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ASSOCIATION BETWEEN POSSESSION OF BIG DATA ANALYTIC SKILLS AND MOTIVATION AMONGST MEASUREMENT EXPERTS: THE MEDIATING ROLES OF JOB EXPERIENCE AND JOB STATUS

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Abstract

The possession of big data analytic skills has become critical competency across all areas of life, hence the demand for experts skilled in it has increased. This study aimed at exploring the association between possession of big data analytic skills and motivation amongst measurement experts in Nigerian universities and the mediating roles of job experience and status. Non-experimental design of correlational research was adopted for the study. Population comprise 235 measurement experts in the 265 universities in Nigeria and used for the study. Two instruments - Evaluators' Job Motivation scale (EJMS) and Big Data Analytic Checklist (BDASC), were used for data collection with reliability estimates of .88 and .76 respectively. One research question guided the study and three hypotheses were tested at 0.05 level of significance. The research question of the study was answered using descriptive statistics (Percentage) while inferential statistics using Model 4 of Hayes macro process in SPSS was used to answer the hypotheses at 0.05 significance level. The findings of the study revealed that a greater percentage of measurement experts in Nigerian universities do not possess and apply 4 out of the 6 big data analytic skills explored in this study such as statistical programming language, machine learning, quantitative analysis and data mining. We also found that job experience and status of measurement experts differently and jointly partially mediated the relationship between motivation and acquisition and application of big data analytic skills. It was recommended amongst others that motivation, upskilling of lecturers should be given needed attention.

Keywords: Analytic skills, Big data, Job experience, Measurement experts, Motivation

Introduction

Today's education undoubtedly depends on technology. Educators and administrators previously used student information and learning management systems (LMSs), with enrollment and admissions management systems to improve and streamline classroom and university operations. More recently, institutions have implemented digital learning systems, e-assessments, online curricula and digital whiteboards to promote teaching and learning. This has given rise to gathering enormous data. Big data (BD) which is byproduct of integrating technology into the classroom is the real game changer for education now because of its tremendous volume, variety and speed (Chakray, 2021; Esomonu Esomonu & Eleje, 2020; Ugodulunwa & Esomonu, 2022). As universities continue to embrace the digital learning systems, large and useful data is generated, which empowers lecturers, students and other stakeholders in education to assess, solve problems and make better decisions that enhance global change. The major aim of gathering and analyzing big data is to develop applicable intuitions that can lead to novel, all-inclusive transformation and basic change in decision-making, productivity, growth, achievement, efficiency and allow for a long-term vision and new knowledge to establish competitive advantages (Bughin, 2016). When big data is collected and shared in educational systems, it can provide usable, vast insights that allow institutions and government organisations to link student, teacher and school performance (Sharma, 2022), and provide associates with

insight into student progress and drifts that affect present and upcoming resource needs, real-time impact on decisions on curriculum structure and instruction (Reid-Martinez, 2015).

Big data can only yield the needed change when it is refined by specialists to provide insights that can lead to better ways of solving problems, making decision for improved productivity (Allen & Socialclimb, 2021; Bughin, 2016). The big data analysis can be for the purpose of diagnosis, formative, summative, descriptive, predictive, or prescriptive (Kvartalnyi, 2022; Maryville, 2022; Autio, 2021). The multifaced nature of BD has also brought about arguments that performing analyses and getting insights from it require scaling up of hardwares and softwares (Singh & Reddy, 2015) and also equipping people with new skills (Ransbotham et al., 2016). Furthermore, BD can transform the worth of skills by downkilling some workers and requiring experts with new and different ones (Schildt, 2017). Due to the limited research in the domain of data analytics skills possession and use (Anikweze et al., 2019), this study aims to provide empirical evidence about big data analytics skills possessed and applied by lecturers in educational measurement in Nigerian universities as well as the association of motivation, job experience and job status on acquisition and application of BDA skills they possess.

However, these potentials can be achieved when the right technique is applied and data is handled by competent analysts who have the required data analytics skills (Lotame, 2021). Big data analysts who reveal and analyse hidden data trends and patterns to problem-solving help universities assess and formulate informed critical academic decisions. In spite of its promise, lack of competence in BDA could pose a lot of challenges and risks. To Ramachandran and Watson (2021), we need experts, not just people who can build an effective model but who understand and know how to explore and link databases and can containerize models, convert them into application programming interface and embed them into working devices, that is, people who can analyse datasets so it can be used in real-world cases. In view of this, analysis of big data requires knowledge and skills in technical, managerial, and analytical areas than mere predecessor technologies or conceptual data modeling (Comuzzi, 2016; CXO, 2022; Dubey & Gunasekaran, 2015) mostly in technology developing nations like Nigeria (Anikweze et al., 2019). It is also required because of the large volume of data that is too difficult for traditional tools to capture, save and refine. Different researchers have proposed statistical programming languages, machine learning, quantitative analysis, data mining, critical thinking, data visualization and interpretation as top must-have data analytic skills needed to stay competitive in the job market (Chakray, 2022; Coursera, 2022; Davies, 2021; Kvartalnyi, 2022; O'Connor, 2020).

Statistical programming languages involve using special e-languages and softwares for statistically computing and data analysis in solving data-heavy problems. Analysising data using these software packages are usually achieved by coding. This concept is widely used in many fields including education. Hence, there is need to have lectures who possess and can apply these skills. Programming languages such as Python, JavaScript, SAS, MapReduce, Apache Spark frameworks, R and C++ create advanced data analysis programs and Structured Query Language (SQL) for databases are core language strategies worth investing on. It might not be possible to learn every programming language, but there is need for experts to master some relevant ones for better career prospects in big data. Measurement experts could do well if they put effort and time in learning coding and honing these skills. Machine learning is an aspect of artificial intelligence that requires using algorithms to bring out data sequence. Aspiring big data experts would do well to become skilled in this technology because it is critical in managing complex data setup and patterns that are complex for the traditional data analytics techniques. Examples are TensorFlow, PyTorch, Google Cloud ML Engine, Amazon Machine Learning (AML), NET, Apache Mahout, Shogun, Oryx.

Quantitative analysis is an essential tool in big data because it centers on the use of mathematics. Experience in mathematical areas as linear algebra could give a big data analyst a good start in understanding the statistics and the fundamentals to excel in big data concerns.

Professionally, therefore there is need to be conversant with Microsoft Excel, SAS, IBM SPSS Statistics.

Data mining involves management, collecting, cleaning, organising and storing data and use of software to find patterns in voluminous sets of data. This enables data managers have in depth knowledge about students and develop more personalised developmental strategies targeted at problems solving problems. Measurement experts ought to be good knowledgeable in data mining in order to attend to big data issues. Expertise in tools such as Rapid Miner, Apache Mahout and KNIME are among the most needed data mining skills in our universities due to advances in technology (Jassim & Abdulwahid, 2021; Khan & Shaheen, 2023)

Critical Thinking involves having a naturally analytical mind that is crucial in big data analysis. It is a learned skill that is essential for anyone in a data-centric profession. Whether you are a naturally endowed analyst or otherwise, you would need continuous practice to internalise BDA skills and become an expert in it. There are different ways to sharpen your critical thinking ability, and this does not have to be technical. Solving puzzles, playing chess, enjoying video games are all activities that improve an individual's ability to solve problems (Birt, 2023; Chatfield, 2022; Lasker, 2022).

Data visualisation involves analysing, synthesising and interpretation of big data. The capability to read and interpret data is a vital skill that merge creativity and wisdom. Data visualisation does not only require the knowledge of pure science and mathematics but also calls for originality, imagination, and curiosity. Hence, being able to articulate and clearly report findings in a compelling manner is critical in data analysis. This could be done through the use of graphics, models and charts. More so, Tableau and D3.js are analytic tools helpful in data visualisation (Simplilearn, 2023).

Big data analytics (BDA) is the process which involves a variety of new technologies, applications and services needed to understand the conglomerate of data. They help to elicit useful information and knowledge which when grouped and interpreted can lead to effective management of issues in education and aptness in solving educational problems. Further, BDA cuts across many fields of study as education, engineering, mathematics and information, social and system sciences (Altexsoft, 2021). However, these disciplines are faced with the problem of harnessing BD values (Ransbotham et al., 2016) due to uncertainties of how to deploy analytics, transform insights into value (Ajax, 2020) as well as shortages of skills. Though, this does not imply that voluminous data and superior analytical methods equate to better insights or greater value, so the era of computational prowess does not obviate the need for intuition and creativity. However, tools as Apache Hadoop, Hortonworks, MapReduce and Tableau Software are intended to leverage big data and analytics without advanced technical knowledge and Microsoft Excel, SAS and IBM SPSS address the challenges of managing data at the lower internet levels (Baker & Siemens, 2013).

Presently, big data platforms are open and user friendly. They also blend technologies and features to derive insight from data compendium. But the presence of technologies and tools notwithstanding, Gartner report (2023), revealed that most big data projects fail because of the expertise gap. In education system, lecturers lack big data skills and managements are lacking big data leadership and capabilities. The critical problem is not just tools but having lecturers who can gather big data, organise it, clean it and then leverage the available technologies. With this challenge in sight, executives are seeking business-minded data scientists and analysts, in short, experts who can use big data practical applications in their daily encounter with data sets. In line with Mahtab et al., (2021), the success of big data project in education must start from a deep understanding of the problems and usefulness of expected outcomes to experts who can apply the required skills to analyse the data.

In Nigeria, there is ongoing struggle in current policies to make education occupy its rightful place of importance, but the study of Anikweze et al, (2019) shows that measurement experts in Nigerian universities do not have the necessary big data analytic skills and required competencies to carry out

professional exercises. Lack of BDA skills is having a direct impact on experts' capability to engage with technological based educational resources and novelty. This could be caused by inadequate motivation, gendered experiences and even learning gap at the early stage of their academic life or reluctance to engage with scholarly change and up-skill training in their career trajectory. Such factor as motivation in the opinions of Afanador (2017), Falco (2017) and Fernández, et al (2016) when not handled rightly, directly cause low level of usage of digital skills in teaching staff hence have effect on their professional competences. Motivation at work place on the part of the teacher inspires a teacher to do their job at the highest level and with ought most satisfaction (Ng, 2022).

Teacher motivation is based on what makes teachers committed and dedicated to their work so they can give the best possible performance when teaching students (Semenova, 2020). This is therefore perceived as factors operating within the school system that could hamper teachers' performance, cause frustration, stress and dissatisfaction if not handled rightly. Motivation therefore has direct effect teacher productivity (Semenova, 2020) and productivity is a factor of skills possessed. Motivation is important for skill acquisition because it brings about engagement and promotes skillful learning and achievement (Cho & Heron, 2015). As a result, when workers are motivated about their jobs, they carry out their duties the best ever thereby increasing productions. In the school system, teachers have a feel of accomplishment and achievement when they are motivated. This help them in meeting personal and professional goals. Teachers who are self-motivated, engage in trainings and activities that will help them improve on both analytic and pedagogical skills. In other words, incentive and rewards have little or no effect on such teachers. They feel motivated only because they are confident in their abilities and capabilities. These levels of teacher most times are productive because of personal challenge and needs of their work. They mostly involve in skill acquisitions and trainings in order to meet up with changes in the academic world and society at large. The level at which measurement experts in the universities are motivated could greatly influence the extent to which they struggle on their own to acquire new skills needed to meet up with demands of their field. BDA skill acquisition and application is expressed by scholars in terms of ability and motivation, thus: BDA skill and application = f(ability)(motivation). Ability on its own depends on knowledge acquired, experience and training and evident through a slow and long process. Motivation on the other hand can be bettered speedly. In principle, Ganta (2014) and Undiyaundeye and Otu (2015) suggested strategies for motivation. Such strategies as positive reinforcement, treating people fairly, satisfying employee's needs, division of labour, rewarding based on job performance directly or indirectly improve skill acquisition and promote worker productivity.

Another distinct factor in the acquisition and use of big data analytics is level of job experience. In the academic system and world organizations at large, crucial decisions are predominantly being made based on intuition and experience/exposure of high ranked members. Hence, better performances are being ignited through trusted and accurate ideas from experienced personnel. In the education system also, better decisions are made which are dependent on experiences and the extent of skills possessed by teachers. The ability to manage, analyze and act on data is very important in the universities and is characterized by the years and experience gathered in the course of growing in the system. Experience in the opinion of Afanador (2017) and Falco (2017), have direct effect on professional skills and competences, influencing highy the level of digital skills of teaching staff. This is supports the principle of isomorphism, which establishes that older lecturers with less big data knowledge and training mutually have greater problems in carrying out a professional exercise in the 21st century techno-pedagogical era. Therefore, big data analytics competence is basic quality of today's educational measurement lecturers. Evidently, due to the increasing demand for understanding trends in massive datasets increases, the academia is giving a wide attention to big data analytics. Recently, educational institutions' massive engagement in online activities, cyber-physical systems, and Internet of Things (IoT) have increased the manner data

are being collected. The analysis of such voluminous data requires high level of expertise. This would help to derive useful information that could lead to efficient reviewing and predicting of future courses of action with high precision and advanced decision-making (Daniel, 2014; Hariri et al, 2019).

In the 21st century-educational setting, in order to achieve the desired level of knowledge, it is necessary that teachers at higher institutions of learning have sufficient level of analytic competence. For this, teachers need to develop an entirely new set of skills for this new era of teaching (Moreno et al., 2018). This requires upskilling in order to acquire and improve the skills and abilities needed and linked to big data (Avitia & Uriarte, 2017; Castañeda et al., 2018), in order to measure up with the technological transformation not minding job status. This could help to prompt the lecturers who are the key drivers of education at university level to acquire and use the necessary skills and knowledge to handle big data in this internet era. The major question to answer is:

Research Question One: What are the big data analytics skills possessed and used by measurement experts in Nigeria universities?

Hypotheses

The stated hypotheses were tested at .05 level of significance which include:

Ho1: Job experience of measurement experts will statistically and significantly mediate the relationship between motivation and acquisition of requisite BDA skills.

Ho2: Job status of measurement experts will statistically and significantly mediate the relationship between motivation and acquisition of requisite BDA skills.

Ho3: Total effect of motivation, job experience and status of measurement experts on the acquisition of requisite BDA skills will not be statistically significant.

Rationale for the Study

Based on past theory and research, the study tests a mediational model of job experience and status on the relationship between motivation at work place and possession of big data analytic skills. Specifically, the study hypothesise that the relationship between motivation and possession of BDA skills will be mediated by job experience and status, such that motivation initiates job experience, which in turn functions as a more proximal factor to possession of BDA skills. More so, to the knowledge of the researchers, no academic studies have been conducted on the links between the aforementioned variables. While previous research indicates that knowledge and competence are key predictors of on-the-job skill acquisition, job experience and status were not considered (Charka et al, 2022). Similarly, while earlier research have investigated the relationship between job motivation and skill possession, their interaction with job experience and job status has not been investigated (Zubairi & Khan, 2018). Thus, based on previous theory and research, it can be argued that there is a strong association between motivation and skill possession; however, no evidence on the mediation of job experience and job status on that relationship has been found.

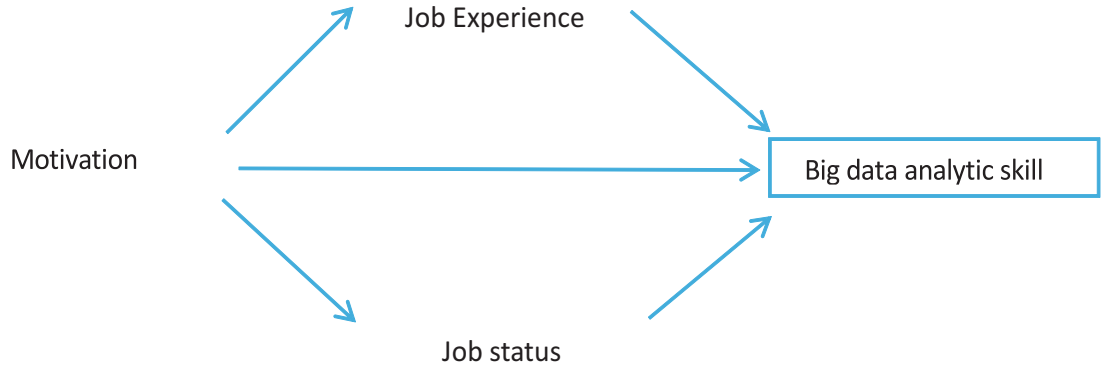

Figure 1. *Conceptual diagrams of the parallel mediation model for the measurement experts possession of big data analytic skills.*

Methodology

The study adopted a non-experimental design of correlational research type. It was conducted across the 265 universities in Nigeria (private - 149 (56%), state - 63 (24%) and federal universities - 53 (20%) (NUC, 2024). The population comprised an estimate of 235 measurement experts in Nigerian universities. In the study, all the 235 measurement experts in the 265 universities were employed. Two research instruments were used for data collection; researcher developed Evaluators' Job Motivation scale (EJMS) and Big Data Analytic Checklist (BDASC) adapted from Chakray (2021). The forty six-itemed EJMS developed by the researchers was used to measure the extent to which the participants were motivated in conducting analysis. Items were rated on a five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree) with higher scores representing higher level of motivation. The Cronbach's alpha estimate of the instrument was .88. On the BDASC, they were requested to indicate the analytic skills they possess and use. The checklist consists of six (6) BDA skills with at least 5 indices for each of the basic skills needed for big data analysis. The reliability was reaffirmed and it yielded an index of .76. The two instruments were face validated by three experts, one from computer science unit of science education department and two from measurement and evaluation unit in the department of educational foundations.

Because this study requires only measurement experts, consent was sort and gotten from all the 235 of them through the two major indigenous evaluators professional bodies (Association of Educational Researchers and Evaluators of Nigeria - ASSEREN and the Association of Behavioural Research Analysts and Psychometricians - ABReAP), describing the nature of the study. Their participation in the current study were requested with assurance that their responses would be treated completely as confidential. Data were then collected from these 235 subjects through the online questionnaire sent through their telegram and WhatsApp platforms. Concurrently with completion of the Google form attachment, we gathered information on job experience and status of the participants. According to their job experiences, 67 (28.5%) were below 5 years, 6 years - 14 years were 62 (24.4%), 15 years and above were 106 (45.1%). Based on job status, those at lecturer II were 86 (36.6%), lecturer I were 54 (23%), senior lecturer were 60 (25.5%) and professors were 35 (14.9%). The research question of the study was answered using descriptive statistics (Percentage) and inferential statistics using Model 4 of Hayes macro process in SPSS was used to test the hypotheses at 0.05 significance level in SPSS 25.

Results

Research Question One: What are the big data analytics skills possessed and used by measurement experts in Nigeria universities?

Table 1: Percentage of big data analytic skills possessed by m easurement experts in Nigerian Universities

Big data skills	Softwares	N	%
Statistical programming languages	Python, SAS and JavaScript	235	27
Machine learning skill	TensorFlow, PyTorch, Google CML Engine, AML, NET, Apache Mahout, Shogun, Oryx		17
Quantitative Analysis	Microsoft Excel, SAS, IBM SPSS Statistics, R-language.		31
Data Mining	RapidMiner, Apache Mahout, KNIME		39
Critical Thinking	Solving puzzles, playing chess, video games		55
Data Visualization and Interpretation	Attention-grabbing graphics, charts, and mathematical models		53

Table 1 present the level of possession and use of big data analytic skill and the respective softwares to be mastered by measurement experts. Data collected from the study revealed that only 27% of the participants are skilled in and can apply statistical programming languages such as Python, SAS and JavaScript; 17% can apply Machine learning skill; 31% are skilled in and can apply Quantitative Analysis; 39% are skilled and can apply Data Mining while 55% and 53% are skilled in Critical Thinking and Data Visualization and Interpretation respectively. From the experts' responses, it can be inferred that the BDA skill mostly possessed and applied by measurement experts in Nigerian universities are Critical thinking skill, Data visualization and Interpretation skill, Data Mining Skill, Quantitative Analysis skill, Statistical Programming Skill and machine learning skill in that other. A greater percentage of the participants of this study do not acquire and apply 4 out of the 6 must-have BDA skills needed to stay competitive in the job market.

Results of the Hypotheses

Ho1: Job experience of measurement experts will statistically and significantly mediate the relationship between motivation and acquisition of requisite BDA skills.

Ho2: Job status of measurement experts will statistically and significantly mediate the relationship between motivation and acquisition of requisite BDA skills.

Ho3: Total effect of motivation, job experience and status of measurement experts on the acquisition of requisite BDA skills will not be statistically significant.

Table 2: Mediation Analysis Summary (Path estimates)

Hypotheses	Total effect	Direct effect	Indirect effect	95% CI Lower bound	95% CI Upper bound	Remark
Mtv → **Exp** → **BDAS**	.0025	.0012	.0025	.0027	.0081	Partial Mediation
Mtv → **Status** →BDAS	.0255	.0027	.0255	-.0086	-.0024	Partial Mediation
Mtv → **Exp** → Status → BDA	.0019	.0032	.0019	.0030	.0100	Partial Mediation

Table 2 shows the path estimates of the mediation of job experience on the relationship between motivation and BDAS as stated in hypothesis one. The finding revealed that the indirect effect (CI = .0027 to .0081, p < .01) was statistically significant. Researchers, therefore, affirmed that job experience partially mediated the relationship between motivation and acquisition and application of BDAS.

Table 2 also shows the path estimates of the mediation of job status on the relationship between motivation and BDAS as stated in hypothesis two. The finding showed that the indirect effect of job status on the link between motivation and acquisition and application of BDAS (CI = -.0086 to -.0024, p < .01) was found to be statistically significant implying that status of measurement experts partially mediated the relationship between motivation and acquisition and application of BDAS.

Furthermore, Table 2 shows the joint indirect effect of job experience and status on the relationship between motivation and acquisition and use of BDAS as stated in hypothesis three. The finding showed that job experience and job status (CI = .0030 to .0100, p < .01) was statistically significant implying partial mediation. The mediation effect is complementary ($a_1 * b_1 * C'$ = positive).

Discussions

The results of this research showed that a very low proportion of lecturers in the field of educational measurement and evaluation had acquired and usually applied the skills needed to analyse the enormous amount of data that are being generated in the system. Since the volume and format of data being generated in the education system is changing, there is need to have individuals who are data literate, lecturers who can become active data explorers to plan for, collect, organise, analyse and infer insights from data collected. This lack of data literacy among measurement experts is a cause for concern since data is one of the key enablers for problem-solving and driving change in the educational sector (Mougiakou et al., 2023; Weiser et al., 2022) but this potential remains untapped due to the lack of data literacy.

Consistent with the hypothesis, we found out that the association between motivation and acquisition of BDAS was positive and significant. This finding infers that lecturers' in educational measurement and evaluation (referred to as measurement experts' in this study) level onef acquisition of necessary BDAS is attributed to their level of motivation as they progress in their professional ladder. This finding is in li with Akhtar et al., (2017); Jobira and Mohammed, (2021); Kumari and Kumar, (2023) which found that motivation has positive and significant effect on job performance which is an index of expertise skills possessed. Additionally, result of joint mediating effect of job experience and job status on the association between experts' motivation and their possession and application of BDAS revealed partial mediation. The results of this study explain that part of the variance that experts' motivation explained in acquisition BDAS was through the combined effects of their on-the job experience and job status. By implication, the number of years of experience as a lecturer and present position in the field have positive contribution to the BDAS possessed and applied by them.

Conclusion

The study revealed that motivation is significantly and positively predicts the acquisition and application of big data analytic skills. It revealed that the association between motivation and BDAS may be because of the impact that motivation had on both job experience and job status, which is associated with increased BDAS. These findings advance our understanding of the role that lecturers' institutional motivation can play in acquisition of BDAS. This study thus contributes to the skills' engagement literature by not merely establishing a link between motivation and acquisition and application of BDAS, but also to show the proportion of measurement experts that have acquired and can apply BDAS and how job experience and job status mediate this particular association.

Recommendations

The researchers recommend that

1. Institutions and government should pay more attention to conditions that boost lecturers' job motivation.
2. There is need for Upskilling lecturers through Workshops and training programs on data analysis techniques, data visualization, and data management specifically tailored to educators, online courses and resources to facilitate self-paced learning, encouraging participation in conferences and workshops focused on educational data analysis.
3. Policymakers in education matters should consider encouraging collaboration with data science departments to develop interdisciplinary courses and building a supportive environment such as providing access to data analysis software and tools within the university. Also, offer mentorship and peer support for lecturers who are developing their data literacy skills and recognize and reward the use of data-driven approaches in educational research and practice.

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