

Teachers' pedagogical skills and student readiness and achievement in data processing in senior secondary schools in Ibadan, Nigeria

¹Babatunde Kasim Oladele, ²Modinat Adetutu Laide-Raji

¹Faculty of Education, University of Johannesburg, South Africa

²Institute of Education, University of Ibadan, Nigeria

ABSTRACT

This study investigated the teachers' pedagogical skills, students' readiness, and achievement in data processing in senior secondary schools in the Ibadan metropolis, Oyo State. The correlational design was adopted in this study to establish the relationship among the variables of concern. We used a multi-stage sampling procedure to select samples. Data was gathered using the pedagogical skills rating scale, the student's readiness questionnaire and the data processing achievement test. Data collected from the respondents were analysed using frequency, percentage, graph, Pearson product-moment correlation, and multiple regression analysis. The study revealed the pattern of teachers' pedagogical skills with regard to communication skills, evaluation skills, adaptability skills, inclusivity skills, and compassion skills, with compassionate skills having the greatest percentage of value. The results further show the composite contributions of teachers' pedagogical skills and students' readiness, having a significant contribution to achievement in data processing. Also, there was no significant relative contribution of teacher pedagogical skills, while there was a significant contribution of student readiness to achievement in data processing. It was recommended that the government should not relent in providing appropriate training and seminars to improve teacher pedagogical skills, while students should work hard to attain positive achievement in data processing.

Keywords: Achievement in data processing, teachers' pedagogical skills components, students' readiness, correlation

INTRODUCTION

The rapid progress in computer technology, coupled with its user-friendly nature, has greatly enhanced its attractiveness to a wide range of users. This evolution, paired with the shift of learners to Generation Z in the digital age, necessitates pedagogical adjustments and advancement (Shaari & Kamsin, 2024). Computers have streamlined data processing, making it both accessible and efficient. Consequently, organizations are increasingly reliant on data scientists to meet their unique needs. Data processing serves as a valuable resource for enriching education by providing supplementary materials and resources for classroom instruction. In this data-driven age, educators must adopt creative, innovative, and flexible approaches while being open to adapting teaching strategies to maximize their advantages. Students and teachers are often seen as having more recent experiences of ICT and as being more committed to its use than longer serving teachers (Hammond, Crosson, Fragkouli, Ingram, Johnston-Wilder, Johnston-Wilder, Kingston, Pope & Wray, 2009). The commercial world has been completely transformed by computers, and as a result, data processing is clearly in demand. The need for data processing systems (dedicated computer software for processing) has become the priority of most data processing organisations. Considering the importance of data processing enables the students to acquire a specific skill that will enable them to create jobs and generate wealth or face the challenges of the new millennium.

Data processing is the method by which unprocessed data is transformed into useful information. There are several difficulties when processing the data. Data Processing integration in school is understood as the usage of technology seamlessly for educational processes like transacting curricular content and students working on technology to do authentic tasks (Kainth & Kaur, 2015). Nowadays, ICT facilities are used to deliver lessons in developed countries, and their use has impacted the teaching-learning process positively. The rise of e-learning resources, educational software, the use of the Internet in education, and the establishment of state databases for student information have led to the creation of extensive repositories of educational data (Romero & Ventura, 2024). The integration of Data Processing (DP) into secondary school education has become increasingly important in preparing students for the digital age. According to a study by Shavinina (2016), students' ability to understand and efficiently use ICT tools was greatly impacted by their past understanding of computer hardware and software. Research

indicates that students who possess a solid foundation in fundamental computer literacy and digital abilities are more likely to be prepared for data processing (Siu, 2017).

The objectives of data processing, as stated by the Nigerian Educational Research and Development Council (2009), are to equip learners with fundamental skills in data management, utilise computers for efficient business transactions, and develop a proficient level of competence in ICT applications that will foster entrepreneurial abilities in students. Data processing is a versatile discipline with wide-ranging applications across several sectors, such as business, education, healthcare, and research. The significance of these disciplines, such as data science, machine learning, artificial intelligence, data quality, and data security, is growing in tandem with their advancements (Omoniyi & Quadri, 2003). However, the inclusion of data processing as a subject of trade is to align with the objectives of the National Empowerment and Economic Development Strategy (NEEDS). These objectives include promoting a change in values, eliminating poverty, creating employment opportunities, generating wealth, and utilising education to empower the population. Therefore, it is crucial to implement teaching methods that encourage active participation and involvement from students to enhance their preparedness and success in the field of data processing.

Teachers must be educated with pedagogical expertise, particularly in the use of various types of educational technology (Omar & Mohmad, 2023), as well as become more creative and flexible in providing instruction (Danuri et al., 2021). Extensive research has demonstrated the advantages of data processing in education, which undeniably impacts teaching and learning. Data processing in education significantly enhances teaching and learning outcomes. It enables personalised learning experiences, allowing educators to customise their instructional strategies to meet diverse student needs (Elbouknify et al, 2025; Sajja et al ,2023). Learning analytics play a crucial role in identifying students at risk of academic failure early, thereby improving retention and success rates. Moreover, data processing supports informed decision-making by providing actionable insights based on student performance metrics and behavioural trends. Information and Communication Technology (ICT) tools increase operational efficiency by automating tasks such as student registration and resource allocation (Romero & Ventura, 2024).

Multiple challenges hinder the teaching and learning of information and communication technology (ICT), which data processing is one of the components in secondary schools in Nigeria.

One major hindrance is the insufficient proficiency of ICT teachers to effectively execute the ICT curriculum in secondary schools (Kabiru & Sakiyo, 2013). Access to ICT is a key issue in encouraging teachers to use ICT (Selwood & Pilkington, 2005). Integrating Information and Communication Technology (ICT) into education can greatly enhance teaching and learning. However, challenges like inadequate infrastructure, limited teacher training, and resistance to change hinder effective ICT integration. Research in Sri Lanka indicates that teachers generally possess positive attitudes toward ICT, but poor infrastructure and a lack of professional development opportunities limit its effective implementation (Palagolla & Wickramarachchi, 2019). Also, artificial intelligence through adaptive learning systems and automated grading tools reduces educators' workload and enhances instructional responsiveness. It is satisfying to affirm that the present global trend in education is to investigate the benefits that data processing brings to the teaching and learning process.

Teachers can assess students' preparedness through periodic screenings or evaluations and use this data to modify instructional approaches and learning activities. Gandhi (2010) cites Thorndike's law of readiness, which states that learning occurs when there is a state of preparedness for action, achieved through preliminary modification, deposit, or attitude. A study indicated that students with elevated self-efficacy exhibit a strong belief in utilising information and communication technology (ICT) tools and resources to showcase a higher level of preparedness (Law, Pelgrum, & Plomp, 2008). Maswati & Krismiyati (2020) reported that students' readiness to learn is influenced by the learning environment and the teacher's ability to adapt pedagogical strategies to meet students' needs. Studies have shown that students' prior knowledge has a more substantial impact on their final performance than their socio-economic backgrounds. Furthermore, the long-term influence of teachers on students' prior knowledge highlights the importance of effective teaching practices (Polymeropoulou & Lazaridou, 2022). The reform of the senior secondary school curriculum is a significant move towards the goal of building a robust and self-sufficient society with a thriving and dynamic economy that offers many possibilities for its residents (Osuafor, 2012).

Pedagogical competence deals with teaching skills, including teaching techniques, curriculum development and assessment (Irmawati et al., 2017). Pedagogical competency refers to the ability to teach by starting with familiar concepts and progressing to unfamiliar ones;

beginning with tangible examples and moving towards more abstract ideas; and starting with basic concepts and gradually introducing more advanced ones. Competence is broadly defined as a combination of cognitive, affective, motivational, volitional, and social dispositions that form the basis for performance (Zlatkin-Troitschanskaia et al., 2016).

Pedagogical competence significantly influences student achievement, as demonstrated in studies across different subjects and regions (Mohammed, Ado & Ibrahim, 2023; Adeyemi, 2020). Padagas (2019) stated that improving teacher education contributes much to the realisation of the goals set for the whole educational system. The relationship between teachers' pedagogical skills and student achievement is evident in various subjects, including data processing, where effective teaching methods can lead to improved student outcomes (Mercado, 2022). Hathaway and Fletcher (2018) highlighted the importance of preparing teachers with the awareness to appropriately discern differences among learners to negotiate the pedagogical challenges related to the impact of learner diversity. In the context of teaching techniques, they utilise various strategies such as independent learning, differentiated learning, and interactive or collaborative learning. Self-regulated learning has a positive effect on academic outcomes (Dignath and Büttner, 2018). Also, teachers' pedagogical communication skills, such as building rapport and varying teaching methods, are important for creating a supportive learning environment (Akinbode, Aderanti & Ayodele, 2023).

Effective teaching requires a combination of skills, including set induction, closure, use of examples, and questioning, which are essential for engaging students and facilitating understanding (Umoh, 2024). The instructional strategies and pedagogical approaches used by educators have a considerable impact on students' preparedness and success in data processing. In research done in Malaysia, the results revealed that implementing student-centred and inquiry-based learning methodologies enhanced students' ICT skills (Hakim & Ting, 2017). Law, Pelgrum, and Plomp (2008) wrote a book at the University of Hong Kong that revealed that project-based learning and group projects, when utilising information and communication technology (ICT), enhance student engagement, foster critical thinking, and facilitate problem-solving. Internationally, educational systems are embracing innovative technology to integrate data processing into the instructional and learning process to equip students with the requisite information and abilities in their respective fields. The teaching profession is transitioning from a

focus on teachers to a focus on students in the design of learning environments. Student readiness, in a broad sense, refers to a learner's capacity to acquire knowledge and make behavioural changes that result in effective and successful outcomes. A well-prepared student for a course will not only have the essential information and skills required to confidently grasp the topic being taught but also demonstrate open-mindedness and a strong desire to learn. Santrock (2012) stated that students who show a great level of readiness and excel academically are less likely to feel frustrated in the classroom because they can complete their tasks efficiently, have positive self-perceptions, and show a strong enthusiasm for learning compared to students who struggle with learning.

Pedagogical skills encompass a teacher's ability to effectively deliver content, engage students, and adapt teaching methods to suit diverse learning needs. These skills are crucial in fostering an environment conducive to learning, which in turn affects students' readiness and achievement. This research highlights the importance of these skills in various educational contexts, emphasising their role in enhancing student performance. This study, therefore, investigated teachers' pedagogical skills, students' readiness and achievements in data processing in senior secondary school to ascertain the status of both teachers and students concerning the variables of concern. The following research questions were asked, and answers were provided.

1. What is the pattern of teacher pedagogical skills in senior secondary schools in Ibadan Metropolis, Nigeria?
2. What are the composite contributions of teachers' pedagogical skills and students' readiness to achievement in data processing in senior secondary schools in Ibadan Metropolis, Nigeria?
3. What are the relative contributions of teachers' pedagogical skills and students' readiness to achievement in data processing in senior secondary schools in Ibadan Metropolis, Nigeria?

METHODOLOGY

The study adopted a correlational design to ascertain the relationship that exists among the variables of the study. The variables of the study include the independent variables which are teacher pedagogical skills and student readiness, and the dependent variable, which is achievement in data processing without any manipulation. The population of the study comprised students in all the senior secondary school students who offered data processing in the Ibadan Metropolis of Oyo State. A multistage sampling procedure was used to select samples for the study. In Ibadan, there are two educational zones, which are Ibadan Metropolis and Ibadan Less City. A purposive

sampling technique was used to select Ibadan Metropolis because of the availability of ICT facilities in the school located in the zone. A simple random sampling technique was used to select two Local Government Areas (LGAs) from the five LGAs in the zone. The two Local Government Areas selected are Ibadan Southwest and Southeast. Also, a simple random sampling technique was used to sample five schools each from the two selected LGAs, totalling 10 schools, and a simple random sampling technique was used to select 40 students each from the ten schools. The envisaged sample size was 400, but 387 students finally participated in the study.

The following three instruments were used to collect data: the Teacher Pedagogical Skills Rating Scale (TPRS), the Student Readiness Questionnaire (SRQ) and the Data Processing Achievement Test (DPAT). Some constructs captured by the TPRS instruments include teachers' communication skill, evaluation skill, adaptability skill, inclusive skill and compassion skill. The SRQ instrument captured statements such as "I make myself prepared for the data processing subject", "I actively participate in the discussion and/or clarifying things I did not know", "I always keen for data processing class", and Data processing is my best subject

The data processing achievement test was used to assess the students' ability in data processing. Items for the data processing achievement test were adopted from the standardised 2021 test items of the West Africa Examinations Council (WAEC). The Teacher Pedagogical Rating Scale (TPRS) and Student Readiness Questionnaire (SRQ) instrument's reliability coefficients were established using the Cronbach Alpha method, while the Data Processing Achievement Test (DPAT) reliability coefficient was established using the Kuder Richardson reliability method 20 for revalidation of the test item. The reliability estimates from the collected data for the instruments are as follows: Teacher Pedagogical Rating Scale ($r = 0.90$), Student Readiness Questionnaire ($r = 0.87$), and Data Processing Achievement Test ($r = 0.72$), respectively.

Also, informed consent was sought from all the respondents and the school authorities. ethical approval was obtained from the school authorities and students who participated in the study before conducting the study to ensure the protection of participants' rights and confidentiality. Data collected were analysed using frequency, percentages, Pearson product movement correlation and multiple regression at $\alpha = 0.05$ level of significance.

RESULTS AND FINDINGS

Table 4.1: Socio-Demographic Distribution of Students

Variable	Frequency	Percent
Gender		
Male	154	41
Female	230	59
Total	387	100
Age		
14-16	337	87
17-19	48	12
20 and above	2	6
Total	387	100

Table 4.1 revealed that 41% of the students are male and 59% are female. This indicated that there are more female students than male students in the school sampled. For the age distribution of the respondents, 87% are between 14 and 16 years old, while 12% are between 17 and 17 years old, and 6% are between 20 and above. This indicates that most of the students are between the ages of 14 and 16, which is the stipulated age for this level of education. The analysis of the sociodemographic data suggests that there is a greater representation of female students in the sampled population because 41% of the students are male and 59% of the students are female. Given that prior research frequently emphasizes gender-based disparities in academic performance, study habits, and learning readiness, this gender distribution may have an impact on findings about readiness and achievement.

Most respondents are in the typical age range for secondary education, with 87% of students being between the ages of 14 and 16. This implies that the results will primarily represent the preparedness and performance of pupils in this age range. The small proportion of older pupils (6% over the age of 20 and 12% between the ages of 17 and 18) may be a sign of delayed academic progress or other factors affecting school attendance, which could influence their readiness and

achievement differently from younger peers. The results of the statistical analysis conducted in this study and answers to the research questions raised are presented as follows:

Research Question #1: What is the pattern of teacher pedagogical skills in senior secondary schools in the Ibadan metropolis?

The result of the analysis of the pattern of the teacher's pedagogical skills is presented in Table 4.2.

Table 4.2: Analysis of Students' Responses on the Pattern of Teachers' Pedagogical Skills

S/N	Statement	Excellent		Good		Moderate		Poor	
		N	%	N	%	N	%	N	%
A	Communication								
1.	Convey ideas and information orally	210	54.3	134	34.6	30	7.8	13	3.4
2.	Teaching resources are well-organised	214	55.3	117	30.2	42	10.9	14	3.6
3.	Check students' work at regular intervals	226	58.4	119	30.7	29	7.5	13	3.4
4.	Ability to speak professionally and articulately	184	47.5	148	38.2	35	9.0	20	5.2
5.	Ability to be an empathetic listener	177	45.7	145	37.5	41	10.6	24	6.2
6.	Ability to provide accurate and comprehensive explanations and answers	213	55.0	123	31.8	27	7.0	24	6.2
B	Evaluation								
7.	Identify what and how the student is thinking and learning	152	39.3	139	35.9	77	19.9	18	4.7
8.	Identify the student's level of knowledge, skills and understanding	174	45.0	156	40.3	39	10.1	18	4.7
9.	Identify strengths and weaknesses in students' work	196	50.6	112	28.9	57	14.7	22	5.7
10.	The materials provided were helpful	179		150	38.8	34	8.8	24	6.2
11.	The information was clear and understandable	202	52.2	127	32.8	26	6.7	32	8.3

Teachers' pedagogical skills and student readiness and achievement in data processing in senior secondary schools in Ibadan, Nigeria

C Adaptability									
12.	Making use of well-designed (existing) resources	152	39.3	145	37.5	61	15.8	29	7.5
13.	Building in additional practice	162	41.9	139	39.5	58	15.0	28	7.2
14	Reframing questions to provide greater scaffolding	173	44.7	145	37.5	44	11.4	25	6.5
15	Plan to connect new content with students' existing knowledge	188	48.6	131	33.9	37	9.6	31	8.0
16.	See opportunity where others see failure	163	42.1	121	31.3	72	18.6	31	8.0
17.	Quickly and easily adjust their teaching methods to meet the needs of students	199	54.4	119	30.7	40	10.3	29	7.5
18.	Able to motivate others despite setbacks	192	49.6	124	32.0	40	10.3	31	8.0
D Inclusivity									
19	Create a safe learning environment	229	59.2	121	31.3	22	5.7	15	3.9
20	Diversify learning materials	152	39.3	153	39.5	62	16.0	20	5.2
21.	Taking students' needs into account	157	40.6	131	33.9	54	14.0	45	11.6
22.	Develop a rapport with each other	149	38.5	153	39.5	55	14.2	30	7.8
23	Offer an open and welcoming environment	176	45.5	128	33.1	56	14.5	27	7.0
25	Actively work to combat biases	160	41.3	143	37.0	59	15.2	25	6.5
E Compassion									
26	Greet students by name	196	50.6	121	31.3	41	10.6	29	7.5
27	Ask about students' work	161	41.6	133	34.4	52	13.4	41	10.6
28	Create a safe and supportive environment	196	50.6	128	33.1	38	9.8	25	6.5
29	Say encouraging words	188	48.6	108	27.9	48	12.4	43	11.1
30	Show care about what is happening in students' lives in and out of the classroom	195	50.4	110	28.4	50	12.9	32	8.3
31	Forgiveness for mistakes	151	39.0	136	35.1	57	14.7	43	11.1
32	Awareness of students' feelings	137	35.4	149	38.5	62	16.0	39	10.1

33	Respectful behaviour toward the teachers, peers, and the classroom	192	49.6	121	31.3	50	12.9	24	6.2
----	--	-----	------	-----	------	----	------	----	-----

Table 4.2 shows that students generally support teachers' ability to convey ideas and information orally, with 54.3% of them expressing positive opinions. Teachers receive praise for their ability to organize teaching resources, regularly check student work, speak professionally, listen emphatically, provide accurate explanations, identify students' thinking and learning levels, incorporate additional practice, reframe questions, plan new content, recognize opportunities where others perceive failure, and adapt teaching methods to meet students' needs.

Students also appreciate teachers' ability to create a safe learning environment, with 31.3% rating them as good, 5.7% as moderate, and 3.9% as poor. They also appreciate teachers' ability to diversify learning materials, take students' needs into account, develop rapport with each other, and offer an open and welcoming environment. Teachers also focus on boosting and maintaining student motivation, actively working to combat biases, greeting students by name, asking about students' interests, creating a safe and supportive environment, saying encouraging words, showing care about students' lives in and out of the classroom, forgiveness for mistakes, awareness of students' feelings, and respecting their behaviour towards teachers, peers, and the classroom.

In terms of teaching resources, 55.3% of students rated them as excellent, with 30.2% rating them as good, 10.9% as moderate, and 3.6% as poor. Students praise teachers for their professional speaking, empathic listening, accurate explanations and answers, ability to identify students' strengths and weaknesses, provision of helpful materials, and use of well-designed resources.

Furthermore, students appreciate teachers' ability to quickly and easily adjust their teaching methods to meet their needs, with 49.6% stating they can motivate others despite setbacks. Overall, students generally support teachers' ability to create a supportive and engaging learning environment, fostering a positive learning environment for all students.

For a better picture of the pattern of the teacher's pedagogical skills, a graphical presentation is provided in Figure 1.

Teachers' pedagogical skills and student readiness and achievement in data processing in senior secondary schools in Ibadan, Nigeria

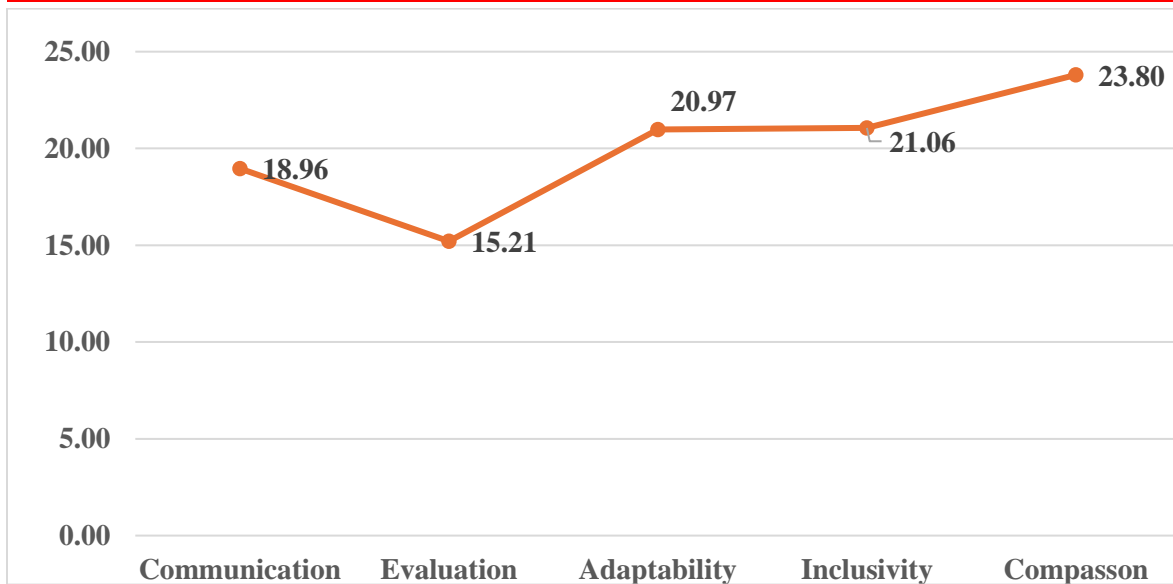


Figure 1: Pattern of the teacher's pedagogical skills

It could be concluded from Figure 1 that the data processing teachers in the school sampled are compassionate and motivational to the students with regards to 23.80% and 21.06% responses received from the students concerning their teacher pedagogical skills.

Research Question #2: What is the composite contribution of a teacher's pedagogical skills and a student's readiness to achievement in data processing?

Table 4.5: Summary of Regression Analysis of Composite Contribution of Teacher

Pedagogical Skills and Student's Readiness on Achievement in Data Processing

Model Summary					
R	=	0.14			
R Square	=	0.19			
Adjusted R Square	=	0.01			
Std Error of the Estimate	=	18.91			
ANOVA					
	Sum of Squares	Df	Mean Square	F	P-Value
	2658.18	2	1329.09	3.72	0.03*

Regression			
Residual	137291.33	384	357.53
Total	130049.51	386	

*Significant at $p < 0.05$, NS= Not Significant, $p > 0.05$

Table 4.5 shows that the co-efficient of regression $R = .14$ which is the combined relationship and adjusted $R^2 = 0.19$ indicating a positive contribution of 1.9% on the variance to contributing to achievement in the data processing. In addition, the results show the contributions of teachers' pedagogical skills and students' readiness having significant contributions ($F_{(2,386)} = 3.72, p = 0.03$) to achievement in data processing. This implies that both the teacher's pedagogical skills and the student's readiness contribute to the student's achievement in data processing when combined.

Research Question #3: What is the relative contribution of teachers' pedagogical skills and student readiness to achievement in data processing?

Table 4.6 Relative Contribution of Teachers' Pedagogical Skills and Student Readiness to Achievement in Data Processing

Unstd Model Coefficients	Std Coefficients	Std Error	Beta	t	P-value	Tolerance	VIF
(Constant)	71.84	8.50		8.44	0.00		
Pedagogical Skills	0.13	0.10	-0.07	-1.26	0.21	0.96	1.04
Students Readiness	0.14	0.07	-0.11	-2.14	0.03*	0.95	1.04

*Significant at $p < 0.05$, NS= Not Significant, $p > 0.05$

Table 4.5 shows that there is no significant relative contribution of teacher pedagogical skills ($\beta = -.07$; $p = 0.21$) while there is a significant contribution of student readiness ($\beta = -.11$; $p = 0.03$) to achievement in the data processing. This implies that only student readiness has a relative contribution to achievement in data processing. In addition, the independent variables do not have any multicollinearity as the tolerance values are not less than 0.1 and the variance inflation factor values are not greater than 10. This indicates that teacher pedagogical skills and student readiness are not correlated but only make a significant relative contribution to data processing.

Discussion

The findings from the data analysis showed that the five components of the teacher's pedagogical skills investigated in the study contributed considerably to the students' achievement in data processing. Poonsook (2013) stated that student prosperity relies on the measure of discovering what happens in the classrooms. From the graphical representation of the pattern of the teacher's pedagogical skills, it was observed that compassion-based skills made the highest contribution to the students' achievement in data processing. This is in line with what Chuleepon (2011) disclosed that for students to perform well in any examination, one of the requirements is that their educators must know them and have significant information about their physical, scholarly and mental preparation. Based on the result, it implies that the compassion-based teacher pedagogical skill observed in this study shows a great extent of positive impact on students' data processing achievement. This also supports the findings of Omoniyi and Quadri (2003) that most secondary school teachers lack the necessary ICT proficiency. The findings of research question #2 showed that the independent variables in the study contributed 1.9% to the variance of contributing to the achievement of students in data processing. That implies that a combination of teachers' pedagogical skills and students' readiness are predictors of students' achievement in data processing.

Research question #3 revealed that both teachers' pedagogical skills and students' readiness impact student achievement in data processing. The results showed that student readiness contributed significantly, but the second predictor-teacher pedagogical skill, did not contribute significantly to the model. Therefore, student readiness is a more potent predictor of a student's achievement in data processing than a teacher's pedagogical skill. This finding opposes prior research suggesting that teachers' pedagogical abilities largely influence students' performance in

data processing. These findings emphasised the importance of students' readiness to achieve in data processing. The study of König and Kramer (2016) found that classroom management expertise can be empirically separated from general pedagogical knowledge, although the two constructs are positively intercorrelated.

Research consistently highlights the significant impact of teachers' pedagogical skills on student achievement. The Technological Pedagogical Content Knowledge (TPACK) framework, developed by Mishra and Koehler (2006), emphasizes the importance of integrating technology, pedagogy, and content knowledge for effective teaching. Doukakis et al. (2021) in their study assessing in-service computer science teachers revealed that, while content and technological knowledge were rated highly, there was less confidence in pedagogical content knowledge. This indicates a need for balanced development across all TPACK domains. Roddun (2010) and Nague (2011) have found evidence suggesting that the level of competence in the professional development of ICT teachers is insufficient. This calls for urgent attention to the pedagogical skills of teachers who teach data processing.

Conclusion and Recommendations

From the findings of the study, it was observed that there are positive relationships among teachers' pedagogical skills, student readiness, and achievement in data processing. Therefore, when teachers gear up efforts in using appropriate pedagogical skills and students see themselves as available to learn, or when students are ready to learn, it will improve students' achievement as additional knowledge will be acquired in the process. Moreover, since the finding of the study reveals that there was a significant relationship between pedagogical skills and student achievement, the government should employ more teachers who have the required skills to teach data processing as one of the entrepreneurship subjects, students should develop positive attitude and readiness towards learning and teachers should collaborate with their colleagues who have better skills in the subject areas to discharge duties correctly and appropriately.

Limitations and Suggestions for Further Studies

The study has limitations, including gender imbalance, age distribution bias, and sample size. The higher proportion of female respondents (59% compared to 41%), which may limit the generalizability of the results to mixed-gender populations, may not fully capture older students' perspectives, readiness, and achievements. The results may not reflect broader trends in other

schools or regions if conducted within a single school or limited geographical area. Other factors, such as socioeconomic background, learning environment, parental support, or prior academic performance, could significantly influence readiness and achievement. Self-reported data may also be a risk of response bias. Suggestions for future studies include expanding the sample size, achieving a more balanced gender representation, broadening the age range, incorporating additional variables, conducting longitudinal studies, using objective measures, exploring gender differences, and analyzing intervention effectiveness. These measures will help to ensure that the findings are equally applicable to both male and female students and provide insights into how these factors evolve as students' progress through their education.

References

- Adeyemi, B. A. (2020). Teachers' Effectiveness and Students' Academic Achievement in Senior Secondary School Civic, Osun State, Nigeria. 7(2), 99–103. <https://doi.org/10.20448/JOURNAL.500.2020.72.99.103>
- Akinbode O. E., Aderanti R. & Ayodele, K. O. (2023). Principals' administrative skills and teachers' productivity in public senior secondary schools, Alimosho Local Government, Lagos State, Nigeria. *Canadian Journal of Educational and Social Studies*, 3(4). <https://doi.org/10.53103/cjess.v3i4.154>
- Bachmann, H. 2018. *Competence-oriented teaching and learning in higher education: essentials*. hep, der Bildungsverlag.
- Chuleepon, D. (2011). A study of students' ability in life skills based on a core curriculum of basic education in 2008 in Assumption Primary School, 2011 academic year. Bangkok: Assumption Primary School. Research Policy, Research Series No. 77.
- Danuri, M., Radzi, H. M., & Abd Rahman, R. O. H. I. Z. A. H. (2021). Student Readiness towards Online Learning During Movement Control Order (MCO) in Malaysia: A Descriptive Analysis. *Akademika*, 97-107.
- Dignath, C., and Büttner, G. (2018). Teachers' direct and indirect promotion of self-regulated learning in primary and secondary school mathematics classes—insights from video-based classroom observations and teacher interviews. *Metacognition and Learning*, 13(2): 127-157.

- Doukakis, S., Psaltidou, A., Stavradi, A., Adamopoulos, N., Tsiotakis, P., & Stergou, S. (2021). Measuring the technological pedagogical content knowledge (TPACK) of in-service teachers of computer science who teach algorithms and programming in upper secondary education. *arXiv* (Cornell University). <https://doi.org/10.48550/arxiv.2105.09252>
- Elbouknify, I., Berrada, I., Mekouar, L., Iraqi, Y., Bergou, E. H., Belhabib, H., Nail, Y., & Wardi, S. (2025). AI-based identification and support of at-risk students: A case study of the Moroccan education system. *arXiv preprint arXiv:2504.07160*. <https://arxiv.org/abs/2504.07160>
- Gandhi, D. P. (2010). Thorndike's laws of learning and its educational implications. *Educational Psychology*. Retrieved from <http://www.dgwaymade.blogspot.com/2010/10/thorndikes-laws-of-learning-andits.html>.
- Hakim, L., and Ting, T. (2017). The effect of inquiry-based learning on students' ICT literacy and self-directed learning skills. *Malaysian Online Journal of Educational Technology*, 5(3), 1-13.
- Hammond, M., Crosson, S., Elpiniki Fragkouli, Jennifer Ingram, Peter Johnston-Wilder, Sue Johnston-Wilder, Yvette Kingston, Melanie Pope & David Wray (2009). Why do some student teachers make very good use of ICT? An exploratory case study, *Technology, Pedagogy and Education*, 18:1, 59-73, DOI: 10.1080/14759390802704097
- Hathaway, T., and Fletcher, P. (2018). An investigation of K-6 preservice teachers' ways of experiencing the teaching of diverse learners using phenomenography. *Educational Research for Policy and Practice*, 17(2): 83-104.
- Irmawati, D. K., Widiati, U., and Cahyono, B. Y. (2017). How do Indonesian professional English teachers develop their pedagogical competence in teaching implementation? *Arab World English Journal*, 8(2): 293-307.
- Kabiru, M. B & Sakiyo, J. (2013). Assessment of ICT teachers' competence to implement the new ICT curriculum in Northeastern Nigeria. *Journal of Education and Practice*, 27:10-20.
- Kainth, K., & Kaur, H. (2015). UK Essays: Integrating ICT in the teaching and process. Retrieved from <https://www.ukessays.com/essays/education/integrating-ict-in-the-teaching-land-learning-process-education-essay.php>

- Khan, S. (2020). The digital divide and student performance: Evidence from a randomized experiment in rural Pakistan. *American Economic Journal: Applied Economics*, 12(2), 333-363.
- König, J., & Kramer, C. (2016). Teacher professional knowledge and classroom management: On the relation of general pedagogical knowledge (GPK) and classroom management expertise (CME). *ZDM*, 48(1-2): 139-151.
- Law, N., Pelgrum, W. J., & Plomp, T. (2008). *Pedagogy and ICT use in schools around the world: Findings from the IEA SITES 2006 study*. Springer.
- Maswati, S. F., & Krismiyati, K. (2020). The effect of teacher's pedagogical competence on students' learning achievement. *PINISI Discretion Review*, 1(1), 155. <https://doi.org/10.26858/pdr.v1i1.13407>
- Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: a framework for teacher knowledge. *Teachers College Record the Voice of Scholarship in Education*, 108(6), 1017–1054. <https://doi.org/10.1111/j.1467-9620.2006.00684.x>
- Mercado, H. A. R. (2022). Instructional competence and students' academic performance in senior high school. *International Journal of Education, Humanities and Social Science*, 05(02), 01–10. <https://doi.org/10.54922/ijehss.2022.0360>
- Miller, A. D., Ramirez, E. M., & Murdock, T. B. 2017. The influence of teachers' self-efficacy on perceptions: Perceived teacher competence and respect and student effort and achievement. *Teaching and Teacher Education*, 64, 260-269.
- Mohammed, T., Ado, Z., & Ibrahim, A. (2023). Influence of Learning Environment and Teachers Skills On Academic Achievement Among Senior Secondary Schools Students in Jigawa State Nigeria. *British Journal of Multidisciplinary and Advanced Studies*. <https://doi.org/10.37745/bjmas.2022.0342>
- Naugue, C.R. (2011). *Guidelines for Successful Integration of ICT in Schools in Cameroon*. Nelson Mandela Metropolitan University, South Africa.

- Omar, M. K., & Mohmad, I. R. (2023). Pedagogy, ICT skills, and online teaching readiness as factors on digital competency practices among secondary school teachers in Malaysia. *Asian Journal of Vocational Education and Humanities*, 4(1), 1-9.
- Omoniyi, T. & Quadri A.T. (2003), Perceived competence of Nigerian Secondary School Teachers in the use of Information and Communication Technology (ICT) *Journal of Education and Practice*, 4, (10), 157 – 164.
- Osuafor, A. (2012). Implementation of the Nigerian New Senior Secondary Education Curriculum structure: Prospects. Challenges and the Way Forward for Sustainable Development. *International Journal of Education, Science and Public Policy in Africa*. Vol 1PP90-97 ISSN 2158- 5598-2158-558X-.
- Padagas, R. C. (2019). Pre-service teachers' competencies in a work-based learning environment. *African Educational Research Journal*, 7(3): 130-142.
- Palagolla, W. W. N. C. K., & Wickramarachchi, A. P. R. (2019). Promoting effective application and management of ICT to enhance performance in secondary schools. *arXiv.org*. https://arxiv.org/abs/1901.01579?utm_source=chatgpt.com
- Polymeropoulou, V., & Lazaridou, A. (2022). Quality teaching: Finding the factors that foster student performance in junior high school classrooms. *Education Sciences*, 12(5), 327. <https://doi.org/10.3390/educsci12050327>
- Poonsook, U. (2013). Causal analysis and effect on teachers' competency development in Southern Region based on professional standard in process of knowledge management development. *Curriculum and Instruction*, Faculty of Education, Taksin University.
- Rodden, N.B. (2010). An investigation into the barriers Associated with ICT use in the Youth reach Classroom. A Case study of a centre for Education in the Northwest. University of Limesick.
- Sajja, R., Sermet, Y., Cwiertny, D., & Demir, I. (2023). Integrating AI and Learning Analytics for Data-Driven Pedagogical Decisions and Personalized Interventions in Education. *arXiv preprint arXiv:2312.09548*. <https://arxiv.org/abs/2312.09548arXiv>

- Santrock, J. W. (2012). *Life-Span Development (Perkembangan Masa Hidup) Jilid I*. Jakarta: Penerbit Erlangga.
- Selwood, I., & Pilkington, R. (2005). Teacher workload: Using ICT to release time to teach. *Educational Review*, 57(2), 163–174.
- Shaari, F., & Kamsin, I. F. (2024). Quantitative analysis of students and teachers readiness for flipped classroom in matriculation. *International Journal of Academic Research in Business and Social Sciences*, 14(5). <https://doi.org/10.6007/ijarbss/v14-i5/21724>
- Shavinina, L. V. (2016). Readiness for learning in virtual worlds: Perspectives of students in a blended teacher education program. *Journal of Interactive Learning Research*, 27(4), 311-333.
- Siu, A. F. Y. (2017). Factors influencing university students' computer and information literacy: Implications for tertiary curriculum. *Interactive Technology and Smart Education*, 14(3), 220-235.
- Umoh, U. E. (2024). Teachers' pedagogical skills and implementation of Trade/Entrepreneurship subjects in senior secondary schools in UYO Education Zone, Nigeria. *Advances in Social Sciences and Management*, 2(5), 01–14. <https://doi.org/10.63002/assm.25.441>
- West African Examinations Council (2021), *Data Processing Multiple Choice Questions*.
- Zlatkin-Troitschanskaia, O., Pant, H. A., & Coates, H. (2016). Assessing student learning outcomes in higher education: challenges and international perspectives. *Assessment & Evaluation in Higher Education*, 41(5), 655–661.
<https://doi.org/10.1080/02602938.2016.1169501>.