

ABSTRACT

This research examines student enrollment patterns at one of the institutions of higher learning in Misamis Occidental from 2022 to 2025 and predicts future enrollment rates from 2026 to 2030 through Time Series Analysis and the Autoregressive Integrated Moving Average (ARIMA) model. Information collected from the institution's registrar demonstrates oscillating trends in enrollment, evident decreases in 2023 and 2024 followed by a strong recovery in 2025. ARIMA was utilized to forecast enrollment for the subsequent five years, exhibiting cyclical behavior based on both institutional and external socio-economic factors. The findings underscore the potential of ARIMA in aiding data-driven decision-making in institutional planning, resource management, and policy development. This research adds to the paucity of local literature on statistical forecasting in Philippine state colleges and offers an applied instrument for education leaders to react affirmatively to enrollment trends. Subsequent studies are invited to develop hybrid forecasting models and include more general variables like economic indicators, demographic changes, and student tastes to improve projection accuracy.

Keywords: *student enrollment, ARIMA model, Higher Education*

INTRODUCTION

Higher education assumes an even more critical role in driving economic development, social mobility, and national advancement. With stronger global competition for a highly qualified workforce, colleges and universities are under increasing pressure to increase access to education without diluting quality and relevance (Gallagher, 2022). Student enrollment numbers

are, therefore, a critical gauge of institutional performance, policy success, and general demand for higher education. Enrollment patterns not only demonstrate the quality of instruction and support services, but also guide strategic planning pertaining to resources, staffing, and campus development (Schroeder, 2023; Taylor et al., 2023).

Another of the public higher education institutions in Misamis

Occidental that is helping to achieve this vision is based in Tangub City. Being a developing institution, it has a diverse array of undergraduate and graduate courses that are meant to address the needs of education in the region. These courses cover areas in education, business, agriculture, mathematics and natural sciences, information technology, arts and humanities, and engineering, among other. Based on the registrar's data for the institution from 2022 to 2025, the rates of enrollment have varied with socio-economic realities, academic change, and institution-building over the years. It is crucial to interpret these patterns to ensure the institution becomes attuned to emerging student and community needs.

To address these issues, the current study utilizes Time Series Analysis based on the ARIMA model. Time series analysis is a robust statistical tool to examine data points over time, whereas ARIMA is extensively utilized for predicting future values by using past trends and seasonal behaviors (Mao et al., 2024). Using actual enrollment figures for 2022-2025 and forecasted numbers for 2025-2030, the present study offers insightful views regarding anticipated variations and long-term enrollment pattern.

Even as past research employed conventional statistical methods for enrollment projections, recent publications imply an increasing demand for more precise and flexible models in the post-COVID era (Niaz et al., 2023).

There is still limited local research particularly among state universities in the Philippines, examining the use of ARIMA-based time series models for institutional planning. Most current forecasting procedures remain based on subjective estimates or near-term forecasts that are not statistically driven and lack forecasting accuracy (Wilson et al., 2024; Gu, 2024).

This research, thus, fills this void by presenting a data-driven, statistically valid prediction of student enrollment. The findings from this research are anticipated to inform decision-making in the development of academic programs, faculty assignments, budget planning, and resource allocation, thus improving the institution's capacity to make effective long-term plans.

The justification for this research is to bridge that gap by providing a data-driven, statistically reliable forecast of student enrollment at one of the higher education institutions in Misamis Occidental. With increasing unpredictability in student enrollment behavior and changing educational demand, particularly in provincial and rural higher education institutions, there is a growing need for reliable forecasting systems. Many state colleges experience fluctuations in enrollment due to economic conditions, demographic shifts, migration, and changing student preferences, which directly affect faculty loading, classroom utilization, budgeting, and academic program planning. Without accurate projec-

tions, institutions may face challenges in resource allocation and long-term institutional planning.

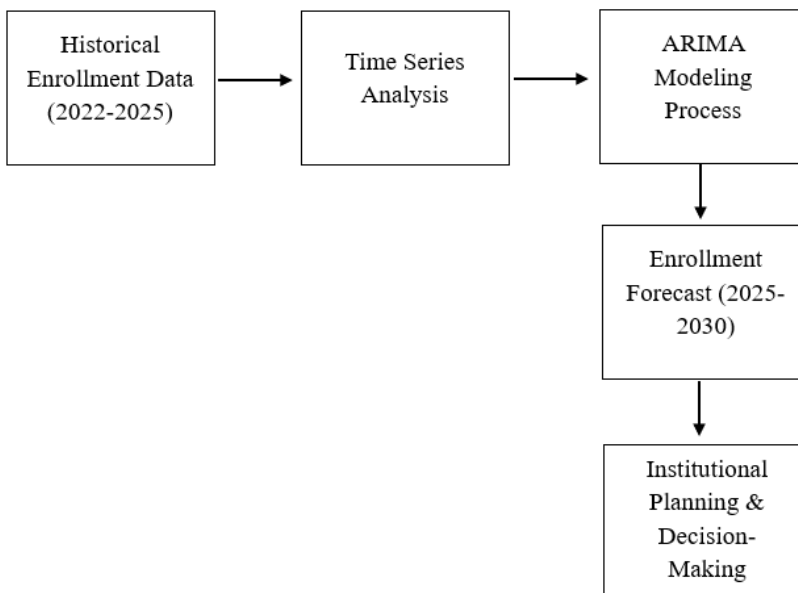
In this context, predictive techniques such as the AutoRegressive Integrated Moving Average (ARIMA) model provide a data-driven approach to analyzing historical trends and forecasting future enrollment patterns (Brahma et al., 2025; Gonugunta et al., 2024). Thus, enrollment forecasting has become an essential tool for proactive educational management and policy development.

The significance of this study lies in its practical contribution to institutional planning and decision-making. It provides administrators with evidence-based projections that may guide faculty recruitment, classroom organization, budgeting, and academic

program development. Moreover, the study contributes to the limited local literature on enrollment forecasting in Philippine state colleges, particularly in Misamis Occidental.

Specifically, this study aims to: (1) analyze the historical student enrollment trends and fluctuations of the institution from 2022 to 2025; (2) determine the recurring patterns and changes in student enrollment behavior and educational demand over time; (3) apply Time Series Analysis and ARIMA model to forecast student enrollment from 2026 to 2030; and (4) provide evidence-based enrollment projections that may support institutional planning, resource allocation, faculty management, and academic decision-making in higher education institutions.

Conceptual Framework



METHODOLOGY

The study employed a quantitative method using time series analysis to analyze and project student enrollment trends of one of the state universities in Misamis Occidental. The college, which provides free tertiary education under the government’s program to enhance access to higher education, caters to a mixed student body across different programs. The enrollment statistics utilized in this study were accessed from the Office of the Registrar of the college for the first and second semesters from 2022 to 2025.

Time Series Analysis was utilized to determine patterns, trends, and seasonality in the enrollment data. For forecasting, the study employed the AutoRegressive Integrated Moving Average (ARIMA) model, a widely used statistical approach that incorporates autoregression (AR), differencing to achieve stationarity (I), and mov-

ing average components (MA). Prior to model estimation, stationarity of the data was assessed through differencing techniques and visual inspection of trend behavior. Initial ARIMA parameters were identified using the Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF) plots. The most appropriate model was then selected and validated using the Akaike Information Criterion (AIC) and residual diagnostic tests to ensure model accuracy, reliability, and goodness of fit.

The completed ARIMA model was subsequently employed to produce enrollment projections for 2026-2030. Ethical principles were strictly adhered to during the study. Data were treated with confidentiality, and consent was obtained from the institution for the use of student enrollment data only for educational and research purposes.

RESULTS AND DISCUSSIONS

Figure 1. The time series trend of student enrollment during the 1st semester from 2022 to 2025

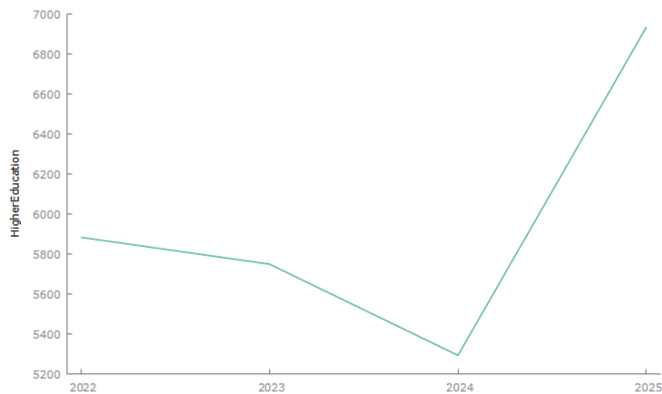


Figure 1 shows the trend of first-semester student enrollment of one of the higher educational institutions in Misamis Occidental from 2022 to 2025. In 2022, there were 5,883 students. This dipped a bit to 5,749 in 2023 and further to 5,293 in 2024 – the lowest among the observed years. But in 2025, enrollment sharply rose to 6,935, the highest level of enrollment.

This variability mirrors broader trends in higher education, where enrollment initially declined due to the lingering effects of the COVID-19 pandemic but gradually recovered as institutions strengthened recruitment initiatives, expanded financial assistance programs, and implemented academic interventions (Crawford, 2023; Silveira et al., 2022). At the national level, undergraduate enrollment increased by 2.1% in Fall 2023 compared to Fall 2022, while first-time student enrollment rose by 5.5% in Fall 2024, reflecting a strong post-pandemic recovery trend (National Student Clearinghouse Research Center, 2024; Collins, 2024). Community colleges likewise recorded undergraduate growth ranging from 5.8% to 6.3%, with certificate programs increasing by nearly 10% (Kisker et al., 2023).

In the context of the institution under study, registrar records from 2022 to 2025 also reflect a similar recovery pattern, particularly the substantial increase in enrollment observed in 2025. This upward trend may indicate the effects of localized institutional initiatives, including intensified enrollment campaigns, improved student support services, expanded academic offerings, and stronger community engagement efforts. The alignment between institutional data and broader national and international enrollment trends further highlights the importance of forecasting models such as ARIMA in understanding enrollment behavior and supporting proactive institutional planning and decision-making.

Figure 2. The five year forecasted student enrollment for the 1st semester from 2026 to 2030 using the ARIMA model.

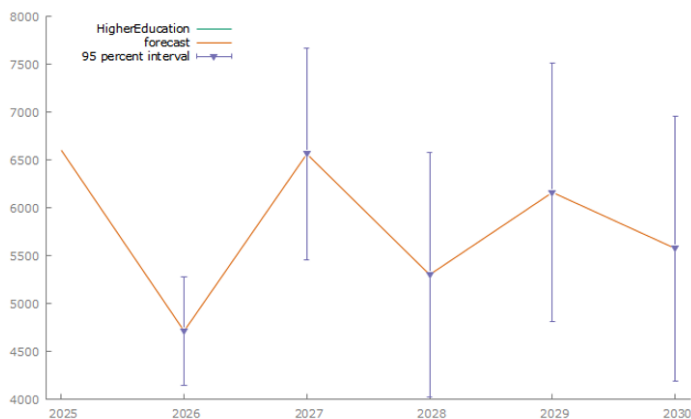


Figure 2 displays the ARIMA prediction of the student enrollment for the 1st semester in one of the Misamis Occidental higher education institutions from 2026 to 2030. The orange line shows the forecasted enrollments, while the blue error bars represent the 95% confidence intervals, plotting the predicted range of variability. There is a steep fall anticipated in 2026, to about 4,700 students—the lowest in the five-year forecast. It could be due to factors like graduation years, decreased intake, or residual external issues. But the next year, 2027, there is a very strong recovery with forecasted enrollment increasing dramatically to around 6,500 students, perhaps because of better recruitment effort or higher demand. In 2028, the trend also falls to approximately 5,300, indicating a cyclical pattern of ups and downs. In 2029, enrollment is projected to grow moderately to more than 6,200 students before dipping modestly to approximately 5,600 by 2030. On average, the projection reveals a cyclical trend instead of growth or decline, highlighting the significance of adaptive planning at the institutional level and informed decision-making based on accurate data projections.

These trends are representative of the cyclical character of student enrollment behavior, something with which ARIMA models can keep pace. For (Tapio & Tarepe, 2025), ARIMA models are effective for predicting enrollments because they can capture both trend and seasonality in education data. Also, (Adoga et al., 2023; Kornelio et al., 2024) also determined ARIMA to be a reliable predictor of student admissions at public universities in favor of its use in institutional planning. (Saroyan, 2023) also highlighted the applicability of the model for future capacity management and policy design in higher education. The findings confirm the appropriateness of the ARIMA model in effectively projecting enrollment trends and supporting educational institutions, such as one of the higher education institutions in Misamis Occidental, in evidence-based decision-making.

Figure 3. The time series trend of student enrollment during the 2nd semester from 2022 to 2025

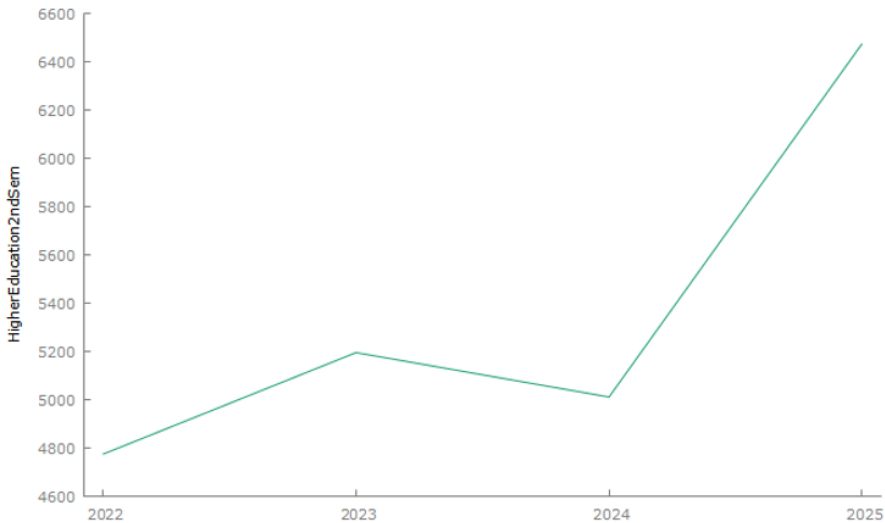


Figure 3 illustrates the trend of second semester student enrollment in one of the higher education institutions in Misamis Occidental from 2022 to 2025. Based on records obtained from the Office of the Registrar, enrollment was at its lowest in 2022 with 4,774 students. This increased significantly to 5,194 students in 2023, reflecting a positive institutional recovery trend. In 2024, enrollment slightly declined to 5,011 students, which may have been influenced by internal and external factors such as economic challenges, student financial constraints, program adjustments, or changing educational preferences. However, enrollment sharply increased in 2025 to 6,475 students, the highest recorded during the observed period. The registrar's data therefore indicate a pattern of fluctuation followed by substantial recovery, suggesting increasing student demand and improved institutional responsiveness over time.

The observed changes align with broader national and international post-pandemic enrollment trends in higher education. Korotchenko and Dobbs (2023) reported that undergraduate and graduate enrollments in the United States declined by approximately 4.2% between Fall 2020 and Fall 2022 before gradually stabilizing in 2023, highlighting the uncertainty experienced by educational institutions during the pandemic period. Globally, the abrupt transition to remote and flexible learning disrupted traditional enrollment systems and contributed to declining participation rates in many institutions. More recent reports, however, indicate

a recovery pattern, with total undergraduate enrollment increasing by 2.1% in Fall 2023 (National Student Clearinghouse Research Center, 2023).

The enrollment recovery observed in the institution similarly reflects possible localized interventions and institutional adaptations implemented during the post-pandemic period. Based on institutional records and enrollment trends, the increase in 2025 may be associated with strengthened enrollment campaigns, expanded academic offerings, enhanced student support services, improved accessibility through flexible learning modalities, and intensified community engagement initiatives. These findings are consistent with studies emphasizing that institutional adaptability, student-centered strategies, and technology integration contribute significantly to enrollment recovery and retention in higher education settings (Zhang & Wei, 2024; Aldaba et al., 2024).

Overall, the fluctuating yet recovering enrollment trend reinforces the importance of forecasting models such as ARIMA in understanding long-term enrollment behavior and supporting evidence-based institutional planning, resource allocation, and academic decision-making.

Figure 4. The five year forecasted student enrollment for the 2nd semester from 2026 to 2030 using the ARIMA model.

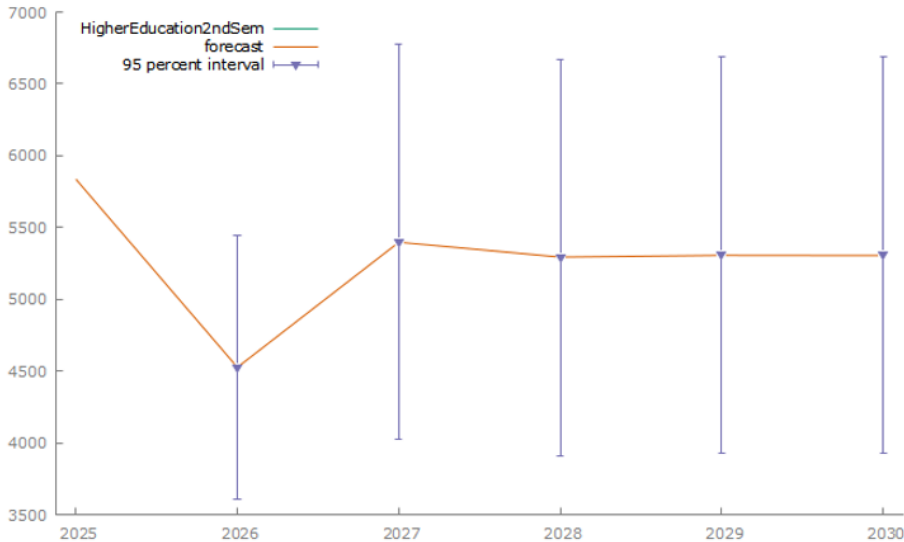


Figure 4 shows the ARIMA projection of second semester enrollment for the period 2026-2030 indicates a fluctuating but stabilizing tendency for one Misamis Occidental higher education institution. In 2026, there is a steep drop to around 4,500 students, the lowest point in the six-year projection. This sharp decline could be impacted by a variety

of reasons such as smaller recruitment student population, graduating large cohorts, or ongoing outside issues like economic or policy disturbances. Nevertheless, a robust comeback is projected in 2027 with enrollment returning to around 5,400 students, possibly because of aggressive recruitment, re-enrollment initiatives, or the normalization of previous institutional setbacks. Between 2028 and 2030, the projection predicts a time of relative stability, with enrollment numbers plateauing just above 5,300 students per year. The plateau implies that the college is possibly settling into a new baseline level of enrollment, with no dramatic increases or decreases predicted unless drastic measures are taken. The broad 95% confidence intervals presented in the graph demonstrate a level of ambiguity, highlighting the need for adaptable, data-informed decision-making. The projection indicates a cyclical but moderate enrollment trend, and the call for sustained activities in student retention, academic relevance, and strategic planning to support long-term institutional strength (Meriwether, 2024). These cyclical patterns have also been supported by findings in current literature that ARIMA models efficiently capture season and trend patterns in education data. For example, (Brahma, 2025) validated ARIMA's prowess in modeling the dynamics of enrollment, and (Tapio & Tarepe, 2025) proved its accuracy in predicting student admissions. Hybrid models that integrate ARIMA with machine learning, including ARIMA-Random Forest, have similarly been found to increase the accuracy of forecasts in higher education settings.

An extended review by (Thota, 2025) emphasizes ARIMA's application in practical education time series, such as confidence interval evaluation for prediction reliability. These reviews confirm the cyclical pattern of enrollment patterns as well as the appropriateness of ARIMA-based approaches for strategic university planning.

CONCLUSION

The application of Time Series Analysis and ARIMA modeling in examining and forecasting student enrollment at one of the higher education institutions in Misamis Occidental revealed noticeable fluctuations and non-linear enrollment behavior for both the 1st and 2nd semesters from 2022 to 2025, with projections extending from 2026 to 2030. For the 1st semester, enrollment experi-

enced a considerable decline from 2022 to 2024, followed by a sharp recovery in 2025. In contrast, the 2nd semester showed its lowest enrollment in 2022, followed by a relatively steadier upward trend and a significant increase in 2025.

The differences between the projected trends of the two semesters may be associated with varying student enrollment behaviors and institutional conditions. First semester enrollment patterns

are often more sensitive to new admissions, economic conditions, program demand, and student transitions from secondary education, resulting in larger fluctuations. Meanwhile, second semester enrollment tends to reflect student retention and continuation rates, which generally produce more stable patterns compared to first semester admissions. Variations between semesters may also be influenced by factors such as financial capability of students, shifting academic preferences, transfer patterns, institutional policies, and post-pandemic adjustments in learning delivery modalities.

The projections from 2026 to 2030 further indicate alternating increases and decreases in enrollment, suggesting a cyclical pattern influenced by academic calendars, institutional interventions, demographic changes, and broader socio-economic conditions. These findings imply that student enrollment behavior in higher education institutions is dynamic and responsive to both internal institutional strategies and external environmental factors.

The study demonstrates that ARIMA modeling serves as a reliable forecasting tool for evidence-based educational planning and decision-making. The projected enrollment trends may assist administrators in improving strategic planning related to faculty recruitment, classroom utilization, budgeting, curriculum offerings, and student support services. Fur-

thermore, the findings provide a valuable basis for institutional policy development and long-term resource management, particularly in preparing for possible enrollment increases or declines. By contributing to the growing body of literature on predictive analytics in education, the study also offers a practical framework for other higher education institutions seeking to implement data-driven enrollment management strategies.

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REFERENCES:

- Adoga, P. I., Muazu, H. G., & Barma, M. (2023). Choosing a Forecast Model for Prediction of Students' Enrolment in Multiple Programmes of the National Open University of Nigeria: Towards Course Materials Production Planning. *West African Journal of Open and Flexible Learning*, 11(2), 1-28.
- Aldaba, F. T., Sescon, J. T., & Alconis, K. E. (2024). Strengthening CHED's developmental and regulatory capacity.
- Brahma, S., Rajendra, S. A., & Sula, A. (2025, March). Data-Driven Decision Making for Enrollment Trends and Educational Policy Analysis in Higher Education. In 2025 Northeast Section Conference.
- Brahma, S., Rajendra, S. A., & Sula, A. (2025, March). Data-Driven Decision Making for Enrollment Trends and Educational Policy Analysis in Higher Education. In 2025 Northeast Section Conference.
- Collins, E., & Williams, R. L. (2024, June). Evaluating the Impact of a Summer Engineering Program Using the National Student Clearinghouse (Evaluation of Program). In 2024 ASEE Annual Conference & Exposition.
- Crawford, J. (2023). COVID-19 and higher education: A pandemic response model from rapid adaption to consolidation and restoration. *International Education Journal: Comparative Perspectives*, 22(1), 7-29.
- Cummings, K. (2024). Exploring the Role of Tuition-Free Community College for Rural Communities: A Mixed Methods Approach (Doctoral dissertation).
- Gallagher, S. R. (2022). The future of university credentials: New developments at the intersection of higher education and hiring. Harvard Education Press.
- Gonugunta, K. C., & Leo, K. (2024). Role of Data-Driven Decision Making in Enhancing Higher Education Performance: A Comprehensive Analysis of Analytics in Institutional Management. *International Journal of Acta Informatica*, 3(1), 149-159.
- Gu, W. (2024). Evaluating Deterministic Approaches to Forecast Population by Educational Attainment in the United States. South Dakota State University.

- Kisker, C. B., Cohen, A. M., & Brawer, F. B. (2023). *The American community college*. John Wiley & Sons.
- Kornelio, S., Balan, R., & Deogratias, E. (2024). Forecasting students' enrolment in Tanzania government primary schools from 2021 to 2035 using ARIMA model. *International Journal of Curriculum & Instruction*, 16(1).
- Korotchenko, S., & Dobbs, R. (2023). The effect of COVID-19 pandemic on college enrollment: How has enrollment in criminal justice programs been affected by the pandemic in comparison to other college programs. *Frontiers in Education*, 8, Article 1136040. <https://doi.org/10.3389/educ.2023.1136040>
- Mao, S., Zhang, C., Song, Y., Wang, J., Zeng, X. J., Xu, Z., & Wen, Q. (2024). Time series analysis for education: Methods, applications, and future directions. arXiv preprint arXiv:2408.13960.
- Meriwether, J. L. (Ed.). (2024). *Prioritizing Enrollment Management: Effective Practices and Strategies for Student Success and Completion*. Taylor & Francis.
- National Student Clearinghouse Research Center. (2023, November 20). A close look at higher education enrollment in Fall 2023. *HigherEdToday*. <https://www.higheredtoday.org/2023/11/20/a-close-look-at-higher-education-enrollment-in-fall-2023-2/>
- National Student Clearinghouse Research Center. (2024). Current term enrollment estimates: Spring 2024. <https://nscresearchcenter.org/current-term-enrollment-estimates/>
- Newmann, J. J., & Rosedale, M. R. (2025). Online Educational Leadership Perspectives: Higher Education in a Post-Pandemic Society. In *Diverse Leadership Perspectives in Education: From K-12 to Higher Education* (pp. 369-398). IGI Global Scientific Publishing.
- Niaz, M., & Nwagwu, U. (2023). Managing healthcare product demand effectively in the Post-Covid-19 environment: navigating demand variability and forecasting complexities. *American Journal of Economic and Management Business (AJEMB)*, 2(8), 316-330.
- Ryan, M. R. (2024). *Transformative Leadership: BIPOC Faculty and Staff as Catalysts for Recruiting and Sustaining a Multicultural Student Body* (Doctoral dissertation, Northeastern University).

- Saroyan, A., & Frenay, M. (Eds.). (2023). Building teaching capacities in higher education: A comprehensive international model. Taylor & Francis.
- Schroeder, C. (2023). Coming in from the margins: Faculty development's emerging organizational development role in institutional change. Taylor & Francis.
- Silveira, S., Hecht, M., Matthaeus, H., Adli, M., Voelkle, M. C., & Singer, T. (2022). Coping with the COVID-19 pandemic: perceived changes in psychological vulnerability, resilience and social cohesion before, during and after lockdown. *International journal of environmental research and public health*, 19(6), 3290.
- Tapio, R., & Tarepe, D. (2025). Comparative Analysis of Random Forest and Hybrid ARIMA-random Forest Models for Student Enrollment Forecasting in Higher Education. *Journal of Advances in Mathematics and Computer Science*, 40(3), 124-136.
- Tapio, R., & Tarepe, D. (2025). Comparative Analysis of Random Forest and Hybrid ARIMA-random Forest Models for Student Enrollment Forecasting in Higher Education. *Journal of Advances in Mathematics and Computer Science*, 40(3), 124-136.
- Taylor, K. L., & Colet, N. R. (2023). Making the shift from faculty development to educational development: A conceptual framework grounded in practice. In *Building teaching capacities in higher education* (pp. 139-167). Routledge.
- Thota, V. R. (2025). Comparative Study of Time Series Forecasting for Trucking Shipments: Evaluating Arima, LSTM, and Hybrid Arima-LSTM Models (Master's thesis, State University of New York at Binghamton).
- Wilson, T., Grossman, I., Alexander, M., Rees, P., & Temple, J. (2022). Methods for small area population forecasts: State-of-the-art and research needs. *Population Research and Policy Review*, 41(3), 865-898.
- Zhang, J., & Wei, Y. (2024). Exploring the Dynamics of Private Higher Education in China: A Human Capital and Institutional Analysis.