Breaking Barriers to Pre-Service Teacher's Engagement through Universal Design for Learning

Aminu Aliyu, Yahaya Muhammad

Adamu Augie College of Education, Argungu

DOI: https://doi.org/10.51584/IJRIAS.2024.912014

Received: 26 November 2024; Accepted: 05 December 2024; Published: 02 January 2025

ABSTRACT

Objectives: This study aims to investigate the efficacy of Universal Design for Learning (UDL) interventions in enhancing engagement among pre-service teachers. Traditional instructional methods often neglect learner diversity, resulting in low engagement and academic achievement. UDL offers a proactive framework that incorporates Multiple Means of Engagement, Representation, and Expression to create inclusive learning opportunities for all students. **Methods:** A quasi-experimental research design was employed, involving a sample of 244 pre-service teachers, randomly assigned into two groups: a UDL-based instruction group (n = 122) and a traditional instruction group (n = 122). Participants' engagement levels were measured using a validated UDL-based Engagement Scale. **Results:** The analysis revealed a significant difference in engagement levels between the two groups ($p < .05$), with the Experimental group exhibiting higher mean engagement scores ($M = 70.48$, $SD = 9.59$) compared to the traditional instruction group ($M = 56.17$, $SD = 9.49$). **Conclusions:** These findings provide empirical evidence that UDL-based interventions significantly enhance engagement among pre-service teachers. By addressing the diverse needs of learners, UDL frameworks can break down barriers to engagement, suggesting that their implementation in teacher education programs may lead to improved academic outcomes and better preparedness for future educators in diverse classroom settings.

Keywords: Universal Design for Learning (UDL), Teacher Education, Pre-Service Teachers, Engagement.

BACKGROUND

For decades, Nigeria's educational system has faced persistent challenges, including inadequate funding and resources, outdated teaching methods and curriculum, infrastructure and material shortages, limited practical training opportunities, and inequitable education access, ultimately compromising the system`s ability to prepare students for future success (Angwaomaodoko, 2023; Omede, 2016). These challenges are further compounded by over-reliance on traditional instructional methods, which has resulted in limited learning experiences (Abosede et al., 2022; Bakare, 2021; Bature, 2020; Faruk Umar, 2022; FME, 2014, 2022; Okoro & Hedima, 2022). Studies have demonstrated that the traditional one-size-fits-all approach to education is no longer sufficient to meet the needs of diverse learners in higher education, where the student body comprises individuals with varying learning styles, abilities, and preferences (Seán Bracken, 2019). Thus, the need for innovative and effective teaching models that can address these challenges.

In response to the above, several studies highlighted the need for a transformation of the Nigerian education system, advocating for dynamism, greater adaptability, and responsiveness to today's learner needs, as well as alignment with global best practices (Adesope & Odekunle, 2022; Akindutire & Ekundayo, 2012; Barnes et al., 2019b; Okoroma & Okoroma, 2006; Uwaifo Oyelere, 2010; Yusuf, 2022b). With the increasing recognition of diversity among learners and the necessity for more engaging and innovative educational practices, the Universal Design for Learning (UDL) has emerged as a fundamental framework aimed at addressing the limitations of the traditional methods and promoting equitable learning opportunities for all students, regardless of their backgrounds or abilities (Meyer, Rose, & Gordon, 2014). UDL is grounded in three core principle of providing multiple means of engagement, representation, and action/expression. By embracing these principles, educators could transform their teaching approach, capable of mitigating barriers

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume IX Issue XII December 2024

associated with conventional methods, thereby accommodating individual differences, stimulating engagement, and improved learning outcomes (Evmenova1 et al., 2024; Basham, n.d.; Seán Bracken, 2019).

Studies reveals growing recognition of the need for more responsive frameworks such as UDL to address instructional barriers in conventional classrooms and effectively provide more engaging, and flexible learning experiences (Ajuwon, 2008; Nganji & Nggada, 2013; Omede, 2016; United Nations, 2020). However, there is lack of studies specifically focusing on the application of UDL in Nigerian classrooms. Example, Sholanke et al. (2018) assessed the compliance of various teaching methods employed at Covenant University (CU) in Ota, Ogun State, Nigeria, through the lens of UDL principles, aiming to identify possible areas for improving methods of curriculum contents delivery. The study demonstrated that many educational institutions across the globe are adopting the UDL framework as a roadmap to provide equitable and more inclusive and engaging learning opportunities for every student, in line with the best practices but its adoption in Nigerian educational contexts remains negligible. This underscores the need for validating its effectiveness in improving learning outcomes in Nigerian contexts. Hence, this study addresses the following research question:

(1) Is there a statistically significant difference in engagement levels between pre-service teachers exposed to the UDL-based intervention compared to those taught using the traditional lecture-based methods?

By investigating this question, this study endeavors to provide empirical evidence on the efficacy of integrating UDL in promoting engagement among diverse learners.

LITERATURE REVIEW

Universal Design for Learning (UDL)

The acronym UDL, standing for Universal Design for Learning, originated from the broader concept of Universal Design (UD), which originated in architecture and product design to create environments and products accessible to as many people as possible, regardless of their abilities. The Universal Design (UD) concept was proposed to develop accessible, navigable, flexible, findable, comfortable, valuable, and satisfying facilities for all users, including those with disabilities (Takacs et al., 2021). The concept was later applied to education, leading to the development of Universal Design for Learning (UDL) (Rose, 2001a).

In the 1990s, educators at the Center for Applied Special Technology (CAST) began to address the limitations of conventional educational approaches that often-excluded students with diverse learning styles, abilities, and backgrounds (Rao et al., 2022; Rao & Meo, 2016; Rose, 2001a). They recognized the need for a framework that would provide equal learning opportunities to all students, irrespective of abilities. This led to the formulation of UDL. As such, UDL can be easily defined as a proactive learning design framework for developing and delivering flexible and engaging educational experiences for diverse learners, both online and face-to-face.

UDL aims to reduce barriers to learning and promote engagement and achievement for all students, including those with disabilities and varying learning needs (Cast & Inc, 2023). Recent studies (Burgstahler, 2020; Almumen, 2020; Conor et al., 2020; Herrera Nieves et al., 2019; Takacs et al., 2021) have indicated that UDL accommodates variability and provides educators a comprehensive framework for designing accessible, inclusive, and engaging educational curricula for all students.

Learning barriers are factors that obstruct the learning process, leading to students' difficulties in comprehending lessons or acquiring skills. These obstacles can encompass substandard teaching quality, ineffective language use and communication, inadequate engagement in hands-on and interactive learning, along with deficient or non-existent learning infrastructure. Potential barriers to learning may be hidden in the choice of objectives, materials, assessment methods, teaching approaches, and curriculum design and delivery (Rao, 2021; Rao & Meo, 2016; Rose, 2001b).

Although, the UDL Guidelines "*are a living, dynamic tool that is continuously developed based on new research and feedback from practitioners*" CAST (2018), the existing UDL framework 2.0 is built upon three

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume IX Issue XII December 2024

core principles of offering multiple ways to engage learners, keeping them motivated and interested, presenting information in various formats to cater to different learning styles, and allowing learners to express their knowledge in multiple ways (CAST, 2018; Basham et al., 2020). The idea behind UDL is to eliminate barriers to learning, ensuring that every student has an equal opportunity to succeed (Boothe et al., 2018).

What sets UDL apart from traditional educational models is its emphasis on inclusivity and flexibility (Lyakurwa, 2018). Traditional methods often adopt a one-size-fits-all approach, which may not cater to students' varying needs and learning preferences (Rao, 2021; Rao & Meo, 2016; Rose, 2001b). UDL, on the other hand, is built on three core principles of offering multiple ways to engage learners, keeping them motivated and interested, presenting information in various formats to cater to different learning styles, and allowing learners to express their knowledge in multiple ways (CAST, 2018; Basham et al., 2020).

Learner Engagement

Engagement refers to the level of interest, motivation, and commitment that students exhibit in the learning process (Delfino, 2019; John & Mkulu, 2022; Li & Li, 2022). It is a critical factor in determining academic success. Studies by Hamish Coates (2006), Maroco et al. (2016), and Redmond et al. (2018a) highlights the significance of student engagement in achieving academic success. Specifically, engagement is conceptualized as the quality of effort invested in pedagogically meaningful activities that directly facilitate the attainment of purposeful and desired learning outcomes (Azizollah et al., 2016). This definition underscores the importance of active participation and motivation in the learning process.

In the context of UDL, engagement is not just about participation; it is about providing students with the tools they need to remain motivated in learning tasks (Smith, 2023), whether in face-to-face, online or blended conditions (Y. Zhang et al., 2022). The UDL framework emphasizes creating opportunities for active learning and fostering a sense of belonging among students (Rogers & Gronseth, n.d.). By engaging students effectively, UDL-based intervention could pave the way for expertise in learning (L. Zhang et al., 2022).

Studies have identified critical factors that significantly impact learner engagement, encompassing the relevance and alignment of instructional materials with learning objectives, pedagogical flexibility and adaptability, a supportive and inclusive learning environment, effective and user-friendly technology, and timely teacher support, feedback, and interaction, all of which collectively foster a engaging and effective learning experience (Barghaus et al., 2023a; Deng et al., 2020; Pramadita et al., 2022; Başal & Eryılmaz, 2021; Z. et al., 2022). Offering varied engagement options arouses attention, enhances active participation, and deeper subject matter comprehension (Sukor et al., 2021). By integrating these considerations and tailored strategies, educators can cultivate a dynamic learning environment that fosters motivated participation, stimulates interest, and optimizes academic achievement (King-Sears et al., 2023b).

Empirical studies reported that implementation of UDL-based strategies across disciplines and educational contexts is positively correlated with increased learner engagement and improved academic achievement (Cao, 2023; Garrad & Nolan, 2023; Ghazal et al., 2018; Penha et al., 2021; Zeqiri et al., 2021). Moreover, Redstone (2023) found that UDL-based intervention increase student engagement and self-efficacy, with a significant difference ($p < .001$) and large effect size (Cohen's $d = 0.868$) between treatment ($M = 39.30$) and comparison ($M = 29.06$) groups. These studies provide strong evidence that adoption of UDL-based approaches have the potential to maximise engagement and improve learning outcomes.

Research Design

This study employed a quasi-experimental design with a pretest-posttest control group structure. This design is selected to compare the effectiveness of the UDL-based approach versus the traditional methods on pre-service teachers' engagement.

Study context and participants:

The study was conducted at Adamu Augie College of Education, Argungu, North-West Nigeria. This site was selected due to its diversity in student population. The participants of this study are sample of 244 students,

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume IX Issue XII December 2024

selected using a stratified random sampling technique to ensure representation of both male and female participants. The participants were also randomly assigned to either the experimental group who were exposed to the UDL -based intervention and a control group, who follow the conventional lecture-based instruction.

Engagement Scale

The UDL-Based Engagement Scale (UDL-BES) was developed in alignment with the UDL framework to assessed pre-service teachers `engagement across three domains: Engagement, Representation, and Action & Expression, through self-reported pretest and posttest evaluations. The scale demonstrated excellent validity and reliability, with expert evaluation yielding high content validity scores (Representation: 1.00, Engagement: 0.91, Action and Expression: 0.81) and a pilot test (N = 30) confirming reliability (Cronbach's alpha: 0.844-0.899, overall alpha: 0.850). Furthermore, Principal Component Analysis (PCA) with 206 pre-service teachers validated the scale's psychometric properties, identifying nine principal components that explained 81.24% of variance, with strong internal consistency ($\alpha = 0.850$

Intervention

The experimental group were exposed to the UDL-based intervention, featuring interactive activities, multimedia presentation, and quizzes, whereas the control group received traditional classroom lecture-based instruction over six weeks. Both groups received the same content through distinct methods. Following the intervention, participants in both groups were tested using the UDL-BES to determine their levels of engagement.

Ethical Considerations

Approval for the study was obtained from the **college prior the intervention**. Informed consent was also secured from all participants, who were also assured of the confidentiality and anonymity of their responses. Participants were informed that their involvement is voluntary and that they can withdraw at any time without consequence.

RESULTS

To find out whether a statistically significant difference exist in engagement levels between pre-service teachers exposed to the UDL-based intervention and those taught using the traditional format, an independent-samples t-test was conducted (Table 1). The results indicated a statistically significant difference with t (242) = 8.314, p = 0.000 were students in the UDL-based intervention group performed better (M=70.48, SD =9,59) than those who followed non-UDL intervention (M = 56.17, SD = 9.49). This implies that UDL-based module appears to have the greatest impact on pre-service teachers' engagement than conventional teaching approach.

Groups	N	Mean	Sd	t	Df	p-value
UDL-based Intervention	122	70.48	9.59	8.314	242	.000
Traditional methods	122	56.17	9.49			

The eta squared, however, showed that the magnitude of the difference observed was small ($\eta^2 = 0.2$) this indicated large effect size.

DISCUSSION

The results of the independent-samples t-test provide compelling evidence regarding the effectiveness of the UDL-based interventions in enhancing engagement levels among pre-service teachers. The statistically significant difference between learners exposed to the UDL-based intervention and those taught using traditional methods. The statistical results t (242) = 8.314 and p = 0.000, indicate a highly significant difference in engagement levels, suggesting that the observed effect is unlikely to be due to random chance.

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume IX Issue XII December 2024

The mean engagement score for the UDL group (M = 70.48, SD = 9.59) significantly outperformed that of the traditional group (M = 56.17, SD = 9.49). This substantial difference not only confirms the hypothesis that UDL interventions foster higher engagement but also aligned with studies such as (Cao, 2023; Garrad & Nolan, 2023; Ghazal et al., 2018; Penha et al., 2021; Zeqiri et al., 2021)which provided strong evidence that adoption of UDL-based approaches has the potential to maximise engagement in educational practice.

The findings imply that UDL-based intervention may create a more engaging learning experiences that caters to diverse learner needs. By emphasizing flexibility in teaching methods, materials, and assessments, UDL can enhance motivation and participation among pre-service teachers. This is particularly relevant in teacher education, where future educators must be equipped with strategies to engage all students effectively.

Since engagement is linked to better learning outcomes, the paper advocate for a shift in pedagogical approaches by educators. Policymakers and educators should consider integrating UDL principles into curriculum design and implementation to address the diverse needs of learners and improve overall educational quality in Nigeria. Incorporating UDL principles could prepare future educators to implement similar strategies in their classrooms.

Limitations and Future Research

While these findings are promising, it is essential to acknowledge potential limitations. The study's design does not account for long-term effects of UDL interventions on engagement or how these changes might translate into actual teaching practices post-training. Future research could explore:

1. Longitudinal Studies: Assessing whether the engagement benefits persist over time and impact teaching efficacy.

2. Qualitative Insights: Gathering qualitative data through interviews or focus groups could provide deeper insights into how pre-service teachers perceive their engagement and learning experiences under different instructional models.

3. Diverse Contexts: Examining the effectiveness of UDL interventions across various educational settings and disciplines would help generalize findings.

CONCLUSION

In conclusion, this study underscores the significant impact of UDL-based interventions on pre-service teachers' engagement levels compared to traditional teaching approaches. The strong statistical evidence supports a broader implementation of UDL principles in teacher education programs, ultimately fostering a more engaging, and effective learning environment for future educators. Further exploration into integration of UDL in blended learning context will enhance our understanding of how best to prepare teachers in an increasingly complex educational landscape and diverse classrooms.

Conflict of Interest

No conflict of interest to disclose

Data Availability

Related data will be made available to individuals or institutions on request through the corresponding author.

REFERENCES

1. Sholanke, A. Adeboye, & O. Alagbe, U. U. (2018). Universal Design for Learning: Assessment of Teaching Methods In Covenant University, Ota, Ogun State, Nigeria. Iated Academy.
2. ADCET. (2023). A compilation of practical application of UDL in Action.

3. Afzal, A., & Babar, S. (2016). Making lectures memorable: A cognitive perspective. Journal of the Pakistan Medical Association, 66(8).
4. Ajuwon, P. M. (2008). Inclusive Education for Students with Disabilities in Nigeria: Benefits, Challenges and Policy Implications. In International Journal of Special Education (Vol. 23, Issue 3). http://www.fme.gov.ng/pages/cati.asp
5. Al-Azawei, A., Parslow, P., & Lundqvist, K. (2017). The Effect of Universal Design for Learning (UDL) Application on E-learning Acceptance: A Structural Equation Model. In International Review of Research in Open and Distributed Learning (Vol. 18).
6. Al-Zoubi, S. M., & Younes, M. A. B. (2015). Low Academic Achievement: Causes and Results. Theory and Practice in Language Studies, 5(11), 2262. https://doi.org/10.17507/tpls.0511.09
7. Angwaomaodoko, E. A. (2023). A Critique of Inclusive Education Policy and the Extent of Its Implementation in Nigeria. Path of Science, 9(11), 2001–2008. https://doi.org/10.22178/pos.98-4
8. Arslan Bülent Ecevit Üniversitesi, A., Yaşar Yüzlü Bülent Ecevit Üniversitesi, M., Yaşar YÜZLÜ, M., & Arslan, A. (2017). Journal of Education and Practice www.iiste.org ISSN (Vol. 8, Issue 18). Online. https://www.researchgate.net/publication/318284718
9. Azizollah, A., Arbabisarjou, A., Zare, S., Shahrakipour, M., & Ghoreishinia, G. (2016). Academic Achievement the Relationship between Academic Achievement Motivation and Academic Performance among Medical Students. In International Journal of Pharmacy & Technology (Vol. 8, Issue 2). www.ijptonline.com
10. Bae, S. , O. N. S. , B. J. (2018). An introduction to UDL and its value in an Aotearoa New Zealand context. https://inclusive.tki.org.nz/guides/universal-design-for-learning/why-udl-is-valuable/
11. Barahona, M., David, V., Gallegos, F., Reyes, J., Ibaceta-Quijanes, X., & Darwin, S. (2023). Analysing preservice teachers' enactment of the UDL framework to support diverse students in a remote teaching context. System, 114. https://doi.org/10.1016/j.system.2023.103027
12. Başal, A., & Eryılmaz, A. (2021). Engagement and affection of pre-service teachers in online learning in the context of COVID 19: engagement-based instruction with web 2.0 technologies vs direct transmission instruction. Journal of Education for Teaching, 47(1). https://doi.org/10.1080/02607476.2020.1841555
13. Boothe, K. A., Lohmann, M. J., Donnell, K. A., & Dean Hall, D. (2018). Applying the Principles of Universal Design for Learning (UDL) in the College Classroom.
14. Cao, W. (2023). A meta-analysis of effects of blended learning on performance, attitude, achievement, and engagement across different countries. In Frontiers in Psychology (Vol. 14). Frontiers Media SA. https://doi.org/10.3389/fpsyg.2023.1212056
15. Cast, & Inc. (2023). CAST | UDL Tips for Assessment.
16. Dalton, E. M., Lyner-Cleophas, M., Ferguson, B. T., & McKenzie, J. (2019). Inclusion, universal design and universal design for learning in higher education: South Africa and the United States. African Journal of Disability, 8. https://doi.org/10.4102/ajod.v8i0.519
17. Dean, T., Lee-Post, A., & Hapke, H. (2017). Universal Design for Learning in Teaching Large Lecture Classes. https://uknowledge.uky.edu/marketing_facpub/6
18. Evans, D., Humphreys, S., & Gray, G. (n.d.). Australian National Curriculum: Applications of the Principles of UDL. http://www.australiancurriculum.edu.au/
19. Evmenova[1], A. S., Hollingshead[2], A., Alisa, K., Kavita, L., Leadon, R., & Williams[3], D. (2024). Designing for Diversity and Inclusion: UDL-Based Strategies for College Courses (Practice Brief). In Journal of Postsecondary Education and Disability (Vol. 2024, Issue 1).
20. Garrad, T. A., & Nolan, H. (2023). Rethinking Higher Education Unit Design: Embedding Universal Design for Learning in Online Studies. Student Success, 14(1), 1–8. https://doi.org/10.5204/ssj.2300
21. Ghazal, S., Al-Samarraie, H., & Aldowah, H. (2018). "i am Still Learning": Modeling LMS Critical Success Factors for Promoting Students' Experience and Satisfaction in a Blended Learning Environment. IEEE Access, 6, 77179–77201. https://doi.org/10.1109/ACCESS.2018.2879677
22. Hamish Coates. (2006). Student Engagement in Campus-based and Online Education.
23. IDA. (2021). Universal Design for Learning and its Role in Ensuring Access to Inclusive Education for All A Technical Paper by the International Disability Alliance. https://www.internationaldisabilityalliance.org/
24. King-Sears, M. E., Stefanidis, A., Evmenova, A. S., Rao, K., Mergen, R. L., Owen, L. S., & Strimel, M.

M. (2023a). Achievement of learners receiving UDL instruction: A meta-analysis. Teaching and Teacher Education, 122. https://doi.org/10.1016/j.tate.2022.103956
25. King-Sears, M. E., Stefanidis, A., Evmenova, A. S., Rao, K., Mergen, R. L., Owen, L. S., & Strimel, M. M. (2023b). Achievement of learners receiving UDL instruction: A meta-analysis. Teaching and Teacher Education, 122. https://doi.org/10.1016/j.tate.2022.103956
26. Li, Z., & Li, J. (2022). Using the Flipped Classroom to Promote Learner Engagement for the Sustainable Development of Language Skills: A Mixed-Methods Study. Sustainability (Switzerland), 14(10). https://doi.org/10.3390/su14105983
27. Lord, L., & Basham, N. J. (n.d.). A Blueprint for UDL: Considering the Design of Implementation.
28. Lyakurwa, S. E. (2018). Universal Design for Learning towards Achieving Inclusive Higher Education in Tanzania.
29. Maroco, J., Maroco, A. L., Bonini Campos, J. A. D., & Fredricks, J. A. (2016). University student's engagement: Development of the University Student Engagement Inventory (USEI). Psicologia: Reflexao e Critica, 29(1). https://doi.org/10.1186/s41155-016-0042-8
30. Mohamed, S. A. S., & Sivakumar, R. (2019). THINK INDIA JOURNAL Inclusiveness in Higher Education through Universal Design Learning-UDL.
31. Morton, C. E., Saleh, S. N., Smith, S. F., Hemani, A., Ameen, A., Bennie, T. D., & Toro-Troconis, M. (2016). Blended learning: How can we optimise undergraduate student engagement? BMC Medical Education, 16(1). https://doi.org/10.1186/s12909-016-0716-z
32. NCCE. (2021). National Commission for Colleges of Education, Abuja. www.ncceonline.edu.ng
33. NCCE, N. (2020). Curriculum Implementation Framework for Nigeria Certificate in Education.
34. Nganji, J. T., & Nggada, S. H. (2013). Adoption of blended learning technologies in selected secondary schools in Cameroon and Nigeria: Challenges in disability inclusion. In Advancing Technology and Educational Development through Blended Learning in Emerging Economies (p. 159). IGI Global. https://doi.org/10.4018/978-1-4666-4574-5.ch009
35. Omede, A. A. (2016). Policy Framework for Inclusive Education in Nigeria: Issues and Challenges (Vol. 6, Issue 5). www.iiste.org
36. Penha, P. B. da C., Lima Filho, L. M. de A., Ferreira, L. P., Almeida, A. A. F. de, Lopes, L. W., & Lima Silva, M. F. B. de. (2021). Effectiveness of a Blended-Learning Intervention in Teachers' Vocal Health. Journal of Voice. https://doi.org/10.1016/j.jvoice.2021.03.012
37. Rao, K. (2021). Inclusive Instructional Design: Applying UDL to Online Learning Universal Design for Learning View project Mathematics and students with disabilities View project Inclusive Instructional Design: Applying UDL to Online Learning. The Journal of Applied Instructional Design, 10(1). https://doi.org/10.51869/jaid2021101
38. Rao, K., Gravel, J. W., Rose, D. H., & Tucker-Smith, T. N. (2022). Universal Design for Learning in its 3rd decade: a focus on equity, inclusion, and design. In International Encyclopedia of Education: Fourth Edition (pp. 712–720). Elsevier. https://doi.org/10.1016/B978-0-12-818630-5.14079-5
39. Rao, K., & Meo, G. (2016). Using Universal Design for Learning to Design Standards-Based Lessons. SAGE Open, 6(4). https://doi.org/10.1177/2158244016680688
40. Redmond, P., Abawi, L. A., Brown, A., Henderson, R., & Heffernan, A. (2018). An online engagement framework for higher education. Online Learning Journal, 22(1), 183–204. https://doi.org/10.24059/olj.v22i1.1175
41. Redstone, A. E. (2023). Investigating the Effect of Universal Design for Learning on Learner Performance, Engagement, and Self-Efficacy. https://doi.org/10.25777/jd7h-h329
42. Rogers, S. A., & Gronseth, S. L. (n.d.). Applying UDL to Online Active Learning Instructional Designer Perceptions. In The Journal of Applied Instructional Design (Vol. 10, Issue 1).
43. Rose, D. (2001a). Universal Design for Learning. Journal of Special Education Technology, 16(2), 66–67. https://doi.org/10.1177/016264340101600208
44. Rose, D. (2001b). Universal Design for Learning. Journal of Special Education Technology, 16(2), 66–67. https://doi.org/10.1177/016264340101600208
45. Sahni, J. (2019). Does Blended Learning Enhance Student Engagement? Evidence from Higher Education. Journal of E-Learning and Higher Education, 2019, 1–14. https://doi.org/10.5171/2019.121518
46. Seán Bracken, N. (2019). Transforming Higher Education through Universal Design for Learning.

Taylor & Francis. https://bookshelf.vitalsource.com/books/9781351132053
47. Smith, S. (2023). Engaging potential: Using the UDL principle of engagement to motivate year 7-8 learners with autism in writing tasks (Vol. 24, Issue 1).
48. Steinmayr, R., Meißner, A., Weidinger, A. F., & Wirthwein, L. (2014a). Academic Achievement. In Education. Oxford University Press. https://doi.org/10.1093/obo/9780199756810-0108
49. Steinmayr, R., Meißner, A., Weidinger, A. F., & Wirthwein, L. (2014b). Academic Achievement. In Education. Oxford University Press. https://doi.org/10.1093/obo/9780199756810-0108
50. The bedrock of inclusion: why investing in the education workforce is critical to the delivery of SDG4 NIGERIA STUDY. (2020). www.NickPurserDesign.com
51. Unesco. (2020). Inclusion and education : all means all.
52. Xue, H., Yuan, H., Li, G., Liu, J., & Zhang, X. (2021). Comparison of team-based learning vs. lecture-based teaching with small group discussion in a master's degree in nursing education course. Nurse Education Today, 105. https://doi.org/10.1016/j.nedt.2021.105043
53. Yong Tan, C., García-Martín, J., Kuo, Y.-C., Yu, Z., weixu, W. X., & Paisan Sukjairungwattana, cityumo. (2022). Meta-analyses of differences in blended and traditional learning outcomes and students' attitudes.
54. Zeqiri, J., Kareva, V., & Alija, S. (2021). Blended Learning and Student Satisfaction: The Moderating Effect of Student Performance. Business Systems Research, 12(2), 79–94. https://doi.org/10.2478/bsrj-2021-0020
55. Zhang, L., Basham, J. D., & Carter, R. A. (2022). Measuring personalized learning through the Lens of UDL: Development and content validation of a student self-report instrument. Studies in Educational Evaluation, 72. https://doi.org/10.1016/j.stueduc.2021.101121
56. Zhang, L., Carter, R. A., & Hoekstra, N. J. (2023). A critical analysis of universal design for learning in the U.S. federal education law. Policy Futures in Education. https://doi.org/10.1177/14782103231179530
57. Zhang, Y., Xu, X., Yue, Y., Liu, J., & Lei, V. N. L. (2022). Improving online learning engagement and cognitive performance: A pilot study of udl-guided personal learning environments. International Journal of Virtual and Personal Learning Environments, 12(1). https://doi.org/10.4018/IJVPLE.307020