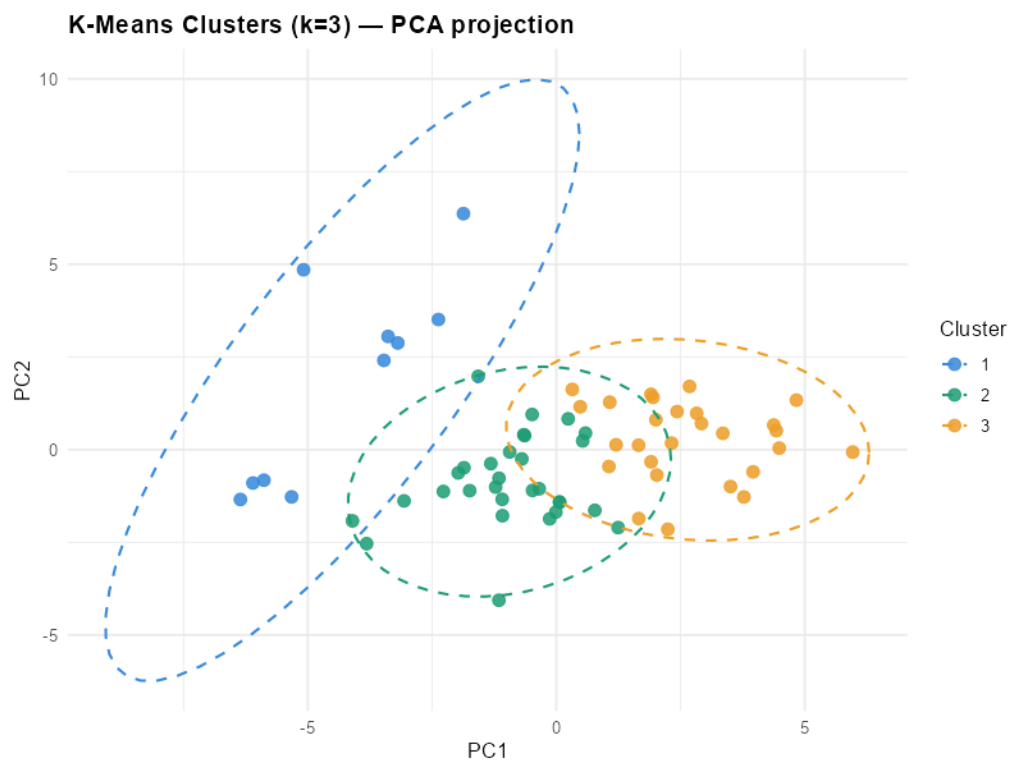


Figure 29 K-Means Clusters and PCA Projection of UDL Implementation

Figure 29 presents the results of a K-means clustering analysis ($k = 3$) applied to group participants ($N = 67$) based on their responses to 36 UDL items. To visualize this high-dimensional data, Principal Component Analysis (PCA) was used to project it into a 2D space, where the first two principal components (PC1 and PC2) were used as the plotting axes.

The analysis reveals three distinct and interpretable clusters. Cluster 1 (blue) is located toward the negative end of PC1 and shows a relatively wide spread along PC2. Cluster 2 (green) occupies the central region of the PCA space and shows some overlap with Cluster 3. Cluster 3 (orange) appears toward the positive end of PC1 and is more densely concentrated. This reflects a high degree of similarity in instructional profiles among its members.

The 95% confidence ellipses further indicate that, while Cluster 2 and Cluster 3 share some common features, Cluster 1 remains clearly separated from Cluster 3.

4.1.2.8 Predictive Modeling and Regression

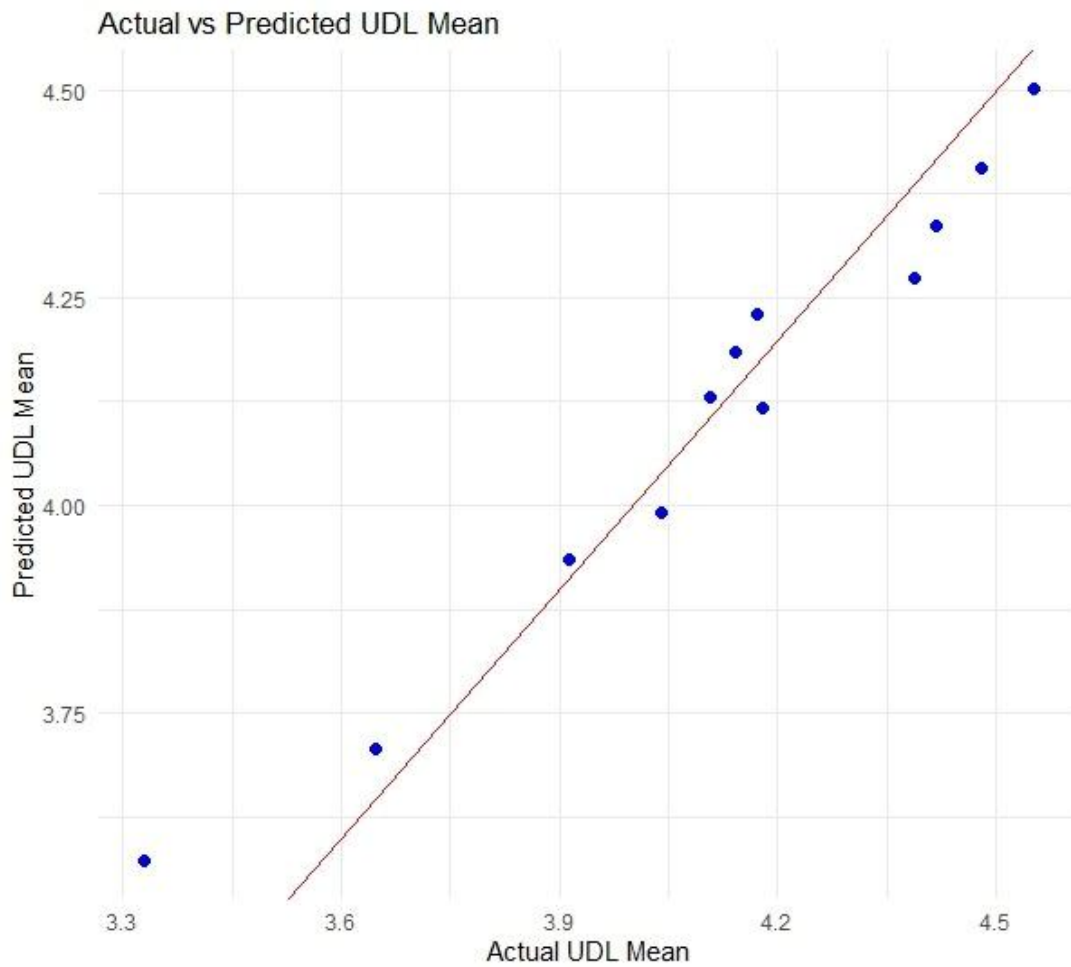


Figure 30 Actual vs. Predicted UDL Mean Scores

Figure 30 shows how the observed UDL implementation scores compare with the values predicted by the model ($N = 67$). The red diagonal line represents the identity line ($y = x$), where points would fall if predictions were perfectly accurate.

Most of the points lie close to this line, which suggests that the model is performing well overall. The scores span roughly from 3.3 to 4.5, and the predictions follow a similar pattern across this range. While there is some small deviation at the lower end, the errors remain fairly consistent, with no clear pattern of increasing or decreasing spread.

This pattern is consistent with a strong model fit, reflected in a high coefficient of determination ($R^2 = .96, p < .001$), indicating that a large proportion of the variance in UDL implementation is explained by the model.

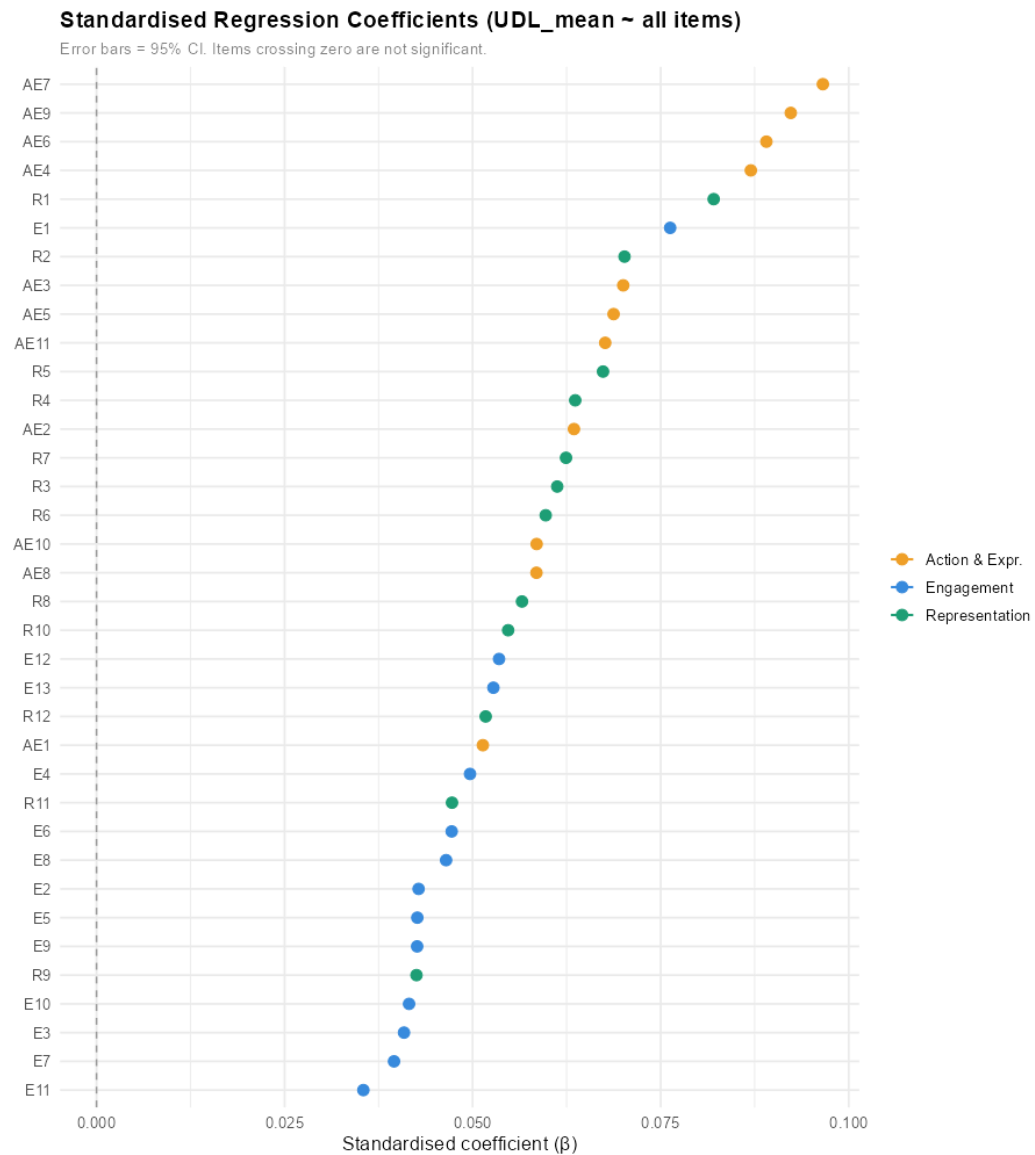


Figure 31 Standardized Regression Coefficients for All UDL Guideline Items

Figure 31 presents the standardized regression coefficients (β) for all 36 UDL guideline items in relation to the overall UDL mean. All coefficients are positive and statistically significant, as none of the 95% confidence intervals (error bars) cross the zero-point line. The items are ranked by the magnitude of their effect sizes.

The analysis reveals that the Action and Expression (AE) domain contains the most influential predictors. In particular, AE7, AE9, AE6, and AE4 show the highest standardized coefficients, with β values approaching or exceeding 0.090. These are followed closely by top-performing items from the Representation (R) domain (e.g., R1) and the Engagement (E) domain (e.g., E1). The β values range from approximately 0.097 for AE7 to 0.035 for E11. Despite this variation, each item contributes positively and uniquely to the overall UDL implementation model, which supports the validity of the 36-item subset.

4.1.2.9 Feature Importance and Key Drives

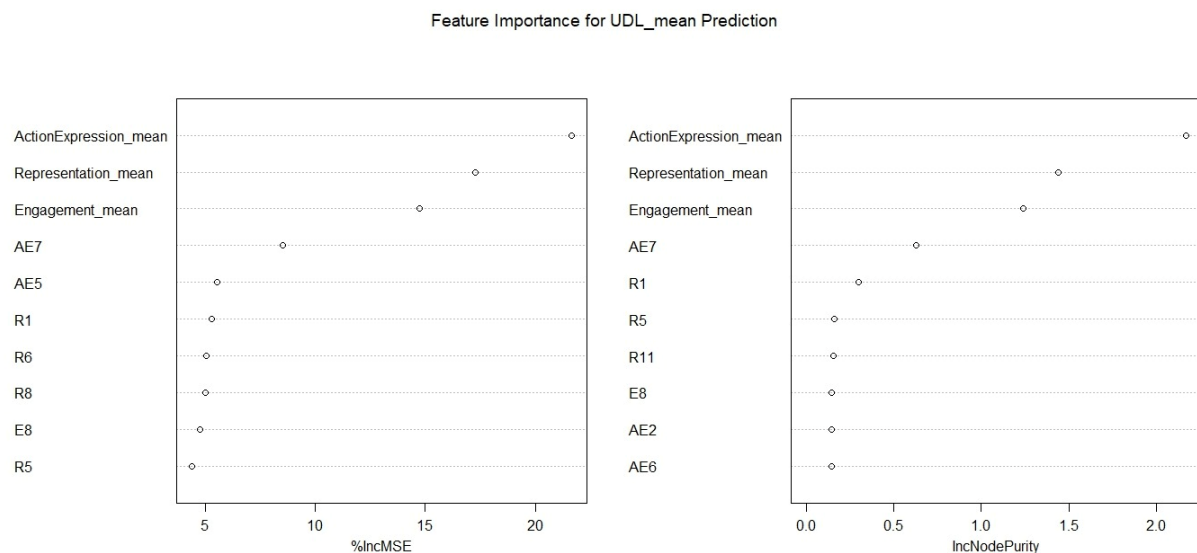


Figure 32 Feature Importance for Predicting Overall UDL Implementation (Random Forest Model)

Figure 32 illustrates the relative importance of the primary predictors for the overall UDL mean score, as determined by a Random Forest analysis ($N = 67$). The results show a clear hierarchy of influence across both the broader UDL domains and specific guideline features.

The dominant predictors are the three aggregate domain means (ActionExpression_mean, Representation_mean, and Engagement_mean), which emerge as

the most significant variables in both the percentage increase in Mean Squared Error (%IncMSE) and Increase in Node Purity (IncNodePurity) metrics. Among these, Action and Expression stands out as the most influential, with a %IncMSE exceeding 20%.

Beyond the aggregate measures, AE7 appears as the most influential individual guideline in predicting overall implementation. Several other high-impact features also show strong contributions, including AE5, R1, R6, R8, and E8 based on the %IncMSE metric. In contrast, the IncNodePurity metric highlights R1, R5, R11, E8, AE2, and AE6 as important predictors. Although the ranking of individual items varies between the two metrics, the prominence of the Action and Expression domain remains consistent across both measures of importance.

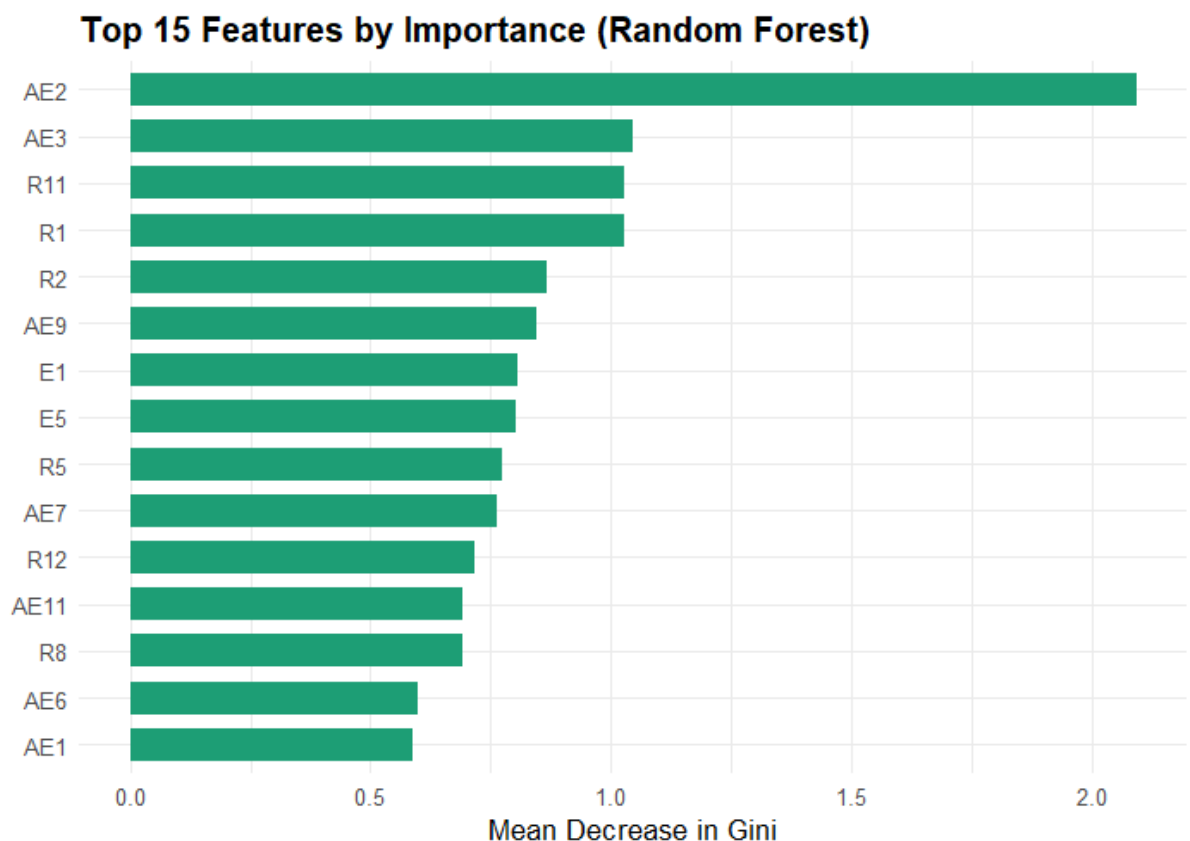


Figure 33 Feature Importance Analysis (Random Forest)

Figure 33 presents the top 15 UDL features (considerations), ranked by their importance as determined by a Random Forest classifier. Importance is evaluated using Mean

Decrease in Gini, which quantifies each variable's contribution to the model's predictive accuracy.

The analysis reveals the exceptional importance of feature AE2, which attained a Gini score exceeding 2.0. This score is substantially higher than any other feature in the dataset, nearly twice the value of the second-ranked feature. Subsequently, features AE3, R11, and R1 form a cluster with comparable importance, each achieving Gini scores around or slightly above 1.0. The remaining features within the top 15, spanning the domains of Engagement (E), Representation (R), and Action and Expression (AE), show a gradual and consistent decline in importance, with scores ranging from approximately 0.85 (R2) to 0.60 (AE1). All three UDL domains are represented among the top 15 features. However, features related to Action and Expression (AE) and Representation (R) are more prevalent in the highest rankings.

Feature Importance for UDL Label Classification

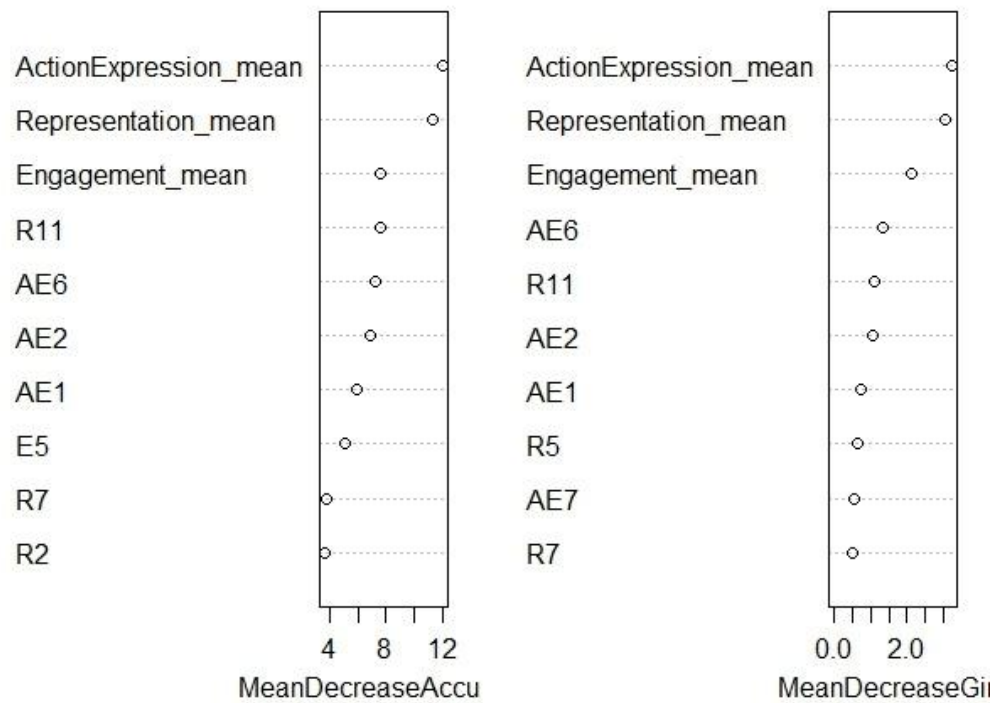


Figure 34 Feature Importance for UDL Label Classification

Figure 34 presents the top 10 predictors for UDL label classification using a Random Forest model ($N = 67$). The results show that aggregate domain means act as the strongest discriminators between implementation levels, followed by specific UDL guideline considerations.

Across both evaluation metrics, the three domain means (ActionExpression_mean, Representation_mean, and Engagement_mean) consistently rank as the top predictors. Among these, Action and Expression stands out as the most critical feature, as its removal results in the largest drop in classification accuracy (Mean Decrease Accuracy = 12) and the greatest increase in node purity (Mean Decrease Gini = 3.5).

Beyond the aggregate measures, several individual guideline features also make notable contributions. R11 from the Representation domain and AE6 from Action and Expression emerge as the most influential individual predictors. Other features, including AE2, AE1, and AE7, also appear regularly among the top-ranked variables across both accuracy- and Gini-based importance measures.

A closer look at domain representation shows that features from the Action and Expression and Representation domains dominate the top rankings. In comparison, Engagement-related items are generally positioned lower in terms of classification importance, with E5 being the only exception.

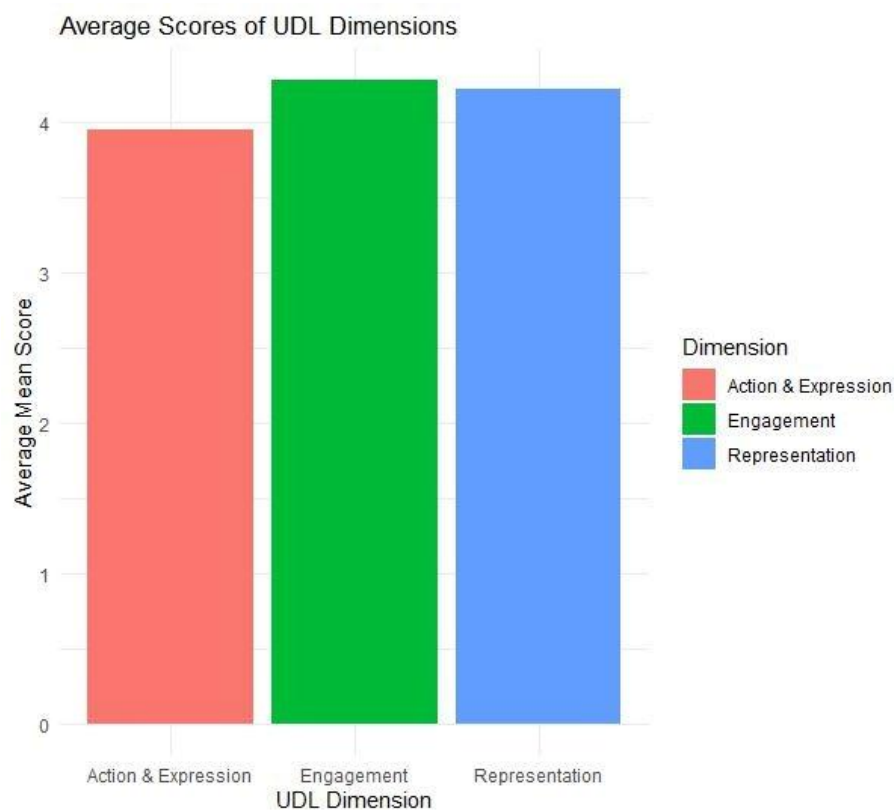


Figure 35 Comparison of Average Scores Across UDL Dimensions

Figure 35 shows the average scores for the three UDL dimensions based on the sample size ($N = 67$). The findings demonstrate a high level of implementation across all three domains, with scores consistently clustering near the upper limit of the scale. Engagement reported the highest average implementation score ($M = 4.28$), followed closely by Representation ($M = 4.22$). The Action and Expression dimension exhibited the lowest average score ($M = 3.96$). Although all three dimensions demonstrate strong pedagogical integration of UDL, a notable disparity exists between the input-oriented domains (Engagement and Representation) and the output-oriented domain (Action and Expression).

4.2 Qualitative Findings (Classroom Observation and Interview Insights)

Qualitative data from classroom observations and semi-structured interviews provide a deeper understanding of how instructional practices are shaped by learner variability and institutional context at AUW. The findings are organized into key themes and interpreted through the lens of the Universal Design for Learning (UDL) framework.

4.2.1 Theme - 1: Learner Variability as a Fundamental Consideration for Instruction

Across interviews, faculty members consistently emphasized that learner variability at AUW is not limited to differences in nationality but is strongly shaped by students' socio-economic, educational, and linguistic backgrounds. Students often come from conflict-affected regions, as well as from historically marginalized and poverty-stricken communities.

This form of variability differs from diversity typically observed in higher education settings in Western countries. It includes limited prior academic preparation, disrupted educational trajectories, and low proficiency in the language of instruction. As a result, instructional design at AUW is not simply about accommodating different learning preferences but involves addressing fundamental gaps in prior academic readiness.

From a UDL perspective, this suggests that faculty members are required to engage deeply with multiple means of representation, particularly in simplifying complex ideas, clarifying language, and making content comprehensible to students with varied levels of preparedness.

4.2.2 Theme - 2: Pre-UG Context: Constraints on Representation and Engagement

Classroom observations at the Pre-UG level revealed a learning environment shaped by both resource limitations and student readiness challenges. Instruction was often delivered using limited tools, primarily whiteboards, markers, and printed materials. In some cases, technological tools such as projectors were either unavailable or of low functional quality.

Students at this level were generally less confident and less likely to participate actively in classroom discussions. Faculty members frequently needed to prompt individual students to respond. A more teacher-centered instructional approach was observed in Pre-UG compared to other academic levels.

Interpreted through UDL, these findings indicate that the implementation of multiple means of engagement is constrained not only by instructional choices but also by student readiness and classroom context. Similarly, limited access to technological tools restricts the use of varied representation strategies, making it more difficult to present information in multiple formats.

At the same time, interview data suggest that faculty members compensate for these limitations by investing additional effort outside the classroom, including extended office hours and individualized support. This reflects an attempt to address learner variability beyond observable classroom practices.

4.2.3 Theme - 3: Undergraduate Context: Interaction-Driven Engagement

At the undergraduate level, a shift in classroom dynamics was observed. Students were more confident, participatory, and responsive, particularly in higher-level courses such as UG3. Faculty members appeared to adapt their instructional strategies in response to this increased student engagement.

Classroom observations showed frequent use of discussion, questioning, and contextual examples. Faculty members often connected course content to students' cultural backgrounds and lived experiences, making learning more relevant and inclusive.

From a UDL perspective, this indicates stronger implementation of multiple means of engagement, supported by student willingness to participate. Multiple means of representation were also observed, although slightly less prominently. However, practices related to action and expression were less visible within classroom sessions, suggesting that these may be embedded more in assessment design rather than in real-time instruction.

4.2.4 Theme - 4: Undergraduate Context (UG1, UG2, and UG3): Interaction-Driven Engagement

At the undergraduate level, a shift in classroom dynamics was observed. Students were more confident, participatory, and responsive, with these characteristics gradually increasing from UG1 to UG3. The highest level of participation and engagement was observed in UG3 classes. Faculty members appeared to adapt their instructional strategies in response to this increased student engagement.

Classroom observations showed frequent use of discussion, questioning, and contextual examples. Faculty members often connected course content to students' cultural backgrounds and lived experiences, making learning more relevant and inclusive.

From a UDL perspective, this indicates stronger implementation of multiple means of engagement, supported by students' willingness to participate. Multiple means of representation were also observed, although slightly less prominently. However, practices related to action and expression were less visible within classroom sessions. This may suggest that this principle is more embedded in assessment design rather than in real-time instruction.

4.2.5 Theme - 5: Graduate Context: High Representation and Discursive Engagement

In the Master of Arts in Education program, instructional practices reflected a different form of learner variability. Students came from diverse disciplinary backgrounds and varied age groups. These two factors create a learning environment shaped by differences in prior knowledge and professional experience.

Classroom sessions were highly discussion-based, with consistent student participation. Faculty members made extensive use of diverse materials, including videos, documentaries, visuals, and textual resources. This indicates strong implementation of multiple means of representation, alongside high levels of engagement.

However, similar to the undergraduate level, multiple means of action and expression were less frequently observed during classroom sessions. The researcher's personal experience with the program provides an important clarification here: faculty members offer diverse assessment formats, including presentations, prototypes, book chapters, assignments, homework, projects, video making, podcasts, hands-on classroom activities, written work, drama, and more. This indicates that while action and expression may not always be visible in classroom interaction, they are embedded in broader instructional design.

4.2.6 Theme - 6: Faculty Adaptation as a Core Mechanism of Inclusion

Across all academic levels, faculty members demonstrated continuous adaptation in response to the learner variability present in their courses. This included simplifying language, using multiple examples, and connecting course content to students' cultural backgrounds and lived experiences. In several cases, faculty members noted that their teaching practices at AUW differ from those they used in other institutions. This suggests that inclusive teaching at AUW is not fixed but evolves through ongoing interaction with student needs.

From a UDL perspective, these practices reflect a flexible application of UDL principles, where instructors adjust their approaches to representation, engagement, and expression based on the specific classroom context.

4.2.7 Theme - 7: Institutional Constraints and Structural Limitations

Class observation and interview findings highlight several institutional constraints that affect instructional practices at AUW. These include limitations in classroom infrastructure, technical disruptions such as power outages, and the logistical challenges of operating across multiple campuses. Faculty members also noted pressures related to student evaluation systems and the need to balance academic expectations with varying levels of student preparedness. Together, these factors shape the conditions under which instructional practices are implemented.

Classroom facilities at AUW vary across campuses and are generally not as technologically equipped as those found in many higher education institutions in more developed contexts. A few exceptions exist in classrooms used for certain master's programs, which are comparatively more advanced in terms of technology and infrastructure. A small

number of undergraduate classrooms are also equipped with smart boards; however, such resources are not widely available.

Most of the lower-resourced classrooms are located at the M. M. Ali campus, particularly those used for Pathways (Pre-UG) programs. Compared to classrooms at the Mahsa Amini and KEPZ campuses, these classrooms are relatively less developed in terms of infrastructure and the quality of technological tools. In many cases, projectors are outdated, which limits the effective use of visual teaching materials.

Inclusive instructional practices are supported by learning environments that provide up-to-date technological resources, adaptable classroom layouts, and adequate space for interaction between instructors and students. These conditions enable instructors to move within the classroom, observe student engagement more closely, and provide targeted support during instruction. In the context of AUW, although faculty members are highly qualified and make consistent efforts to adopt inclusive approaches, limitations in classroom infrastructure and technology in a majority of classrooms restrict the extent to which these practices can be effectively implemented.

4.2.8 Theme - 8: Gap Between Observed and Unobserved UDL Implementation

An important insight emerging from the data is the gap between what is observable in classroom sessions and what exists within broader instructional design. While engagement and representation were frequently observed, action and expression were less visible.

However, interview data indicate that faculty members do incorporate multiple means of action and expression, particularly through assessment design. Beyond exams and paper writing, assessments include projects, problem-based tasks, case study analysis, poster presentations, debates, and similar activities. This suggests that classroom observation alone provides only a partial view of UDL implementation.

5 Discussion

5.1 Overview of Findings

This section addresses the three research questions of the study by drawing on both quantitative and qualitative findings generated through a convergent mixed-method approach. Rather than presenting the two strands separately, the findings are integrated to provide a comprehensive understanding of how Universal Design for Learning (UDL) principles are reflected in faculty instructional practices at AUW. Each research question is examined individually, with evidence drawn from survey results, classroom observations, and faculty interviews. This is followed by a discussion of the study's limitations and directions for future research, before presenting the final conclusions.

5.1.1 RQ1: To what extent do faculty instructional practices at AUW reflect the principles of Universal Design for Learning (UDL)?

The findings indicate that faculty instructional practices at AUW demonstrate a consistently high level of alignment with Universal Design for Learning (UDL) principles. Quantitative results reveal that most participants are categorized as “High” or “Very High” in implementation, with none classified as “Low.” This pattern suggests that inclusive instructional practices are not peripheral but are already embedded within the institution's teaching approaches.

At the domain level, a clear hierarchy is evident. Multiple Means of Engagement is the most strongly implemented dimension, followed closely by Representation, whereas Action and Expression demonstrates comparatively lower levels of implementation. Although the difference between Engagement and Representation is relatively minor, the persistent gap between these domains and Action and Expression indicates that UDL implementation is not evenly distributed across all principles.

Qualitative findings reinforce this pattern. Classroom observations consistently revealed faculty practices aligned with engagement, including questioning, interaction, and connecting content to student experiences. Representation was also widely evident through explanations, visual aids, and varied instructional approaches. However, opportunities for Action and Expression were less apparent during classroom sessions, suggesting that while students are supported in accessing and engaging with content, they are less frequently provided with flexible means to demonstrate learning in real time.

Simultaneously, qualitative evidence suggests that elements of Action and Expression may be embedded within assessment design rather than classroom delivery. At the master's level, students were provided with multiple formats for demonstrating learning, including presentations, written assignments, and creative outputs. This finding indicates that lower quantitative scores for this domain do not necessarily reflect absence, but rather a difference in the context and manner of implementation.

Overall, the findings demonstrate that Universal Design for Learning (UDL) principles are widely present in faculty practices at AUW, although their implementation remains uneven across domains. Engagement and Representation are more consistently integrated into everyday teaching, whereas Action and Expression requires more structural and intentional design.

5.1.2 RQ2: How do learner variability and institutional context shape faculty approaches to inclusive instructional practices at AUW?

The study finds that faculty approaches to inclusive instructional practices are strongly shaped by both learner variability and institutional context. Implementation patterns are not uniform but vary significantly depending on classroom conditions, student backgrounds, and available resources.

Qualitative findings underscore the significant learner variability at AUW. Faculty report that students possess highly diverse linguistic, educational, and socio-economic backgrounds, with varying levels of academic preparation. Instructors respond by continuously adapting their teaching, including simplifying language, revisiting foundational concepts, and offering additional academic support. In this context, teaching is characterized as an ongoing process of adjustment rather than a fixed instructional strategy. These adaptations represent a pragmatic response to variability, with inclusion driven by immediate classroom needs rather than strict adherence to a formal framework.

Variability is further demonstrated across academic levels. At the Pre-Undergraduate level, instruction is more structured and teacher-led, with limited technology use and lower student participation. Faculty employ repetition, simplified explanations, and direct instruction to support learners. At the undergraduate level, classrooms are more interactive, featuring increased student engagement and the integration of culturally relevant examples. At the master's level, teaching is characterized by greater flexibility and resource availability, incorporating diverse materials, discussion-based formats, and varied assessment practices.

Institutional context is equally influential. Resource constraints, including limited classroom technology, unreliable infrastructure, and logistical challenges across campuses, directly affect the instructional strategies that faculty can implement. Instructors in less-equipped environments encounter barriers to applying certain Universal Design for Learning (UDL) strategies, especially those that require technological support or flexible assessment structures. Additionally, time constraints, workload pressures, and institutional expectations further shape instructional decisions, often limiting the full realization of inclusive practices.

Quantitative findings corroborate these observations by demonstrating variability in implementation patterns among faculty members. Clustering and principal component

analyses identify distinct groups of instructors based on their Universal Design for Learning (UDL) practices, indicating the absence of a single, uniform approach. Feature importance and regression analyses further reveal that certain practices contribute more substantially to overall implementation, even if they are not universally adopted.

Collectively, these findings indicate that Universal Design for Learning (UDL) implementation at AUW is highly context-dependent. Faculty practices are shaped by the realities of diverse classrooms and institutional conditions, resulting in adaptive yet uneven approaches to inclusion. In this context, UDL functions less as a standardized framework and more as a responsive process shaped by both learner needs and structural constraints.

5.1.3 RQ3: What implications do the findings suggest for the future implementation of UDL-informed instructional practices in multicultural higher education environments?

The findings of this study suggest several important implications for the future implementation of UDL-informed instructional practices, particularly in multicultural and resource-constrained higher education contexts.

First, the consistently high levels of overall UDL implementation indicate that faculty members are already employing inclusive teaching practices, even when these are not explicitly identified as UDL. Therefore, future initiatives should prioritize strengthening and formalizing existing practices rather than introducing UDL as an entirely new concept. The primary challenge is to support faculty in responding to learner needs more systematically and intentionally.

Second, the observed imbalance across UDL domains underscores the need for targeted professional development. While Engagement and Representation are well integrated into current teaching practices, Action and Expression is implemented less consistently.

Professional development should therefore focus on flexible assessment design and alternative methods for students to demonstrate learning. Addressing this domain is essential for achieving comprehensive UDL implementation.

Third, the findings highlight that UDL implementation is closely linked to institutional context. Resource constraints, infrastructure limitations, and workload pressures significantly affect the feasibility of inclusive practices. Consequently, institutional support is essential. This support should include enhanced access to teaching resources, allocation of time and flexibility for instructional design, and recognition of the additional effort required to implement inclusive practices effectively.

Fourth, the variability among faculty members indicates that a uniform approach to UDL training is unlikely to be effective. Differentiated support should be provided, taking into account variations in teaching context, experience, and resource availability. Faculty in resource-constrained environments may require distinct forms of support compared to those in resource-rich settings.

Finally, the study underscores the importance of conceptualizing UDL as an integrated system rather than a collection of isolated strategies. Engagement may initiate inclusive practices, while representation and expression serve to deepen and sustain them. Future implementation efforts should emphasize the interconnectedness of UDL principles and encourage faculty to design instruction that balances all three domains.

In summary, advancing UDL implementation in multicultural higher education environments requires transitioning from intuitive, fragmented practices to more structured, context-sensitive, and institutionally supported approaches. This process involves enhancing faculty awareness and skills as well as addressing the broader institutional conditions that shape teaching and learning.

5.2 Contribution to Literature

This study contributes to the existing body of UDL research in several important ways. To begin with, it provides empirical evidence from a context that is still underrepresented in the literature. Much of the current work on UDL has been carried out in Western higher education settings, with limited attention to low- and middle-income countries. As noted by McKenzie et al. (2021), there is a need for research that reflects how UDL is practiced in environments shaped by resource limitations and diverse student backgrounds. By focusing on such a setting, this study adds to a growing but still limited body of work that examines inclusive teaching beyond well-resourced contexts.

A more important contribution of this study relates to how UDL is examined methodologically. A recurring issue in the literature is that UDL implementation and its outcomes are difficult to measure in a clear and consistent way. Many studies rely on descriptive accounts, self-reported perceptions, or small-scale qualitative observations. In some cases, conclusions are based on anecdotal evidence. While these approaches are useful, they do not always provide a clear picture of how UDL is implemented or how much difference it makes in practice. As pointed out in previous reviews, there is limited discussion of how UDL can be studied using more structured analytical approaches (Schreffler et al., 2019).

This study takes a step in that direction by treating UDL not only as a framework, but also as something that can be examined through measurable patterns. The UDL principles were translated into specific variables, and their relationships were explored using multiple analytical methods. These included reliability testing, correlation analysis, clustering, and regression. This approach makes it possible to look at how different aspects of UDL are connected, rather than simply noting their presence. It also allows for a clearer understanding of which practices contribute more strongly to overall implementation. In this sense, the

study offers a practical way of examining UDL that goes beyond description and moves toward a more structured form of analysis.

The findings also contribute to existing discussions about uneven implementation. Earlier research has suggested that UDL is often applied in parts rather than as a complete framework (Dell'Anna et al., 2024). The results of this study show this pattern clearly. Engagement and Representation appear more frequently in practice, while Action and Expression is less consistently applied. This difference is not only visible in the data but also supported by classroom observations and faculty perspectives. By showing how this imbalance appears in measurable terms, the study adds clarity to an issue that has often been discussed but not always demonstrated in detail.

Finally, the study adds to our understanding of how faculty interpret and apply UDL in real teaching contexts. Previous research has shown that instructors often use inclusive strategies without explicitly identifying them as UDL (Kirsch & Luo, 2023). The findings here support that view. Faculty members appear to respond to student needs and adapt their teaching accordingly, but this does not always follow a structured or intentional framework. This suggests that UDL, in practice, develops through experience and context, rather than through formal design alone.

By bringing together quantitative patterns and qualitative insights, this study helps connect theoretical discussions of UDL with what is actually happening in classrooms.

5.3 Implications of the Study

The findings of this study have several implications for UDL implementation in higher education, particularly in institutions where learner diversity is not an exception but part of the everyday teaching context. The results show that faculty members are already using many inclusive practices, especially those related to engagement and representation.

However, the lower level of Action and Expression suggests that UDL implementation remains uneven. This indicates that institutions should not assume that general inclusive awareness is sufficient. Faculty may be able to engage students and explain content in multiple ways, but offering flexible ways for students to demonstrate learning requires deeper course redesign, assessment planning, and sustained institutional support.

One important implication is that UDL should be treated as a structured pedagogical framework rather than a loose collection of “good teaching” strategies. The qualitative findings show that faculty members respond thoughtfully to student needs, particularly when students face challenges related to language, prior academic preparation, or confidence. However, these practices often appear to emerge from individual teaching experience rather than systematic design. This aligns with broader concerns in literature that inclusive practices may exist in classrooms without being explicitly grounded in UDL principles. As highlighted in the UDL literature, effective implementation requires intentional planning of goals, methods, materials, and assessments, rather than reactive adaptation. Therefore, AUW and similar institutions would benefit from faculty development initiatives that help instructors conceptualize, organize, and extend practices they may already be using intuitively.

A second implication concerns the nature of faculty training. The findings suggest that faculty are not resistant to inclusive teaching; rather, they require structured support to transition from intuitive adaptation to intentional instructional design. Research consistently shows that UDL training improves teaching practice, but the book further emphasizes that transformation in higher education requires more than isolated interventions. It involves sustained engagement, collaboration, and shifts in teaching culture. Therefore, faculty development should move beyond one-time workshops toward ongoing professional learning environments that include peer exchange, practical course redesign, and discipline-specific application.

The study also has important implications for institutional planning. UDL cannot be implemented solely at the level of individual faculty effort. Classroom observations revealed that infrastructure plays a critical role in shaping what is pedagogically possible. In Pre-UG classrooms, limited technological resources and constrained physical environments reduced opportunities for varied representation and expression. This reflects a broader argument in UDL literature that learning environments themselves can become “disabling” when they are not designed to accommodate diverse learners. Therefore, institutional commitment to UDL must include investment in classroom design, access to instructional technologies, and alignment between pedagogical expectations and available resources.

Another key implication relates to the contextual adaptation of UDL in Global South settings. The findings reinforce that UDL cannot be implemented as a direct transfer of Western models. Instead, it must be adapted to local institutional realities, including resource limitations, linguistic diversity, and varied educational backgrounds. The book highlights that higher education systems worldwide are experiencing increased diversification of student populations, which demands flexible and inclusive frameworks rather than standardized approaches.

In the AUW context, where students come from multiple countries and educational systems, UDL must be interpreted as a flexible and context-sensitive approach. This includes the use of both high-tech and low-tech strategies, such as visual scaffolding, multilingual clarification, peer learning, and culturally responsive examples.

The findings also contribute to a broader understanding of learner variability. In this study, variability extended beyond disability to include language proficiency, confidence, prior schooling, and socio-cultural background. This aligns with the foundational principle of UDL that learner variability is the norm rather than the exception. In institutions like AUW,

where students' educational trajectories are shaped by migration, socio-economic challenges, and unequal access to schooling, UDL should be understood as part of a wider commitment to inclusive pedagogy and educational equity, rather than as a framework limited to disability support.

A further implication concerns the role of assessment in UDL implementation. Since Action and Expression was the least developed domain, institutions should prioritize supporting faculty in designing flexible assessment methods. Importantly, UDL does not imply lowering academic standards. Rather, it involves maintaining clear learning goals while providing multiple pathways for students to demonstrate their understanding. The literature emphasizes that assessment design is a critical component of inclusive learning environments, as rigid assessment formats can create barriers even when teaching methods are inclusive. For AUW, this suggests that future development efforts should focus on assessment innovation, ensuring that students can express learning in ways that reflect their strengths without compromising academic rigor.

Finally, the findings suggest that UDL implementation should be understood as a long-term institutional transformation rather than a short-term instructional adjustment.

The book highlights that meaningful change in higher education requires shifts in policy, culture, and practice, as well as collaboration among faculty, administrators, and support services. In this sense, UDL is not simply a teaching strategy but a framework for rethinking how learning environments are designed, how students engage with knowledge, and how institutions respond to diversity. For AUW, this implies that future progress will depend not only on individual faculty practices but also on coordinated institutional efforts that integrate pedagogy, infrastructure, and policy.

5.4 Limitations of the Study

This study has several limitations that should be considered when interpreting the findings. These limitations do not reduce the value of the study, but they help clarify the scope within which the results should be understood.

First, the findings are based entirely on data collected from faculty participants through surveys, classroom observations, and interviews. As a result, the study reflects instructional practices from the perspective of faculty members only. Student perspectives were not included, which means the findings do not capture how students experience or interpret UDL practices in the classroom. Including student voices could have provided a more balanced understanding of how inclusive teaching is received and how effective it is from the learner's point of view.

Second, the study is situated within a single institutional context, and that context is highly specific. AUW operates in a unique higher education environment characterized by international student diversity, varied educational backgrounds, and distinct institutional goals. Because of this, the findings are not directly generalizable to other universities in Bangladesh or to higher education institutions more broadly. However, while the results are context-specific, the methodological approach used in this study are transferable to other settings where researchers aim to examine UDL implementation in a structured way.

Another limitation relates to the uneven representation of academic programs within the dataset. The Master of Science in Apparel Science program had very limited participation, with only a small number of survey responses and no classroom observation or interview data. This means that the findings do not fully represent all programs within the institution, and caution should be taken when interpreting the results at the institutional level.

The scope of classroom observation also presents certain limitations. Although multiple sessions were observed for each faculty member, the number of observations ranged from three to five classes. A larger number of observations could have provided a more comprehensive view of instructional practices. In addition, it was not always possible to observe a complete learning cycle for each course. In some cases, observations took place in the middle or toward the end of a topic, rather than from the beginning to the conclusion. This limited the ability to consistently capture how all three UDL principles were applied across an entire instructional sequence.

The presence of the researcher in the classroom may also have influenced instructional practices. Since faculty members were aware of the purpose of the study before granting observation access, it is possible that they adjusted their teaching approaches during observed sessions. While this is a common challenge in classroom-based research, it introduces the possibility that observed practices may reflect, to some extent, a heightened awareness of inclusive teaching rather than routine instructional behavior.

Another limitation concerns the method of interview data collection. Due to the lack of permission for audio recording, interview data were collected through note-taking. Although efforts were made to document responses accurately, it is possible that some details, nuances, or exact phrasing were not fully captured during the process. This may have affected the depth of qualitative interpretation.

The use of self-reported survey data also introduces the possibility of response bias. Since participants evaluated their own instructional practices, there is a risk that some responses may reflect overestimation or socially desirable reporting rather than actual classroom behavior. While this limitation is partially addressed through the inclusion of

classroom observation and interviews, it remains a factor to consider when interpreting the quantitative results.

Finally, the overall number of participants, while sufficient for analysis, could have been higher. Participation was initially limited, and although adjustments were made to increase response rates, a larger and more balanced sample across programs would have strengthened the robustness of the findings.

These limitations should be understood in relation to the scope and design of the study rather than as weaknesses of the research itself. They reflect the practical constraints of conducting classroom-based and participant-driven research in a real institutional setting. At the same time, they help clarify the boundaries within which the findings can be interpreted and applied. Recognizing these limitations provides a clearer foundation for future studies to build on and extend the work presented here.

6 Conclusion

This study set out to examine how Universal Design for Learning (UDL) is understood and enacted within a higher education context characterized by significant learner variability. By focusing on the Asian University for Women (AUW) in Bangladesh, the research engaged with a setting where diversity is not peripheral but central to the teaching and learning experience. The findings demonstrate that UDL-aligned practices are already present across faculty teaching, though not always through formal or explicitly structured application of the framework.

Across the quantitative results, a consistently high level of UDL-related practice was observed, particularly in the domains of engagement and representation. These findings indicate that faculty are actively working to make learning accessible and meaningful through interaction, contextualization, and varied forms of content delivery. However, the comparatively lower presence of action and expression highlights a critical area for development. This imbalance suggests that while students are often supported in accessing and engaging with learning, they are not always afforded equally flexible opportunities to demonstrate their understanding. The qualitative findings provide important context for this pattern. Faculty frequently adapt instruction in response to linguistic diversity, uneven academic preparation, and socio-cultural differences, often drawing on experience and situational judgment rather than formal UDL training. At the same time, structural constraints such as resource limitations, assessment structures, and institutional expectations shape what is possible in practice.

Taken together, these findings point to a form of UDL implementation that is both meaningful and uneven. UDL is not absent; rather, it is present in partial, adaptive, and context-driven ways. Faculty are responding to learner variability with considerable effort and awareness, yet their practices are not always guided by a cohesive or system-level framework.

This reinforces the understanding that inclusive pedagogy does not emerge solely from theoretical frameworks, but from the interaction between teacher agency, institutional conditions, and student needs.

A central contribution of this study lies in its attempt to move beyond descriptive accounts of inclusive teaching toward a more structured examination of UDL implementation. By operationalizing UDL 3.0 considerations and integrating quantitative and qualitative analyses, the study offers a methodological approach that captures both measurable patterns and lived classroom realities. In doing so, it addresses a recognized gap in the literature, where the implementation and impact of UDL are often difficult to define and assess in consistent terms. The study also extends empirical evidence from a Global South context, where institutional realities and learner profiles differ significantly from those in which UDL has been most extensively studied.

At a broader level, the findings underscore the need to approach UDL as a holistic and institutional endeavor rather than an individual teaching strategy. While faculty play a central role in shaping inclusive learning environments, their efforts are shaped by curriculum design, assessment structures, available resources, and institutional priorities. Strengthening UDL implementation therefore requires alignment across these dimensions, including sustained professional development, curriculum-level integration, and supportive infrastructure. Without such alignment, UDL is likely to remain uneven in its application, dependent on individual initiative rather than embedded practice.

In conclusion, this study affirms the relevance of UDL as a framework for addressing learner variability in higher education, while also highlighting the complexities of its implementation in real-world contexts. It shows that inclusive practices are already taking place, often in adaptive and context-sensitive ways, but that their potential can be further

realized through more intentional and coordinated approaches. By bringing together empirical analysis and contextual insight, the study contributes to a deeper understanding of how inclusive pedagogy can be both practiced and strengthened in diverse educational environments.

7 Recommendations

The findings of this study suggest that strengthening UDL implementation requires more than isolated interventions. A shift toward a more coordinated and system-level approach is needed, where instructional practice, curriculum design, institutional support, and infrastructure are aligned rather than treated separately.

A first priority is to move beyond one-time faculty training and toward sustained professional development. While training remains important, the findings show that many instructors are already making efforts to teach inclusively, often based on experience rather than formal preparation. What is needed is not only awareness, but structured opportunities to translate UDL principles into course design, assessment planning, and day-to-day teaching decisions. Previous work in higher education has shown that UDL becomes more effective when faculty are supported through ongoing engagement, peer collaboration, and access to concrete teaching examples (Dell’Anna et al., 2024; Moriña et al., 2025). This suggests that institutions should consider longer-term models of professional development, where faculty can redesign courses, reflect on their practices, and adapt strategies over time rather than relying on short workshops.

At the same time, faculty development alone is not sufficient. The study highlights that many aspects of UDL, particularly those related to Action and Expression, depend on structural conditions that go beyond individual teaching practice. This points to the need for a more integrated approach to curriculum and assessment design. Institutions should consider embedding UDL principles into course outlines, assessment frameworks, and program-level expectations, so that flexibility in learning and expression is not left to individual discretion. Bracken and Novak (2019) emphasize that UDL is most effective when it is built into the design of courses from the outset, rather than added as an adjustment later. In this sense, curriculum planning and UDL implementation should be treated as part of the same process.

Another important area concerns infrastructure and classroom conditions. The observations from this study show that limitations in classroom technology and physical resources can restrict the range of instructional practices available to faculty. While UDL does not depend entirely on advanced technology, access to basic and reliable tools plays a significant role in supporting multiple forms of representation and engagement.

This aligns with broader discussions in global higher education, where institutional capacity is closely tied to the quality of inclusive teaching environments (Sanger & Gleason, 2020). Institutions should therefore consider how classroom design, technological support, and learning spaces can be improved in ways that make UDL practices more feasible and sustainable.

Building on this, institutions may also need to move toward a more coordinated institutional strategy for inclusion, rather than leaving UDL implementation at the level of individual instructors. Comparative discussions in higher education contexts show that when inclusion is treated as an institutional priority, it is more likely to be reflected in policies, teaching expectations, and support systems (Sanger & Gleason, 2020). This could include aligning UDL principles with institutional teaching standards, integrating them into program review processes, and creating shared guidelines that support consistent practice across departments. Without such alignment, implementation is likely to remain uneven and dependent on individual initiative.

Another area that deserves attention is the role of instructional design and support structures. In many higher education systems, effective UDL implementation is supported not only by faculty, but also by instructional designers and teaching support units. These roles help translate pedagogical principles into practical course materials and learning experiences. As suggested in the literature, collaboration between faculty and instructional support teams

can strengthen the quality and consistency of UDL integration (Fornauf & Erickson, 2020; Hills et al., 2022). For institutions like AUW, developing or strengthening such support structures could help bridge the gap between understanding UDL and applying it effectively in course design.

The findings also suggest the need to adapt UDL approaches to local contexts rather than applying them as fixed models. In settings characterized by linguistic diversity, uneven academic preparation, and varied socio-economic backgrounds, UDL must respond to the realities of the student population. McKenzie et al. (2021) argue that in low- and middle-income contexts, inclusive teaching strategies need to balance ideal frameworks with practical constraints. For institutions like AUW, this means developing approaches that combine both low-resource and high-resource strategies, such as the use of structured handouts, culturally relevant examples, and flexible participation methods alongside digital tools where available.

Finally, future research should continue to build on the methodological direction taken in this study. There is a need for more work that examines UDL implementation using structured and transparent analytical approaches, particularly in higher education settings outside Western contexts. Future studies may explore how UDL practices evolve over time, how students experience inclusive teaching, and how different institutional models influence implementation. Expanding the scope of participants and including more balanced representation across programs would also help strengthen the evidence base.

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Appendix A

Designing for Every Learner: A Faculty Survey on Universal Design for Learning (UDL) Practices at AUW

Luthfun Nesa Sonam

Master of Arts in Education

Asian University for Women

Dear Respected Faculty Members,

As part of my Master's thesis, I am exploring the extent to which the **Universal Design for Learning (UDL) framework** is practiced as an instructional approach by faculty members across different disciplines at the Asian University for Women (AUW). Developed by Center for Applied Special Technology (CAST), UDL is an educational framework that aims to make learning accessible and inclusive for all students, regardless of their backgrounds, abilities, or learning preferences. Given AUW's limited financial, technological, and infrastructural resources, this study seeks to understand how faculty members creatively implement inclusive teaching practices within these constraints. Your participation will provide valuable insights into how AUW can further support diverse learners and strengthen inclusive teaching practices.

Participation in this survey is completely voluntary, and you may withdraw at any time. However, you are highly encouraged to complete the survey to support the successful completion of this study. All personal information will remain strictly confidential and will not be disclosed to anyone. The data collected will be used solely for academic research purposes.

I sincerely appreciate your time and willingness to share your thoughtful responses. Your contribution is invaluable to this research.

Section 1: Participant Information

Instruction: Please tick (✓) the option that best describes you. If applicable, select only one option unless otherwise stated.

Email (optional) _____

1. Gender ☐ Male ☐ Female ☐ Other

2. Age ☐ 20–29 years ☐ 30–39 years ☐ 40–49 years ☐ 50 years and above

3. Country _____

4. Nationality _____

5. Current Academic Position (e.g., Fellow, Instructor, Professor, Adjunct Faculty)

6. Level You Are Currently Teaching at AUW (You may select more than one option)

☐ Pre-UG/Pathway ☐ UG1 ☐ UG2 ☐ UG3 ☐ MA ☐ MS

☐ Other _____

7. Which AUW campus do you teach at? (You may select more than one option)

☐ M. M. Ali Campus ☐ Mahsa Amini Campus ☐ KEPZ Campus

8. Years of Teaching Experience

☐ 0–5 years ☐ 6–10 years ☐ 11–15 years ☐ 16–20 years ☐ 20 years above

9. Highest Academic Qualification

☐ Bachelor's Degree ☐ Master's Degree ☐ MPhil ☐ PhD ☐ Postdoc

☐ Other _____

10. Discipline or Major You Teach

- ☐ Applied Mathematics and Data Science (AMDS)
- ☐ Biological Sciences
- ☐ Computer Science
- ☐ Development Studies
- ☐ Economics
- ☐ Environmental Sciences
- ☐ Finance
- ☐ Humanities (History, Philosophy, or Literary Studies)
- ☐ MA in Education
- ☐ MS in Apparel and Fashion Business Management
- ☐ Philosophy, Politics & Economics (PPE)
- ☐ Public Health
- ☐ Other _____

11. Typical Class Size You Usually Teach

- ☐ 10–15 students ☐ 16–20 students ☐ 21–25 students ☐ 26–30 students ☐ More than 30 students

12. Course Delivery Mode You Primarily Use

- ☐ Face-to-face (In-person)
- ☐ Online (Fully online)
- ☐ Hybrid (Blend of in-person and online)

Section 2: Design Multiple Means of Engagement

This section focuses on **how you engage learners** in your teaching. In the UDL framework, Multiple Means of Engagement refers to the ways educators motivate learners, sustain their interest, provide challenges, and support persistence in learning. This includes how you offer choices, encourage collaboration, foster a sense of belonging, and help learners develop motivation and self-regulation skills.

Please tick (✓) the option that best reflects your level of agreement with the following statements.

1. I collaborate with learners in co-designing instructional goals, activities, and tasks in order to provide greater learner choice and autonomy.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

2. I design learning activities that are relevant, authentic, and meaningful to learners' academic goals, cultures, and communities.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

3. I create learning environments that spark joy by incorporating opportunities for exploration, experimentation, discovery, and storytelling.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

4. I actively address potential biases, threats, and distractions in the learning environment, whether overt or subtle.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

5. I make sure learners clearly understand the learning goals and explain why these goals are important and relevant to their lives or future aspirations.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

6. I set high expectations for all learners while providing appropriate support so they can achieve challenging learning goals.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

7. I foster collaboration and collective learning by encouraging students to share and learn from one another's diverse ideas, perspectives, and lived experiences.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

8. I design learning environments where students feel a strong sense of belonging and community, with particular attention to learners who have been historically excluded or marginalized.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

9. I offer action-oriented feedback that is relevant, constructive, accessible, and timely to support learners' continuous improvement.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

10. I support learners in setting learning goals that are clearly defined, time bound, and achievable based on their current progress.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

11. I design classroom activities that allow learners to develop awareness of themselves and others.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

12. I design instructional strategies to promote individual and collective reflection on learning progress among my students.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

13. I use empathy and community-building approaches to restore harmony in the classroom.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

Section 3: Multiple Means of Representation

This section explores **how you present information and content** to learners. Multiple Means of Representation in UDL refers to the variety of ways educators share knowledge, ideas, and concepts, ensuring that all learners can perceive, comprehend, and engage with the material. This includes using visual aids, audio, text, interactive media, and other flexible strategies to make learning accessible and meaningful.

Please tick (✓) the option that best reflects your level of agreement with the following statements.

14. I customize the display of information (e.g., font, size, spacing, character width, background and text color, volume, speed, timing, subtitles etc.) to meet the diverse needs of learners.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

15. I design lessons that incorporate multiple formats (*e.g., Images, graphics, animations, videos, music, sound, text etc.*) to make learning easier for everyone.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

16. I incorporate and represent diverse perspectives, identities, and cultures in authentic ways in my instructional materials, classroom examples, and class discussions.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

17. I always clarify vocabulary, symbols, and language structures used in learning materials.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

18. I assist learners in decoding text, mathematical notation, and symbols used in learning materials.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

19. I cultivate understanding and respect across languages and dialects among my students.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

20. I address biases in the use of language and symbols in my teaching practices.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

21. Instead of solely relying on text format, I illustrate information through multiple modes (*e.g., diagrams, tables, models, comic strips, storyboards, photographs, VR, physical or virtual manipulatives etc.*).

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

22. I connect students' prior knowledge to new learning.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

23. I highlight and explore patterns, critical features, big ideas, and relationships while teaching.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

24. I cultivate multiple ways of knowing and making meaning of information.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

25. I help learners maximize their ability to generalize and transfer learning to new contexts.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

Section 4: Multiple Means of Action and Expression

This section explores **the different ways students can demonstrate their learning** in your courses. *Multiple Means of Action and Expression* in UDL focuses on providing learners with different ways to interact with content, complete tasks, and express their knowledge. This includes offering flexible learning tools, alternative methods for assignments, and options for communication.

Please tick (✓) the option that best reflects your level of agreement with the following statements.

26. I respectfully provide learners with flexible options to respond, navigate, and physically interact with learning materials and the classroom environment.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

27. I provide learners with accessible learning materials, assistive technologies and support them in using these tools effectively.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

28. I allow learners to demonstrate their knowledge using multiple media, such as report writing, case studies, oral presentations, videos, dramas, debates, posters, prototypes, podcasts, animations, infographics, etc.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

29. I provide learners with multiple subject-related tools for construction, composition, and creativity.

(e.g., spell checkers, grammar checkers, word-prediction software, sentence starters or strips, writing software, calculators, graphing calculators, geometric sketchpads, pre-formatted graph paper, virtual or concrete mathematics manipulatives, computer-aided design tools, web applications, etc.).

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

30. I provide learners with step-by-step supports that are gradually reduced to help them become fluent and independent in their learning.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

31. I address biases that devalue some forms of knowledge expression and communication (e.g., drama, debate, podcast, video forms) while prioritizing others (e.g., text-based, project design, oral presentation forms).

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

32. I support learners in setting personal learning goals that are challenging, motivating, and SMART (Specific, Measurable, Achievable, Relevant, and Time-bound).

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

33. I give learners time and space to anticipate challenges when they work toward their learning goals and to plan strategies for overcoming them.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

34. I provide learners with tools (*e.g., graphic organizers, checklists, guides, prompts, note-taking strategies etc.*) to help them organize information and learning resources while reducing their working memory load.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

35. I ensure my feedback is timely, clear, and connected to learning goals so students can monitor their own progress and improve their academic performance.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

36. I create space for learners from marginalized communities to share their voices and experiences in order to identify and challenge exclusionary practices in my teaching environment.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

Section 5: Invitation for Interview and Classroom Observation

Thank you for completing this survey!

For the next phase of data collection, I would like to invite interested faculty members to participate in a brief follow-up interview and allow me to observe one of their classes.

Participation in either is completely voluntary, and you may choose the option that best suits your preference and availability.

Would you be interested in participating in a short follow-up interview for this study?

- Yes, I prefer an in-person interview
- Yes, I prefer an online interview (via Zoom or Google Meet)
- Yes, I prefer to respond to interview questions through another Google Form
- No, I am not interested in participating in the interview

If you're comfortable with a classroom observation, please provide your class schedule (date, time, room number, and campus).

Email (please skip if you have already provided)

Please feel free to leave any comments, insights, or recommendations here.

Appendix B

Interview Guideline

Study Context

Institution: Asian University for Women

Participants: Faculty members

Method: One-on-one semi-structured interview

Estimated duration: 40 minutes

Introductory Script

Thank you for agreeing to participate in this interview. As part of my Master's thesis, I am examining instructional practices at Asian University for Women through the lens of Universal Design for Learning (UDL). The purpose of this interview is to better understand how faculty address learner variability and create inclusive learning environments given limited institutional resources. This interview builds on the survey and classroom observations and will help provide deeper insights into instructional decision-making/design processes. Your participation is voluntary, and your responses will remain confidential. With your permission, I would like to take notes of this interview to ensure data accuracy.

Section 1: Teaching Context and Learner Variability

1. Can you briefly describe the courses you currently teach at AUW?
2. What forms of diversity do you commonly observe among students in your classes?
3. In what ways do these differences influence your teaching approaches?

Section 2: Instructional Practices and Assessment

4. What forms of assessment or assignments do you typically use?

5. Do you provide students with different ways to demonstrate their learning? Could you give some examples?

Section 3: Reflection on Classroom Practices

6. How do you usually decide which teaching strategies to use in a given class?
7. Do you find yourself adapting your teaching during class based on student responses?
If so, how?
8. Which teaching approaches do students tend to respond to most positively?
9. Are there strategies you would like to use more often but find difficult to implement?

Section 4: Awareness of Inclusive Teaching and UDL

10. Before participating in this study, how familiar were you with the concept of Universal Design for Learning (UDL)?
11. Are there aspects of UDL or inclusive teaching that you find particularly practical or relevant in your teaching context?
12. Which aspects of inclusive teaching do you find most challenging?
13. After participating in this study, have your perspectives on teaching diverse learners changed in any way?

Section 5: Institutional Context and Constraints

14. How do institutional factors influence your teaching practices?
15. What challenges do you face when trying to address diverse learning needs?
16. How do you adapt your teaching when resources are limited?
17. What kinds of institutional support would help you better address learner variability?

Section 6: Future Directions and Recommendations

18. What recommendations would you suggest for improving inclusive instructional practices at AUW?

Closing Question

19. Is there anything else you would like to share about your teaching experiences or perspectives on inclusive education?