**Industry 4.0 as a Catalyst for Utilisation of Innovative Instructional Resources in the Teaching of Economics in Secondary Schools in Nigeria**

**Abidat Oluwashola MOHAMMED1 and Afolakemi Olasumbo OREDEIN****2**

1Department of Language, Arts and Social Science Education,

Faculty of Education, Lagos State University, Ojo.

1abidat.mohammed@lasu.edu.ng
**2**Department of Arts and Social Science Education, Lead City University, Ibadan.

**2**opefolake1@yahoo.com

**Abstract**

*The study examined the impact of Industry 4.0 (4IR) on adopting innovative instructional materials in teaching economics in Lagos State Education District V senior secondary schools, Nigeria. The descriptive survey design was adopted. Four objectives were raised to guide the study. Three hypotheses were tested at 0.05 level of significance. A self-constructed questionnaire was used to collect relevant data from teachers. The results revealed that the influence of 4IR has made it easier to integrate such materials in teaching economics. It was found that the fourth industrial revolution have a significant influence on usage of innovative instructional materials on teaching economics in senior secondary schools in Lagos State Education District V (F = 431.476, p<0.05). The study also showed that 68.5% (R2 = 0.685) of utilization of innovative instructional materials in teaching economics can be explained by fourth industrial revolution and innovation. In addition, there were significant differences in economics teachers’ utilization of innovative instructional materials on the basis of school type (t =12.983, P<0.05) and gender (t = 6.983, P<0.05). The study therefore concludes that 4IR had a positive effect on the adoption of innovative instructional materials in the enhancement of economics education in Lagos State Education District V secondary schools. It was recommended that regular professional development and training programs should be organised for teachers to effectively integrate and utilise innovative instructional materials in economics, ensuring students receive up-to-date and relevant education aligned with current economic realities.*

**Keywords:** Industry 4.0, economics education, instructional materials, innovation

**Introduction**

The Fourth Industrial Revolution, is bringing about revolutionary changes in a number of fields, including education, by integrating cutting-edge technology like big data, robots, machine learning, and artificial intelligence into routine human tasks. These developments are changing the way information is created, shared, and learned, which has significant implications for methods of teaching and curriculum delivery across the board (Linney, 2019; Sekiyama, 2020; Jimoh et al, 2024). The shift to a global society driven by knowledge necessitates the development of new paradigms for training that place an emphasis on flexibility, creativity, and digital proficiency.

This revolution presents both urgent challenges and timely opportunities inherent in economics education at all levels of education (Sekiyama, 2020). Industry 4.0 enables the adoption of technology-enhanced instructional resources, such as data-driven simulations, interactive visualization tools, MOOCs, and AI-based tutoring systems, that make abstract economic concepts more concrete, dynamic, and accessible (Sekiyama, 2020; EdX, 2019). These resources are vital for equipping students with the critical and analytical thinking skills required to navigate an increasingly complex economic landscape.

Modern instructional content is expected to meet the rapidly growing global knowledge pool, which is made feasible by real-time data collection and AI-assisted analysis (Bindé et al., 2005). Nevertheless, the problem of knowledge obsolescence also accompanies this expansion. Educational systems must constantly upgrade their teaching methods and resources to stay current since information is becoming obsolete faster than ever before (Sekiyama, 2020; Oredein & Obadimeji, 2022). This requirement highlights how Industry 4.0 can be both a disruptor and a catalyst for innovation in not only economics education, but the entire education industry.

Furthermore, the bounds of education delivery have been reshaped by the shift in global connection, which allows students and teachers to communicate both synchronously and asynchronously without being physically present. Even in resource-constrained contexts, such as many sections of Nigeria, high-quality economic education may now be widely disseminated thanks to tools like EdX and other online learning platforms (Penprase, 2018; World Economic Forum, 2019). However, there are several limitations to the use of these technologies. Full-scale implementation in public secondary schools is still hampered by problems including curricular rigidity, teacher readiness, digital inequality, and inadequate infrastructure (Baweja et al., 2016; Shorrocks et al., 2019). This calls into question how well-equipped educational stakeholders are to take advantage the potentials of Industry 4.0. Therefore, this study investigates how Industry 4.0 acts as a catalyst for the utilisation of innovative instructional resources in the teaching of economics using Lagos State Education District V senior secondary schools as case study.

**Statement of the Problem**

The teaching of Economics in the classroom is largely handled by the teachers through the use of visual materials, mainly textbooks and some pictorial materials. Meanwhile, Economics is an interactive subject because it involves negotiation, demonstration and bargaining. These could be well represented through dramatization or demonstration. It is a subject that deals with outside activities. These activities need to be documented and reproduced for the students. The poor performance of students in the subject could not be separated from the lack of adequate innovative instructional materials. Lack of innovative instructional materials in industrial revolution era will undoubtedly affect the quality of students and have not been able to answer the challenges of the age, and lack of complete and competent in their fields such as; Less good at communicating both orally and in writing; Similarly, the work is mechanical, not creative, low work ethic, individualist, less proficient in using technology and a weak leadership attitude. The problem in which this study has been concerned about is the effect of industrial revolution on innovative instructional materials for teaching economics in senior secondary schools in Lagos State Education District V.

**Purpose of the Study**

The purpose of this study was to examine the potentials of industry 4.0 to serve as catalyst for utilisation of innovative instructional resources in the teaching of economics in secondary schools in Lagos State, Nigeria. Specifically, the study sought to:

1. Ascertain the innovative instructional materials brought about by fourth industrial revolution used for teaching Economics in senior secondary schools in Lagos State Education District V.
2. Determine the influence of industry 4.0 on utilisation of innovative instructional resources for teaching economics in senior secondary schools in Lagos State Education District V.
3. Find out the difference in economics teachers’ usage of innovative instructional materials to teach Economics between public and private senior secondary schools in Lagos State Education District V.
4. Find out the gender difference in economics teachers’ usage of innovative instructional materials to teach Economics in senior secondary schools in Lagos State Education District V.

**Research Question**

1. What are the innovative instructional materials brought about by fourth industrial revolution used for teaching Economics in senior secondary schools in Lagos State Education District V?

**Research Hypotheses**

The following research hypotheses were formulated for this study:

H01: The fourth industrial revolution does not have any significant influence on usage of innovative instructional materials on teaching economics in senior secondary schools in Lagos State Education District V

H02: There is no significant difference in economics teachers’ usage of innovative instructional materials to teach Economics between public and private senior secondary schools in Lagos State Education District V

H03: There is no significant gender difference in economics teachers’ usage of innovative instructional materials to teach Economics in senior secondary schools in Lagos State Education District V.

**Theoretical Review**

This study was anchored on the “Theory of Diffusion of Innovation”.

**Theory of Diffusion of Innovation**

Diffusion of innovation theory has been proposed the patterns and speed at which any new innovative ideas, activities, products, or thoughts have been spread through a population. The main parameters of this theory are innovators, early adopters, early majority, late majority, and laggards (Sartipi, 2020). Innovators are playing to gather knowledge and spread the knowledge through innovations. Persuasion about the innovation has been carried through early adopters who adopt the innovation first. Then the early majority decided to implement those, and the late majority implemented the innovations (Sartipi, 2020). The last parameter laggard has been performed for confirmation of the innovations. In such a practice, a new idea spreads through populations and is adopted by the population. In the case of the ESL process, teachers are adopting such new ideas to provide lessons through Innovative technologies such as 3D printing, AR, VR, AI and others have been utilized. Students have confirmed whether the technologies are helpful or not. ESL learning process has gained huge technological innovation and earlier the process of learning through utilizing such technologies. Overall, the diffusion of innovations theory provides useful understanding of the process of societal change, as well as the essential traits that contribute to an innovation’s effective diffusion. These include the value of peer-to-peer interactions and peer networks, as well as an awareness of the demands of various user groups.

**Conceptual Model**

The conceptual model shows the hypothesised relationship between the predictor variable (Industry 4.0 (4IR), criterion variable (utilisation of innovative instructional resources for teaching economics) and moderating variables (school type and teachers’ gender).

  **Moderating Variables**

**School Type:**

Public and Private

H02

**Teachers’ Gender:**

Male and Female

 **Independent Variable Dependent Variable**

 H03

Industry 4.0 (4IR)

Utilisation of Innovative Instructional Resources for teaching Economics

 H01

**Figure 2.1:** Conceptual Model (**Source: Researcher, 2024)**

**Methodology**

This study employed descriptive survey research design. Hundred teachers each from public and private secondary schools in Lagos State Education District V were sampled using Slovin sample size determination formula. A self-constructed questionnaire titled: “Fourth Industrial Revolution and Innovative Instructional Resources for Teaching Economics Questionnaire (4.0IIRTEQ)” with the four scale Likert type of strongly disagree (1) to strongly agree (4) was used to obtain data. The instrument were validated using content and construct validity and subjected to test-re-test for estimation of its reliability. A reliability value of .690 was obtained for 4.0IIRTEQ and this value was found to be reliable when subjected to psychometric test. The instrument was distributed personally by the researcher to the sampled teachers in Lagos State Education District V. Bio data of teachers were analysed using frequency and percentage. Research question was answered using frequency counts while hypotheses were tested using simple linear regression and t-test at 0.05 level of significance.

**Results**

**Demographic Data Presentation**

**Table 1: Demographic Data of Teachers (n = 200)**

|  |  |
| --- | --- |
| **Public Schools (n = 100)** | **Private Schools (n = 100)** |
| **Bio data**  | **Frequency** | **Percent** |  | **Frequency** | **Percent** |
| **Gender**  | Male | 64 | 32.0 | Male | 32 | 16.0 |
|  | Female | 36 | 18.0 | Female | 68 | 34.0 |
| **Employment Status** | Full Time | 98 | 49.0 | Full Time | 29 | 14.5 |
|  | Part Time | 2 | 1.0 | Part Time | 71 | 35.5 |
| **Age (Years)** | Under 25  | 17 | 9.0 | Under 25  | 21 | 11.0 |
|  | 25-29 | 36 | 18.0 | 25-29 | 39 | 20.0 |
|  | 30-39 | 24 | 12.0 | 30-39 | 27 | 14.0 |
|  | 40-49 | 23 | 12.0 | 40-49 | 13 | 7.0 |
| **Education Level** | NCE | 34 | 17.0 | NCE | 56 | 28.0 |
|  | B.A/B.ED | 60 | 30.0 | B.A/B.ED | 41 | 21.0 |
|  | PG/Masters | 6 | 3.0 | PG/Masters | 3 | 2.0 |
| **Teaching Experience (Years)** | 3-5 | 40 | 20.0 | 3-5 | 59 | 30.0 |
|  | 6-10 | 41 | 21.0 | 6-10 | 37 | 19.0 |
|  | 11-15 | 19 | 10.0 | 11-15 | 4 | 2.0 |

 **Source: Field survey, 2023**

Table 1 showed that most teachers (32.0%) are males in public schools while majority of them (34.0%) are females in private schools. Most teachers (49.0%) are on full time employment in public schools whereas majority of them (71.0%) are on part time employment in private schools. Most teachers are within 25-29 years of age in both public (18.0%) and private (20.0%) schools. Majority (60.0%) have B.A/B.Ed as their highest educational qualification in public schools while most of them (28.0%) have NCE as their highest educational qualification in private schools. Lastly, most teachers (21.0%) have 6-10 years of teaching experience in public schools whereas most of them (30.0%) have 3-5 years of teaching experience in private schools.

**Research Question**

**Research Question One:** What are the innovative instructional materials brought about by fourth industrial revolution used for teaching Economics in senior secondary schools in Lagos State Education District V?

**Table 2:** Frequency Count of Response of Respondents onInnovative Instructional Materials by Fourth Industrial Revolution used in Teaching Economics in Schools in Lagos State Education District V

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Innovative Instructional Materials | Power Point Presentation | Virtual Learning Platforms | Internet Google Search | 3D and 4D printing | Total  |
| Public School Teachers |  | 45 | 4 | 15 | 36 | 100 |
| Private School Teachers |  | 9 | 31 | 56 | 4 | 100 |

**Source: Field survey, 2023.**

Table 2 shows the frequency count fourth industrial revolution instructional materials used to teach Economics in senior secondary schools in Lagos State Education District V. From the table above, the power point presentation and 3D and 4D printing Instructional Materials are mostly used by teachers in public schools. Although, virtual learning platforms and internet Google search are the mostly used instructional materials by teachers in private schools to teach Economics. Finally, the participants all agreed that Power Point Presentation, Virtual Learning Platforms, Internet Google Search and 3D and 4D printing are all industrial revolution instructional materials used to teach Economics in senior secondary schools in Lagos State Education District V, also, fourth industrial revolution has influence on usage of innovative instructional materials on teaching economics. Hence, this answers the research question one and two.

**Test of Hypotheses**

**H01:** The fourth industrial revolution does not have any significant influence on usage of innovative instructional materials on teaching economics in senior secondary schools in Lagos State Education District V

**Table 3:** Summary of Regression Analysis of Fourth Industrial Revolution and Innovation on usage of Innovative Instructional Materials in teaching Economics

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Model | Sum of Squares | Df | Mean Square |  F | Sig. |
|  | Regression | 97.554 | 1 | 97.554 | 431.476 | 0.000 |
| Residual | 44.766 | 198 | .226 |  |  |
| Total | 142.320 | 199 |  |  |  |

R2=0.685,

Tables 3 showed a significant influence R2=0.685, F = 431.476, *p*<0.05 of industrial revolution and innovation on instructional materials used in teaching economics in secondary schools in Lagos state. This implies that the industrial revolution and innovation significantly predict usage of innovative instructional materials in teaching economics in secondary schools in Lagos state. The R2 indicates how much of the total variation in the dependent variable which is usage of innovative instructional materials in teaching economics can be explained by the independent variable which is industrial revolution and innovation. In this result, the whole 68.5% of usage of innovative instructional materials in teaching economics can be explained by fourth industrial revolution and innovation.

**H02:** There is no significant difference in economics teachers’ usage of innovative instructional materials to teach Economics between public and private senior secondary schools in Lagos State Education District V

**Table 4: Results of t-test Analysis on Public School and Private School Economics Teachers’ Usage of Innovative Instructional Materials to Teach Economics**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Variable**  | **N** | **Mean** | **SD** | **SE** | **t- value****Calc.** | **df** | **P** | **Remark** |
| **Public School Teachers** | 100 | 2.73 | 0.45 | .045 | 12.983 | 99 | \*0.00 | Sig. |
| **Private School Teachers** | 100 | 2.10 | 0.72 | .072 |  |  |  |  |
| \*Significant at p<0.05 |  |  |  |  |  |  |  |  |

In Table 4, the result revealed that the t- value calculated was 12.983 and p value observed is 0.00 at df =99. Since the P value observed (0.00) is less than p 0.05, it means there is a significant difference in the mean scores of the two groups. The significance is in favour of the private school teachers who used the innovative instructional materials to teach economics as indicated by the mean scores.

**H03:** There is no significant gender difference in economics teachers’ usage of innovative instructional materials to teach Economics in senior secondary schools in Lagos State Education District V

**Table 5: Results of t-test Analysis on Male and Female Economics Teachers’ Usage of Innovative Instructional Materials to Teach Economics**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Variable**  | **N** | **Mean** | **SD** | **SE** | **t- value****Calc.** | **df** | **P** | **Remark** |
| **Male Teachers** | 100 | 1.81 | 0.39 | .039 | 6.983 | 99 | \*0.00 | S |
| **Female Teachers** | 100 | 1.48 | 0.50 | .050 |  |  |  |  |
| \*Significant at p<0.05 |  |  |  |  |  |  |  |  |

In Table 5, the result revealed that the t- value calculated was 6.983 and p value observed is 0.00 at df =99. Since the P value observed (0.00) is less than p 0.05, it means there is a significant difference in the mean scores of the two groups. The significance is in favour of the male teachers who used the innovative instructional materials to teach economics as indicated by the mean scores.

**Discussion of Findings**

Based on the data generated for this study which was subjected to statistical analysis. The analysis addressed the research questions, formulated hypotheses and the design of the study. The results from data analysis reveals that industrial revolution influence the utilization of innovative instructional materials for teaching economics in senior secondary schools. This analysis also revealed that there is significant difference in the effect on gender.

The outcome of the study is in tandem with those of Chang (2016), who opined that using a blended learning approach, which is the integration of e-learning and classroom-based learning, could increase learners’ satisfaction and performance by about 15% compared to only the classroom teaching approach. In comparison to the traditional face-to-face classroom teaching and learning, the internet and other forms of emerging technology facilitate competency-based and self-directed learning, while increasing the variety, including the speed at which information is provided to learners irrespective of their location (Ng’ambi et al, 2016).

Consistent with Beetham and Sharpe (2019), digital technology is not only facilitating interactions between tutors and learners, but it also augments, as well as transforms, the teaching and learning process. With the rate of diﬀusion and acceptance of technology, especially in many production and service industries, scholars and practitioners in the education sector have questioned the eﬀectiveness and eﬃcacy of technology (Henderson & Bayne, 2024), particularly online teaching, in facilitating teaching and learning. Despite the positive prospects of technology in enhancing teaching and learning by changing the way learners experience studies, the nature of teaching and learning, particularly in higher education (HE), has not been eﬀectively transformed through digital technologies (Beetham & Sharpe, 2019).

The findings further revealed that the usage of audio-visual resources significantly impact on teaching and learning in that they promote better understanding and so create emotional balance which gives room to personality development. Similarly, the findings of the study are in tone with that of Oladejo et al (2011) who worked on instructional materials and students’ academic achievement in physics. They observed that instructional materials perform such functions as the extension of the range of experience available to learners, supplement and complement the teachers verbal explanations thereby making learning experience richer and providing the teacher with a wide variety of learning activities.

The outcome of the study is also in agreement with that of Awolaju (2016), the researcher had investigated the use of instructional materials as it correlates with the academic performance of students in Senior Secondary Schools in Osun State. Findings from the study revealed that students taught with instructional materials performed better than those taught without instructional materials. On the other hand, a study by Ayaz et al (2016) which focused on the effect of using of instructional technology to elementary school students' academic achievement posited a contrary finding to this study. The data collected was subjected to an independent sample t-test to measure the mean difference between the experimental and control groups. The results showed that the use of technology in instruction did not increase student academic achievement.

**Conclusion**

Fourth industrial revolution influences the utilization and adoption of innovative instructional materials on teaching economics in senior secondary schools in Lagos State Education District V and the utilization differs on the basis of school type and teachers’ gender.

**Recommendations**

1. Curriculum planners should encourage the use of the fourth industrial revolution innovative instructional materials by inculcating them in the educational syllabus of all levels of education.
2. Workshop/seminar should be organized for Economics teachers on the effective use of industrial revolution innovative instructional packages in dissemination of knowledge.
3. Economics teachers should, therefore, be encouraged to use industrial revolution innovative instructional packages to teach abstract and difficult concepts, to enhance easy retention and high improved academic performance of by students.

**References**

Awolaju, B. A. (2016). Instructional materials as correlates of students’ academic performance in biology in senior secondary schools in Osun State. *International Journal of Information and Education Technology*, *6*(9), 705-708.

Ayaz, M. F., Şekerci, H., & Oral, B. (2016). The effect of using of instructional technology to elementary school students' academic achievement: A meta-analysis study. *Journal of the Faculty of Education*, *17*(1), 35-54.

Baweja, B., et al. (2016). *Extreme Automation and Connectivity: The Global, Regional, and Investment Implications of the Fourth Industrial Revolution*. London: UBS.

Bayne, S. (2015). What’s the matter with ‘technology-enhanced learning’? Learn. Media Technol, 40, 5–20.

Beetham, H., & Sharpe, R. (2019). An introduction to rethinking pedagogy. In *Rethinking pedagogy for a digital age* (pp. 1-14). Routledge.

Bindé, J., et al. (2005). *Toward Knowledge Societies*. Paris: UNESCO.

Chang, V. (2016). Review and discussion: E-learning for academia and industry. *International Journal of Information Management*, *36*(3), 476-485.

EdX. (2019). *Schools and Partners*. Retrieved from https://www.edx.org/schools-partners

Henderson, W., Homan, H., & Bayne, K. (2024). Experiential Learning Instructional Methods. In *Effective Teaching* (pp. 101-128). Routledge.

Jimoh, A. S., Mohammed, A. O., Lawal-Arogundade, S. O., & Obimuyiwa, G. A. (2024). Effect of the Flipped Classroom Model with Loop Game on Learning Outcomes in Economics Threshold Concepts. *Asian Journal of Assessment in Teaching and Learning*, 14(2), 30–40. https://doi.org/10.37134/ajatel.vol14.2.3.2024

Linney, S. (2019). How Is the Industrial Revolution 4.0 Influencing Higher Education? QS. https://www.qs.com/industrial-revolution-4-0-influencing-higher-education/

Ng’ambi, D.; Brown, C.; Bozalek, V.; Gachago, D.; Wood, D (2016). Technology enhanced teaching and learning in South African higher education–A rearview of a 20 year journey. Br. J.Educ. Technol. 2016, 47, 843–858.

Oladejo, M. A., Olosunde, G. R., Ojebisi, A. O., & Isola, O. M. (2011). Instructional materials and students’ academic achievement in physics: Some policy implications. *European Journal of Humanities and social sciences*, *2*(1).

Oredein A. O. & Obadimeji C. C. (2022). Digital leadership and public primary school teachers’ job performance for sustainable education in Oyo State, Nigeria. *Educational Research Journal (ERJ).* 12 (5): 55 – 64

Penprase, B. E. (2018). The Fourth Industrial Revolution and Higher Education. In N. W. Gleason (Ed.), *Higher Education in the Era of the Fourth Industrial Revolution* (pp. 207–229). Singapore: Palgrave Macmillan. https://doi.org/10.1007/978-981-13-0194-0\_9

Sekiyama, T. (2020). *The Impact of the Fourth Industrial Revolution on Student Mobility from the Perspective of Education Economics*. *Creative Education*, 11(4), 435–446. https://doi.org/10.4236/ce.2020.114031

Shorrocks, A., Davies, J., & Lluberas, R. (2019). *Global Wealth Report 2019*. Zürich: Credit Suisse Research Institute.

World Economic Forum. (2019). *The 4 Biggest Challenges to Our Higher Education Model—and What to Do About Them*. Retrieved from https://www.weforum.org/agenda/2019/12/fourth-industrial-revolution-higher-education-challenges/