International Journal of Computers in Education
2025, Volume 8, Issue 1, 44-56
Research Article

Basic Chart Creation Skill Retention of Business Teacher-Educators in Nigeria

Mohammed Inuwa Bello [1] *

[1] Abubakar Tafawa Balewa University, Bauchi, Nigeria.

Abstract **-** The study investigates the basic chart creation skill retention of Business Teacher- Educators (BTE) in Nigeria. The study adopted within group experimental repeated measures design through using pretest posttest retention approach. The study is anchored on conscious competence learning model, with population of 154 and a sample of 42 using purposeful sampling. A basic guide to chart creation downloaded from the net was adapted and use in all the three rounds of pretest, posttest and retention. The findings of the study among others revealed short term memory recall to have surpassed the long term memory recall of the trainees, as those that passes in the posttest were found to be slightly above those that pass at the retention level. The study recommends that practical guide; more especially in computer related courses should always accompany lessons and be shared on the students' virtual platforms in the form of exercises with an option of download. This when done will serve as a depository of knowledge which clearly can enhanced upgrade in knowledge at will and so improved skill retention of students.

Keywords: Spreadsheet; Chart Creation; Skill Retention; Business Teacher-Education

Introduction

Learning a skill by a novice requires expert guidance in the process involve. For novice to be certain of being skillful requires performing that skill with ease at any given time. On the other hand, for expert to ascertain whether novice can perform the skill being trained for requires assessing the novice on the depth of performance. Interface between the expert and the novice requires the use of different teaching/learning approaches, usually complimented with what technology has to offer. For teaching and learning to be successful nowadays, use of information and communication technology (ICT) facilities are paramount, as ICT eases teaching and helps assimilates knowledge by the learners (Onyema, 2020; Rahimi, 2023; Stein, Gurevich & Gorev, 2020). This prompted universities to provide the needed ICT artifacts in order to ease the teaching/learning processes. Some of the ICT artifacts among others include the Electronic Smart Board [ESB] (Min & Siegel, 2011; May, 2014; Haleem, Javaid, Qadri & Suman, 2022), which is mostly used by teachers for presentation of lessons.

Universities occupy different areas of endeavour, among which was Business Teacher-Education (BTE). To be a graduate of BTE, one must undergo courses in related software skills that have direct relations to their specialization (Françoise, François-Marie & Éric, 2008). Therefore, spreadsheet (excel) as a subset of Microsoft Office Suite software was among the taught courses in universities in general and BTE in specific, due to its applicability and usability (Abubakar Tafawa Balewa University [ATBU], 2018; Carl Jr., Queen, Hayden, Steve, Mark & Loreen, 2023). Also BTE as an area of specialization was designed not only to train students to be teachers, but also work in the industrial or private sectors of the economy.

One of the employability skills that are being demanded by employers is being skillful in the computer applications as required of graduates' respective profession (Gibbs & McgKinnon, 2009; Stoner, 2009; Lantushenko, Lipton & Erkis, 2018). Additionally, as competition increases due to

* Corresponding author: Abubakar Tafawa Balewa University, Bauchi, Nigeria.
e-mail addresses: ibmohd@atbu.edu.ng

https://doi.org/10.5281/zenodo.15774108
Received 27 Jan 2025; Accepted 10 Apr 2025
ISSN: 2636-8722. This is an open access article under the CC BY license.

globalization, a need to be competent in summarizing and presenting accurate information through chart creation is also a skill that must be learn, as charts creates an instant impact to the user (Meeks, 2018) and so help make informed decision. A chart is a graphic representation of data that transforms it into visual components (Santori, 2023). Elaborating further, Morris (2021) outline the benefits derivable from chart to includes visually comparing multiple sets of data; gives a better understanding and easy to remember information; and helping users to make their point more convincing and so lends credibility to their presentation. Different types of charts exists, so choice of which to used depends on the user and what the user intends to visualize and achieved. Some of the common types of charts are line chart, bar chart, pie chart, column chart, stacked chart, etc. Irrespective of the type of chart a user is visualizing, the most common parts of a chart are chart area, plot area, chart title, data series, grid lines, vertical axis title, vertical axis, horizontal axis titles, horizontal axis and legend. Taking cognizance from the foregone, Morris (2021) outline the importance of charts to the business world to among others include conveying a great deal of information and so help viewers remember the data presented easily; enables business people to make quick informed decisions and so takes action promptly; conveyed relationship between two or more sets of data and so helps audience to retain information.

To create chart in any form relies heavily on the basic concepts, as basics are the foundation to achieving the complex. Excel as an application contained cells that are organized in rows and columns that help in arranging, calculating and sorting of data. Data in excel takes different dimension, including numeric values, text, formulas, references and functions (Sestoft, 2014; Alexander & Kusleika, 2016; Tella, 2016). For teaching/learning to be effective, and so makes the BTE employable, basics to complex concepts in excel are a must (Formby, Medlin & Ellington, 2017), as basic concepts are the foundation upon which complex relies for execution thereafter (Theall, Wager & Svinicki, 2021).

The study is anchored around conscious competence learning model. The model is attributed to Noel Burch and his colleagues in 1970. However, other origin and its evolutions has also emerged (Mukherjee, Basu, Faiz & Paul, 2012; Kongsvik, 2021). Irrespective of its origin, embedded within the model are four stages of competence, which relates to the process of progressing from incompetence to competence. The four processes include unconscious incompetence, conscious incompetence, conscious competence, and unconscious competence. Inherent in the stages was arousing the individual instinctiveness of moving from unconsciousness to consciousness level in learning that help perform the task easily without any difficulty in future. To arouse unconscious incompetence, the BTE were informed of the planned training with emphasis on the importance of being skillful on how to summarize and presents accurate information using chart creation. This prompted BTE instinct in seeing the usefulness of acquiring the skill, and so develop interest in the training. With this, the BTE moved on to the conscious incompetence after recognizing the importance and value of having a skill in chart creation, and so developed the willingness to learn towards overcoming the deficit.

To ease the skill passage, ESB was used in order to augment the training in achieving its purpose, which ultimately helps to moving the instinctiveness of the BTE to the level of conscious competence. Performance as rightly said is a journey not a destination (Elger, 2007). So, what the learner does in terms of putting learning into practice is a journey that can only be assumed to reach its peak when the skill learnt can be replicated by the learner. This level covers the unconscious competence, as the learner is now in a good position at whatever period to recall and use what was learnt earlier in basic chart creation.

Literature Review

Taking cognizance of the importance of chart to the world of work, it became imperative to infuse chart creation as a subject subset, more especially in business related courses in the universities. This is because, most of the businesses; from banking industries to stock exchange outlets make use of charts in amplifying their achievements, which hitherto led to taking informed decision by the audience. Therefore, literatures (Jin & Kwon, 2021; Asamoah, 2022; Al-katheri, 2023) revolving round the importance of chart to businesses were reviewed. Jin and Kwon (2021) were able to analyze the effects of stock chart characteristics on stock price prediction via convolutional neural networks using price graph images, rather than the traditional forecasting of using standardized numerical data to showcase the happening in the stock market. ANOVA was use as method for data analysis, and it revealed the accuracy of prediction to improve when solid lines and a single image without axis marks are utilized. Asamoah (2022) used curriculum designed approach for teaching basic and advanced concepts in data visualization. This is with a view to examine whether respondents perceived the pedagogic approach to have enhanced their data visualization competence. Mixed population of 121 undergraduates and graduates students was used. Using a convenience sampling, a total of 67 was deduced. Collated results were analyzed using mean and standard deviation to answer research questions, with t-test used in testing the hypotheses formulated. The results revealed the respondents to have rated most components of the curriculum and the pedagogical structure to be high. An indication that, the designed curriculum developed help the respondents to achieve competency required in data processing and preparation, which are the key requirement for effective data analysis, which hitherto leads to chart creation and data visualization.

Al-katheri (2023) examines the impact of using charts and graphs in financial reports in a banking sector, with focus on enhancing the readability, comprehension, and decision-making process for investors, analysts, and managers. Nine research purposes were raised. The study employed a mixed method design. Using a Google Form, a returned rate of 317 respondents was recorded. Collated results were analyzed using percentages and charts to answer the research questions raised, with chi-square and one-way ANOVA used to test the hypotheses formulated. The study among others concludes that graphs and charts when used effectively conveyed significant facts and insights, and so help in understanding a large amount of information in a glance, which make viewers remember easily and so enabled them to make informed decisions and take action quickly.

While authors above revealed the importance of chart to the world of business, the studies of Partiprajak and Thongpo (2016); Subramaniam et al. (2022); Ugwuanyi (2022) focused on different variables, but their methodological approach to research design are similar to the one employed in this study. Therefore, their findings provide valuable insights into the application of methodological approach. Partiprajak and Thongpo (2016) examine the retention of basic life support (BLS) knowledge, self-efficacy and chest compression performance of Thai undergraduate nursing completing a BLS course at three stages of pretest, posttest and retest. Of the 180 students, 30 were randomly selected. Selected participant were contacted and debriefed on the modalities to be used; and all agreed to participates in the study. Three instruments were used for data collection. Percentage and charts were used in answering research questions raised, with ANOVA and pairwise comparison used in testing hypotheses formulated, all at 0.05 level of significant. Subramaniam et al. (2022) evaluates the final year medical students' long term retention of knowledge following cardiac life support training prior to exit from medical school to determine the need to revise and re-strategize if need be, before graduating. A convenience sampling method was adopted and 37 participants that met the inclusion criteria were used. Participants were measured using a one best answer 30-items test administered at three different times, pre-test, immediate and 6 months posttests after the course. Mean and standard deviation were used in answering research questions raised, with repeated measure ANOVA and pairwise comparison adopted to test the

hypotheses formulated.

Ugwuanyi (2022) study tested the effectiveness of a flipped classroom instructional technique on children's development of sound knowledge of Basic Science concepts. A simple repeated measures research design was used in study. The study population was 9,564, with a sample of 31 primary school three pupils' deduced using purposive sampling technique. Criteria for being selected as sample was, a child must have access to PCs and smartphones with internet capabilities gadgets at home. The instrument for data collection was a self-developed instrument, and it contained 30-item multiple-choice test with options from A to C, which the pupils are expected to choose from. Using Kuder-Richardson formula 20, the instrument yields an internal consistency reliability index of 0.84. Mean and standard deviation were used to answer the research questions raised, with F-test of repeated measures ANOVA used to test the hypotheses.

Be as it may, one of the employability skills that are being demanded by employers is being skillful in the computer applications as required of graduates' respective profession (Gibbs & McgKinnon, 2009; Stoner, 2009; Lantushenko, Lipton & Erkis, 2018). Therefore, as BTE, need for competency in summarizing and presenting accurate information through chart creation is a skill that must be learn, as chart creates an instant impact to the user (Meeks, 2018) and help make informed decision. Therefore, testing the competency of chart creation of BTE a necessity, as it will go a long way in helping towards revising or re-strategizing if need be in the areas found wanting. One way to ascertaining the competencies as revealed in the literature was through measuring retention.

Skill Retention

Rigor in learning any computer skill is to retain it for future use (Welsh, Wanberg, Brown & Simmering, 2003). However, sometimes individual finds it very difficult in recalling what was learnt or done of recent, due to some circumstances they may have come across after being tested (Arthur Jr., Bennett Jr., Stanushu & McNelly, 1998; Krätzig, 2016). For instance, BTE being in their final year in the university take courses, not only from computer courses, but also from other areas of endeavor that has direct relation to their specialization. In view of that, there is tendency of skills gained in spreadsheet in general and specifically in chart creation to weaken due to academic load they are going through. This to some extent might affects their recalling capacity, so leads to inability of putting chart creation skills gain into practice after some period. Because the longer the period of non-use of skills acquired, the greater the retention loss will be (Arthur Jr. et al., 1998).

Retention has been described as the process in which long-term memory preserves learning so that, it can be located, identified and retrieved accurately for future used (Ritter, Baxter, Kim & Srinivasmurthy, 2013; Haqie, 2021). To commit something to memory, learners must use construct acquired through organizing the elements with which the matter in hand is to be dealt with, referred to as schemas (Sweller, 1994). Da Silva (2005) added the more trainees are committed to organized schemas, the better their retention of an intended skill will be. To use the retained schemas thereafter, it must be retrieved from the depository, which is usually the memory (Cherry, 2020). He further categorized memory into three consisting of sensory, short, and long term. Skill stored at the sensory level is for a very brief period of time, while at the short term level is stored in active or working memory, with long term been the continuing storage of skill that received deserved attention while at short term level. So, retention is all about making new skill stick in short term enroute to long term memory for future use. Additionally, Cherry (2020) also outlined four reasons why what was in the memory diminished to include failure to store; interference; motivated forgetting; and retrieval failure. For these, needs to further explore the BTE chart creation skill retention a necessity, because for knowledge to have effect, the knowledge gain must persist (McEvily & Chakravarthy, 2002). It is against this background that this study determines the Basic Chart Creation Skill Retention of BTE in Nigeria.

To achieve the main aim, the study intends to determine the (1) difference between BTE scores in pre-test, post-test and retention in basic chart creation; (2) significant difference of the BTE scores in pre-test, post-test and retention in basic chart creation (3) pair-wise comparison of basic chart creation measurements of BTE at pretest, posttest and retention.

Methodology

The study uses a single group of respondents who were exposed to pretest, posttest, and retention using the same instrument. Therefore, within group experimental repeated measures design to explore the basic chart creation skill retention of BTE in Nigeria was adopted. This design has recently been adopted in some studies that used the same approach of pretest, posttest and post posttest [retention] (Partiprajak & Thongpo, 2016; Subramaniam et al., 2022; Ugwuanyi, 2022). Repeated measures have been described as an experimental study where all participants in a single group participate in all experimental treatments, with each group becoming its own control (Cohen, Manion & Morrison, 2007; Creswell, 2012). The intent of adopting this design was to test the resilient and ability of BTE of recalling basics of chart creation, which are the foundations to creating any type of chart desired. The population of the study was One Hundred and Fifty Four (154) BTE university final year students. The sample of the study was Forty Four (44) deduce through purposeful sampling technique. To deduce the sample from the population, a free training was advertised through BTE final year WhatsApp group platform, detailing the importance of chart creation to the world of work. Subsequently, request those interested in the training to download, print and fill an attached form and submit in person to the instructor within a week. Forty-Four (44) BTE students showed interest in the training and were therefore used as the study sample. Upon submission of the form, a full explanation of the purpose of study and data collection procedure was revealed to all the 44 BTE, and all reaffirmed their willingness to participate. A basic chart creation guide downloaded from (https://support.microsoft.com/en-us/office/create-a-chart-from-start-to-finish-0baf399e-dd61-4e18-8a73-b3fd5d5680c2) was adapted and used as a guide (Appendix 1). Percentages, mean and standard deviation were used in answering research questions raised, with repeated measures ANOVA used in testing hypotheses formulated at 0.05 level of significant.

Data Collection

Pretest was conducted prior to introducing ESB. Immediately after the pretest, basic chart creation steps were taught with the aid of ESB. After that, a posttest was conducted. Retention was carried out nine weeks after the posttest. Below in a diagram are the stages used in Figure 1:

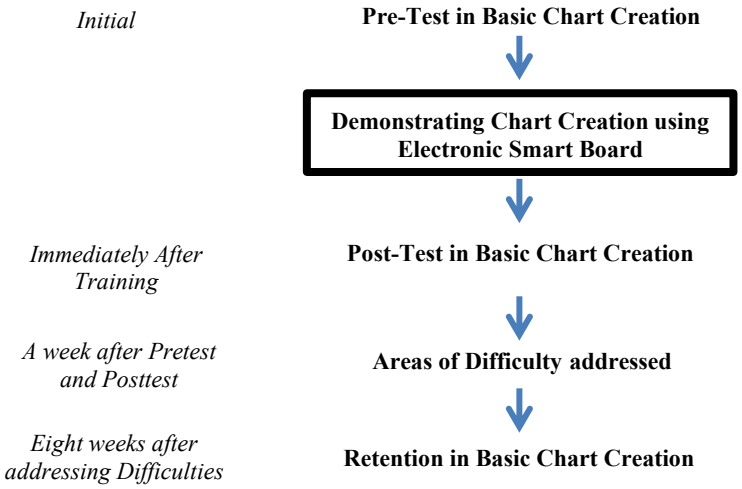

Figure 1: Stages of Data Collection

To attained being skillful in basic chart creation by any of the trainee, a trainee must overcome fourteen steps as outline in the rubric (Appendix 2). This when added result in the highest score of Thirty-two (32), indicative of a trainee to have produce a chart correctly as depicted in (Appendix 3).

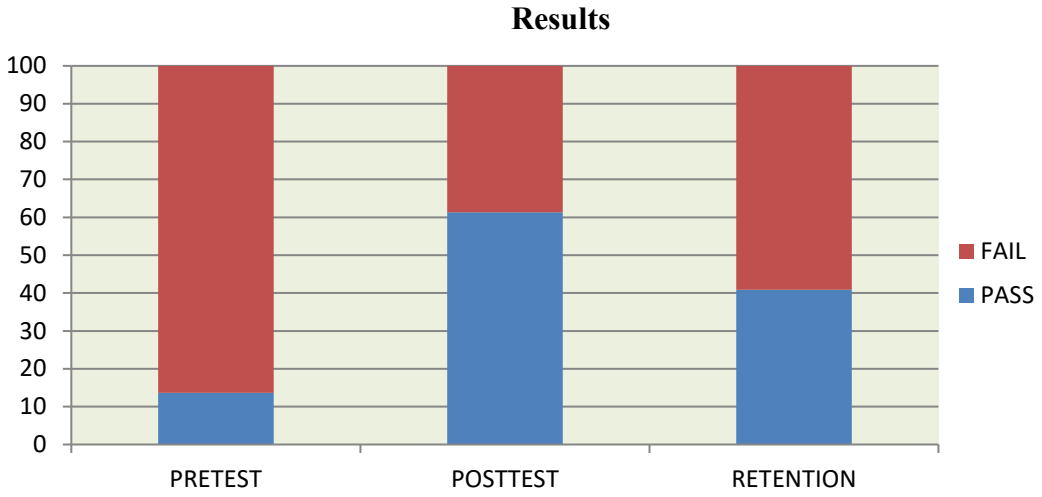

Figure 2: Comparison of Percentage Pass

The pretest revealed only 6 (14%) trainees passed the basic chart creation test, with a mean of 18.41 (SD = 8.65). Immediately after the training, the posttest revealed 26 (61%) to have passed the test, with a mean of 27.77 (SD = 5.97). In the retention after 9 weeks, the result revealed a slight decline with only 18 (41%) to have passed, with a mean of 26.18 (SD = 5.88). The number of those that passed and failed is as presented in Figure 2. The comparison between the mean changes in pretest, posttest and retention of the basic chart creation measurements is shown in Figure 3.

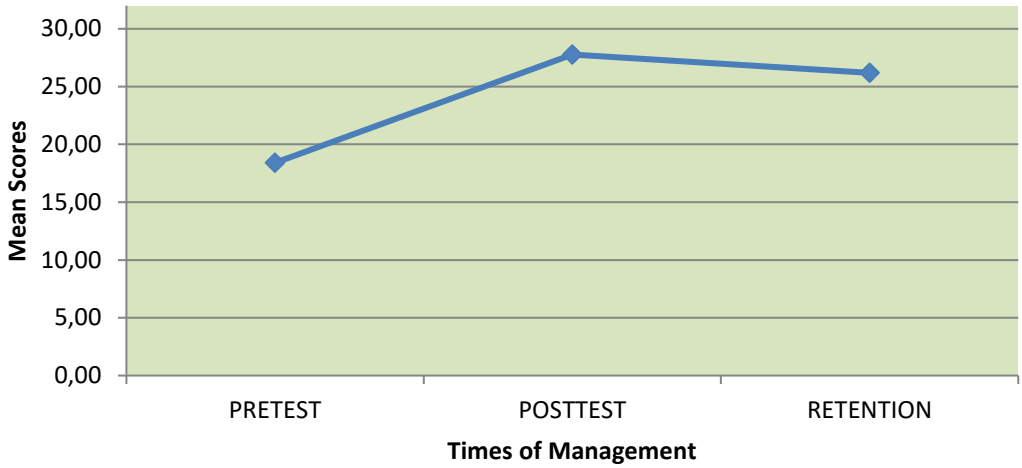

Figure 3: Mean of Chart Creation over Time

To check the assumption of repeated measure ANOVA, Mauchly's test of sphericity data output was used (Table 1).

Table 1: Mauchly's Test of Sphericity

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	Df	Sig.	Epsilon Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Time	.881	5.338	2	.069	.893	.930	.500

The result revealed the difference of repeated measure across time to be equal (p = 0.07). This implies that homogeneity of variance as it affects the three measurements is not violated. Having not violated the homogeneity of variance across the dependent variables using the test of sphericity, Wilks' Lambda output of multivariate results (Table 2) was chosen to determine the significance difference and its effect size. An indication that, the F-statistic and p-value reported are valid and do not require correction using Greenhouse-Geisser or Huynh-Feldt values.

Table 2: Multivariate Test of Wilk's Lambda and its Effect Size

Effect	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Pillai's Trace	.797	82.573[b]	2.000	42.000	.000	.797
Wilks' Lambda	.203	82.573[b]	2.000	42.000	.000	.797
Hotelling's Trace	3.932	82.573[b]	2.000	42.000	.000	.797
Roy's Largest Root	3.932	82.573[b]	2.000	42.000	.000	.797

The result revealed F(2,86) = 82.57, with p < 0.001 and a η = 0.80. From the result, it can be concluded that there is a significant difference within the three time management. To further confirmed the mean difference as observed in the descriptive and in the multivariate test, pairwise comparison of pretest, posttest and retention was carried out and reported in Table 3 that follows.

Table 3: Pairwise comparison of mean difference and the 95% confidence interval

	Pairwise Difference				p-value
	Mean	SE	95% Confidence of interval difference		
			Lower	**Upper**	
Pretest-posttest	-9.364	.722	-11.162	-7.565	0.000
Pretest-retention	-7.773	.785	-9.728	-5.817	0.000
Posttest-retention	1.591	.574	.162	3.020	0.025

Pairwise comparison results revealed the existence of slight mean difference between the three tests, but were all found to be statistically significant. A mean difference (-9.364, p<0.001) was found between pretest-posttest. As for pretest-retention, a mean difference of (-7.773, p<0.001) was found, with a mean difference of (1.591, P<0.05) to have existed between posttest-retention. From the result, posttest-retention though less than 0.05, but was found to be greater than 0.001 significant levels.

Discussion

The result as presented revealed both scores at posttest and retention measurements to be above the scores as obtained in the pretest, albeit scores obtained in the posttest to be above the scores in the retention level (Figures 1 and 2). Though a slight declined was observed between posttest and retention, the outcome was still a success as there was an increase from 14% to 41%, i.e. an increase of close to 200% from the pretest to the retention level. Therefore, the scores as obtained in the three measurements clearly indicate the trainees to have used the opportunity given in learning the skill in chart creation. This achievement made by the trainees was as a result of paying deserved attention while undergoing training (Cherry, 2020), which was made possible through transferring the schemas acquired from short term to long term memory (Sweller, 1994; Da Silva, 2005). Attaining this level by the trainees indicates recalling the skill in basic chart creation by a substantial number with ease at any given time.

Mauchly's Test of Sphericity (Table 1) and Multivariate Test of Wilk's Lambda and its Effect Size (Table 2) revealed a significance difference to have exists between the three measurements. The significant different as observed might be as a result of course load the BTE are undergoing, as apart from specialization courses, they do also partake in other non-examinable courses that

includes research project; seminar presentations; industrial training seminar and report writing, etc. These non-examinable couple with interference of course load the BTE are undergoing might lead to reduction in long term memory depository of skill in chart creation (Cherry, 2020), and so affects recalling capacity of skills gained in chart creation, especially at retention level.

As it pertained to the pairwise comparison, the result revealed a slight difference from the means, with all the three comparison to be statistically significant at 0.05. Additionally, the result obtained though indicates posttest-retention to be less than 0.05, but was found to be greater than 0.001 level of significant. The significant difference as observed might be as a result of time span between the posttest and retention, as the longer the period of non-use of skills acquired, the greater the retention loss will be (Arthur Jr. et al., 1998; Krätzig, 2016).

Conclusion

BTE skill in basic chart creation was found to be declining using three management rounds. This signifies a possibility of deterioration of skill in summarizing data using computer skills in general and specifically in chart creation. The results obtained clearly indicate a need to infuse some preventive measures of reducing such decay in skill. To reduce the decay as observed, and so improved the recalling level of BTE graduating students far above what was obtained, a need to diversify from teacher-centred to learner-centred approach is required. Additionally, chart creates an instant impact, and so help in taking an informed decision by the audience. But of worry, the skill retention of basic chart creation among BTE graduating students was found to be low. This lack of recalling portends a danger to BTE students in securing job in advance. Even if employed, the BTE might results in visualizing misleading facts that are inaccurate when the need arise in future using chart skills, which can ultimately affect their job in specific, and as well creates problems for their employers' sustainability in general.

Recommendations

The current study can be interpreted as a first step in the research on basic chart creation skill retention. However, the results of this study should be treated with caution due to the small sample size; contracted population of BTE graduation students only; and the lack of details regarding the participants' characteristics.

A practical guide more especially in computer related courses should always accompany lessons and be shared on the students virtual platforms in the form of exercises with an option of download. This would serve as a depository of knowledge to which students in general and BTE in particular can always return to for skills upgrade and so helps in retention.

Future research using different approach, ICT artifacts and time interval be used to evaluate the effectiveness of the measures currently put in place in this study. This will go a long way in adding value to the teaching and learning in the chart creation, and so improve skill retention of BTE in specific and graduating students in general.

References

Abubakar Tafawa Balewa University [ATBU] Bauchi (2018). Reviewed Curricula for Bachelor of Technology Degrees, Vocational and Technology Education Programme

Alexander, M., & Kusleika, R. (2016). *Excel 2016 formulas*. John Wiley & Sons.

Al-katheri, M. A. M. (2023). The Effect of Using Charts in Financial Reports in Commercial Banks in Saudi Arabia. *Ijrsp*, *4*(46), 439-474.

Arthur Jr., W., Bennett Jr., W., Stanushu, P. L., McNelly, T. L. (1998). Factors that Influence Skill

Decay and Retention: A Quantitative Review and Analysis. *Human Performance*, 11(1), 57 – 101.

Asamoah, D. (2022). Improving Data Visualization Skills: A Curriculum Design. *International Journal of Education and Development using Information and Communication Technology (IJEDICT),* 18(1), 213-235.

Carl, M. R. Jr., Queen, E. B., Hayden, W., Steve, L., Mark, M. & Loreen, M. P. (2023). An Industry Survey of Analytics Spreadsheet Tools Adoption: Microsoft Excel vs Google Sheets. *Information on Systems Education Journal*, 21(5), 29-42**.**

Cherry, K. (2020). The Role of Schema in Psychology. Retrieved from https://www.verywellmind.com/what-is-a-schema-2795873.

Creswell, J. W. (2012). Educational Research: Planning, Conducting, And Evaluating Quantitative And Qualitative Research. Boston: Pearson Education Inc.

Cohen, L.; Manion, L. & Morrison, K. (2007). Research Methods in Education (6th Ed.). London and New York: Routledge Taylor and Francis Group.

Da Silva, M. (2005). Constructing the Teaching Process from Inside Out: How Pre-Service Teachers Make Sense of Their Perceptions of the Teaching of the Four Skills. *TESL-EJ*, *9*(2), 1 - 19.

Elger, D. (2007). Theory of Performance. *Faculty Guidebook: A comprehensive tool for improving faculty performance*, 1, 19-22.

Formby, S. K., Medlin, D., & Ellington, V. B. (2017). Microsoft Excel®: Is it an Important Job Skill for College Graduates?. *Information Systems Education Journal*, 15(3), 55.

Françoise, T., François-Marie, B. & Éric, B. (2008). Spreadsheet Knowledge and Skills of French Secondary School Students. In: R.T. Mittermeir and M.M. Sysło (Eds.): ISSEP 2008, LNCS 5090, 305–316, 2008.

Gibbs, S. & McKinnon, A.(2009). "The Computing Skills expected of Business Graduates: A New Zealand Study". Americas Conference on Information Systems (*AMCIS). Proceedings* 628. http://aisel.aisnet.org/amcis2009/628.

Haleem, A., Javaid, M., Qadri, M. A. & Suman, R. (2022). Understanding the Role of Digital Technologies in Education: A Review. *Sustainable Operations and Computers*, 3, 275-285.

Haqie, Alisha (2021). What is Learning Theory? Retrieved from https://www.lorman.com/what-is-learning-retention.

Jin, G., & Kwon, O. (2021). Impact of chart image characteristics on stock price prediction with a convolutional neural network. *Plos one*, *16*(6), e0253121.

Karsai, G., Sztipanovits, J., Ledeczi, A. & Bapty, T. (2003). Model-Integrated Development of Embedded Software. *Proceedings of the IEEE*, *91*(1), 145-164.

Krätzig, G. P. (2016). Skill retention: A test of the Effects of Overlearning and Skill Retention Interval on Maintenance of Infrequently used Complex Skills. Ph.D Thesis, University of Regina, Canada.

Kongsvik, J. R. (2021). *Using the conscious competence matrix to support teacher change by boosting teacher efficacy when implementing new techniques from professional development workshops*. Unpublished Ph.D Dissertation submitted to New Mexico State University.

Lantushenko, V., Lipton, A. F. & Erkis, T. (2018). Teaching Basic Spreadsheet Skills with Peer Tutoring. *Managerial Finance*, 44(7), 885-901.

Lucey, T. (2005), Management Information Systems. Book Power: London.

May, P. (2014). Effectiveness of SMART Board Use in the Teaching and Learning of Statistics. *Electronic Journal of Mathematics & Technology*, *8*(1).

McEvily, S. K., & Chakravarthy, B. (2002). The Persistence of Knowledge-Based Advantage: An Empirical Test for Product Performance and Technological Knowledge. *Strategic Management Journal*, 23(4), 285-305.

Meeks, E. (2018). What charts Do [Blog Post]. Retrieved from https://medium.com/nightingale/what-charts-do-48ed96f70a74

Min, K., & Siegel, C. (2011). Integration of SMART Board Technology and Effective Teaching.

Imanager's Journal on School Educational Technology, *7*(1).

Mukherjee, A. N., Basu, S., Faiz, B., & Paul, P. (2012). HRD in SME: A Study in Inculcation of the Practice of Conscious Competence Learning in Moonlight Engineering Company. *International Journal of Management, IT and Engineering*, 2(5), 638-653.

Morris, A. (2021). What Is a Chart & Why Is It Important for Businesses? Retrieved from https://www.netsuite.com/portal/resource/articles/erp/chart.shtml

Onyema, E. M. (2020). Integration of Emerging Technologies in Teaching and Learning Process in Nigeria: The Challenges. *Central Asian Journal of Mathematical Theory and Computer Sciences*, 1(11), 35-39.

Partiprajak, S., & Thongpo, P. (2016). Retention of basic life support knowledge, self-efficacy and chest compression performance in Thai undergraduate nursing students. *Nurse education in practice*, 16(1), 235-241.

Rahimi, A. R. (2023). A bi-phenomenon analysis to escalate higher educators' competence in developing university students' information literacy (HECDUSIL): The role of language lectures' conceptual and action-oriented digital competencies and skills. Education and Information Technologies, 29(6), 7195–7222. https://doi.org/10.1007/s10639-023-12081-0

Ritter, F. E., Baxter, G., Kim, J. W. & Srinivasmurthy, S. (2013). Learning and retention. *The Oxford handbook of cognitive engineering*, 125-142.

Rosenthal, L. (1986). Integrated Software for Microcomputer Systems (Final Report).

Santori, Ann (2023). What is a Chart? Definition, Types & Examples. Retrieved from https://study.com/academy/lesson/chart-definition-types-examples.html

Sestoft, P. (2014). *Spreadsheet Implementation Technology: Basics and Extensions*. The MIT Press.

Stein, H., Gurevich, I. & Gorev, D. (2020). Integration of Technology by Novice Mathematics Teachers–What Facilitates Such Integration and What Makes it Difficult? *Education and Information Technologies*, *25*(1), 141-161.

Stoner, G. (2009). Accounting students' IT application skills over a 10-year period. *Accounting Education*, *18*(1), 7-31.

Subramaniam, T., Hassan, S., Tan, A. J., Rahman, A., Ramlah, S., & Tay, J. S. (2022). Impact of cardiac life support training on retention of knowledge measured by pretest, immediate posttest, and 6-months posttest. *International E-Journal of Science, Medicine & Education*, 169(2).

Sweller, J. (1994). Cognitive Load Theory, Learning Difficulty, and Instructional Design. *Learning and Instruction*, 4, 295 – 312.

Tella, M. (2016). Microsoft Excel 2016: Beginner's Guide. Bauchi: Greenleaf Publishing Company.

Theall, M., Wager, W., & Svinicki, M. (2021). Gaining a Basic Understanding of the Subject. Retrieved from *IDEA: https://www. ideaedu. org/idea-notes-on-learning/gaining-a-basic-understanding-of-the-subject*.

Ugwuanyi, C. S. (2022). Developing sound knowledge of basic science concepts in children using flipped classroom: A case of simple repeated measures. *Education and Information Technologies*, 27(5), 6353-6365.

Welsh, E. T., Wanberg, C. R., Brown, K. G. & Simmering, M. J. (2003). E-learning: Emerging Uses, Empirical Results and Future Directions. *International Journal of Training and Development*, *7*(4), 245-258.

APPENDIX 1

GUIDE USED IN BASIC CHART CREATION IN ALL THE THREE ROUNDS OF PRETEST, POSTTEST AND RETENTION

You have 15 minutes to complete all the 7 steps. If you get stuck and fail to move on, type END. Take note, this assignment is only meant to improve your skill in chart creation as discussed earlier while submitting the consent form, so not for awarding any grade. So do your best to complete all parts of the assignment. After finishing or getting stuck, save the file using your registration number.

S/No. **Steps**

1. Type the following data and convert it to chart

	A	B	C	D
1		Year 1	Year 2	Year 3
2	Group 1	2.5	3.6	2.15
3	Group 2	3.2	2.15	2.6
4	Group 3	2.75	2.5	2.3
5	Group 4	2.5	1.9	2.7

2. Select complete data OR click on any area within the data and Press CTRL A
3. Click on INSERT in the Ribbon
4. Enclose within the chart groups are different chart types
5. Within the chart types, click on the drop down arrow in COLUMN
6. Move down to 3D groups
7. Click on the first one

APPENDIX 2
RUBRICS FOR PRETEST, POSTTEST AND RETENTION

Step	Possible Point	
1	0	Open Excel
2	3	Making **B1** active cell and entering YEAR 1
3	2	Using the right arrow to move to C1 and entering YEAR 2
4	2	Using right arrow again to move to D1 and entering YEAR 3
5	3	Using mouse to make A2 active cell, then entering GROUP 1
6	2	Pressing enter and typing GROUP 2 in A3
7	2	Pressing enter and typing GROUP 3 in A4
8	2	Pressing enter and typing GROUP 4 in A5
9	3	Clicking on B2 to start entering the data
10	2	Clicking on any area within the data entered
11	2	Pressing CTRL A to highlight all data entered
12	3	Using mouse to move to the ribbon and clicking on INSERT
13	3	Clicking on drop down arrow under COLUMN
14	3	Moving to the 3D groups and clicking on the first icon
TOTAL	**32**	

APPENDIX 3

CORRECT CHART OBTAINABLE FROM ALL THREE ROUNDS