PREDICTORS OF TRAINEE TEACHERS' INSTRUCTIONAL GRAPHIC PRODUCTION COMPETENCE

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Abstract This study investigated predictors of College of Education Trainee Teachers' instructional graphic production competence. Two hypotheses were raised while the instruments used to collect data was a validated competency rating scale and questionnaires for students' response. From the analysis of the data collected it was found that creative arts experience significantly contributed to trainee teachers' instructional graphic production competence (B = 0.683, t = 4.631, P < 0.05). It was found that information technology experience significantly contributed to trainee teachers' instructional graphic production competence (B = 0.539, t = 3.535, P < 0.05). It was found that trainee teachers' attitude significantly contributed to instructional graphic production competence. (B = 0.023, t = 6.316, P < 0.05). Results also revealed that creative arts experience, information technology experience and attitude taken as a whole significantly predicted trainee teachers' instructional graphics production competence. (F_{1198} = 31.048, P < 0.05). It was recommended that the predictor variables should be considered educational technology lecturers during professional preparation of 21st century teachers.

Keywords: computer graphics, drawing, educational media, 2-dimensional visuals, graphic design principles

Introduction

Teacher education is that component of an educational system charged with the responsibility of training teachers to acquire the competencies of teaching. The Federal Government of Nigeria, FGN (2013), in National Policy of Education emphasized that since no education system may rise above the quality of its teachers, teacher education shall continue to be given major emphasis in all educational planning and development, all teachers in educational institutions shall be professionally trained and the goal of teacher education is to encourage further the spirit of enquiry and creativity. It should be noted that irrespective of any instructional strategy used by a teacher, effective utilization of instructional media will significantly enhance the impact of the strategy. The inclusion of Educational Technology in teacher education is to provide teacher trainees with creative thinking, ingenuity, flexibility, innovativeness, originality and artistic creativity to design, develop, utilize, manage and evaluate instructional materials. Besides, instructional media production skills will provide support for teachers during and after training. Teachers use instructional media to improve motivation, cater for students with different learning disabilities, address differences in learning styles and expose students to several information avenues. According to Barnard (2015), students learn best when they are allowed to manipulate and interact with educational media. Researchers in the field of education continue to emphasize the inclusion of educational technology in teacher training because of teachers' creative and innovative values. This inclusion has the potential for teachers to improve their teaching practice in classroom situations, on the acquisition of various skills including design and production of instructional media (Mangal & Mangal, 2010). The Federal Government of Nigeria, FGN (2012), in the National Commission for Colleges of Education Minimum Standard for General Education Courses stipulates that Educational Technology: Theory and Practice as a 2 - Credit Compulsory Course is designed to broaden trainee teachers' knowledge on principles and practice of

design, production, improvisation, use, maintenance, storage and retrieval of educational media for the junior secondary level.

For instance, instructional graphic is visual material used to describe process, show hierarchy, compare data, stimulate learners' imagination, illustrate relationship, and promote retention and memory besides saving teaching time. Basically, graphic design is the art of selecting and arranging visual elements such as typography, images, symbols and colours to convey messages (Ametordzi et al., 2012). Graphic Design is a creative procedure that combines arts and technology to communicate information visually for clarity and precision. Graphic materials are flat or 2 - dimensional visuals which are symbolic as they represent real objects not available at the time of need. The use of graphic communication for visual representation is with understanding that such presentation will improve visual messages especially for visual learners. Instructional graphic is used to illustrate images of life, expression of feelings, communication of information and expression of societal culture in the context of education. Instructional graphics consist of charts, flat maps, realistic drawings, posters, flip charts, flash cards, cartoons, diagrams, graphs, lettering, sketching, pictures, photographs used for educational purposes. For instance, the primary use of charts in statistics is to present descriptive characteristics of a population in a graphically understandable manner. Mbahi (2005) noted that the use of instructional charts will stimulate learning because trainee teachers on teaching practice will be able to get students' attention and generate more students' interest during the lessons.

Educational technology is a study that deals with theory and practice of systematic design, development, utilization and evaluation of processes and resources for learning. Therefore, the objectives of educational technology curriculum include but not limited to inculcating in the trainee teachers' competencies in design and production of visual media such as drawing, pictorial charts, poster, maps, photograph, charts, pie graph, bar graph, line charts, flowcharts,

timelines, venn diagrams, wiring diagrams, scattergrams, thumbnail, sketches, lettering, pictographs, and graphs. A technique is the use of stick (isotype) drawing to draw stick people and simple outlines. One can also copy pictures in existing books, magazine, and newspaper through the use of graph and projection methods. Manually a creative teacher should note that the basic materials for making instructional graphic are paper board, wrapping paper, back of old posters, newsprint, cloth, PVC flex material, old pictures, magazine, calendar, almanac, pencils (2B, 4B, HB, 6B), eraser, pens, markers, brushes, paints, crayon, rulers, penknife, blade, scissors, adhesives, lettering aids and stencil for captions of instructional charts (Olori, 2010). In embarking on the layout and preparation of instructional graphic, a well-trained teacher should be able to show competence in using visual graphic elements such as line, shape, space, colour, texture, value, typography and graphic principles such as simplicity, unity, emphasis, balance, proportion, contrast, perspective, hierarchy, proximity, alignment, repetition, harmony, pattern and rhythm respectively. Teachers are expected to possess competence in developing 2-dimensional graphics manually using simple sketching, lettering, drawings, painting, rendering, grid, and projection methods for diagram enlargement.

With the emergence of computer system various software have been developed for graphical presentation of information and this made most designers shifted from manual to digital methods. Graphic communication on computer interface is popular in engineering discipline and this is being adopted in the field of educational technology for the purpose of training teachers how to use computer for designing and producing 2-dimensional instructional materials. It is a technique of visual presentation of information using computer for drawing, preparation of line charts, organizational charts, graphic organizer, diagrams, pie charts, bar charts, pictorial charts, flip charts, graphs, cartoon, flash cards, posters etc. Ward & Blesser (2018) noted that computer can be used to do various graphic design activities such as drawing, sketching, lettering, coloring,

painting, grid, projection, texturing, rendering, emphasis, balancing with the use of Photoshop, CorelDraw, Publishing, InDesign, Microsoft words etc.

According to Rouse (2019), graphic designers do make use of computer to design all kinds of 2-dimensional drawings, lettering and pictures with the help of software such as Adobe illustrator, Lucidchart, Sketch, Sketchbook, Draw.io flow chart tools, Pingboard, ArtRage, Visio, Krita, Cacoo, Affinity Designer, CorelDraw, EDraw Max, Samepage, FlowMapp, Inkscape, Paint Tool SAI, DesignEvo, Concept Draw Diagram and Artboard. The use of these softwares has made it easier for teachers to show their creativity skills in terms of illustration and examples (Osamah & Ziad Waleed, 2015). Graphic softwares are tools designed to simplify the use of computer programmes by a computer graphic artist for drawing using a mouse to manipulate text and images on the monitor. With these tools a teacher can draw any objects and makes use of tools like eraser, painting, brush and mixing of colours to get the desired instructional graphic or pictorial output.

Despite importance attached to instructional materials in educational practice, studies show that majority of Nigerian teachers lack competency in designing simple instructional graphics. To support this assertion, Mbahi (2005) in a study reported that majority of trainee teachers in Nigerian Colleges of Education lack skills in visual elements for graphic design such as texture, line, typography, colour, space, shape and form. Olanleyin (2013) in a study found that majority of trainee teachers in Nigeria College of Education do not possess skills in production of instructional charts as observed during their teaching practice with respect to principles of graphic design such as harmony, emphasis, proximity, alignment, hierarchy, pattern, proportion, contrast and rhythm. It was also reported that majority of the participants could not draw objects with software applications. Fatuyi (2005) in a study found that 95% of Nigerian teachers who graduated from College of Education lacked required skills to use colour in computer graphics design such as primary, secondary, tertiary, warm, cool, monochromatic, analogous, complimentary and triadic, tint, shade and

tone. Adamu (2005) in a study found that majority of trainee teachers in Nigeria tertiary institutions were deficient in the use software for visual elements such as line, space, shape, texture and colour. Adelabu & Idowu (2011) found that majority of teachers in Nigeria schools are deficient in the use of design tools like CorelDraw, Photoshop, Sketches, Adobe Illustrator, Clipart etc. It was reported by Akinsanya (2020) that despite the fact that Nigerian teachers were exposed to educational technology in their training majority could not use Photoshop, Adobe illustrators and Publishers for instructional graphic design.

With respect to the above challenges confronting Nigerian teachers, Olanleyin (2013) posited that factors predicting teachers' possession of instructional media production skills include gender, area of specialization and age. Akinsanya (2020) in a survey study reported that the factors influencing instructional material production skills of trainee teachers are school college facilities, accessibility to resources and personal resourcefulness of the trainers. Of much concern to the researcher in this study is how significant can trainee teachers' creative arts experience, information technology experience and trainee teachers' attitude towards creativity predict instructional graphic production competencies? The reason however, is that available research works on these factors are scarce, especially in Nigeria context.

Creative art is a discipline that involves creative thinking, receptive mind, imaginary ideas, use of drawing for communication, the use of symbols, imitation, exhibition of talents, improvisation, decoration, aesthetic and awareness etc. Studies have identified creative art experience as a factor predicting teachers' skills in instructional material improvisation. Swan (2017) in a study reported that students with cultural and creative arts experience in primary or post primary education level were found to be proficient in creative activities in tertiary institutions. Kay (2018) reported in a study that teachers with previous experience in creative art classroom showed significant creativity in instructional material improvisation than those without previous experience. On the other hand, Tailor & Kelly (2019) in a study reported that previous creative arts

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classroom experience has no significant influence on proficiency in instructional media improvisation.

Information technology is the innovative digital device used for communication of ideas, thoughts and messages. The innovativeness in an information technology experienced person are ingenuity, novelty, flexibility, open mind, developing new ideas, solving problems with innovation, choice of materials and aesthetic ideas. Information technology experience is reported to have significant contribution to teachers' production of instructional technologies. Colman (2018) in a study found significant contribution of information technology experience on improvisation of instructional media. Brownell (2019) in a study found that teachers with information technology experience were significantly proficient in the use of technology to produce multimedia instructional packages. Cotton (2020) reported no significant influence of information technology experience on the use of digital devices to produce power point instructional packages.

Attitude is a construct showing a persons' disposition, behavior, interest, motivation and readiness towards a knowledge or belief. It is generally understood that when a person shows significant commitment towards acquiring a knowledge or skill, such skill is easily mastered on training unlike a person with negative attitude. Kimm & Goldman (2017) in a study reported that teachers' disposition towards aesthetic products significantly influenced instructional material improvisation. Mandey (2018) reported that teachers with positive attitude towards effective teaching were found to be significantly aware of the importance of instructional media in instructional process. Timm & Martin (2020) reported no significant influence of teachers' attitude on instructional media improvisation skills.

This study is situated in David Kolb's (1984) Theory of Learning Styles which stated that all students have a preferred learning style influenced by genetic, life experiences and the demand of our current environment. The learning

styles reported in literature are visual, audio and kinesthetic (VAK), that students who learn by observation, watching, viewing and using mostly their sense of sight are visual learners (Felder & Silverman, 1988). This group of learners are competent in tasks requiring the use of sight, forgets verbal information quickly; learn best through map, poster, cartoon, flashcard, picture, concept map, graphic organizer, tables, charts, technical drawing, diagram illustrations and other visual media. Studies showed that graphic communication improves students' learning outcomes as they emphasize area of interest, visualize experience, sustain attention, stimulate reality, encourage manipulative skills, promote continuity of thoughts, make learning concrete and permanent. Teachers are therefore trained on creativity to develop learner friendly instructional graphic to complement verbal presentation of information in the classroom for improved learning.

Statement of the problem

Since teachers play major role in the education of young children, the quality of their own training is a matter of concern for education stakeholders. Among the importance aspect of teacher training is the production and utilization of instructional media to reinforce learning, motivate learners and make learning real. However, studies established lack of use of instructional media especially instructional graphics by teachers, and this is likely to have resulted from deficiencies in graphic production skills during professional training amongst others. This lack of competence among trainee teachers in Nigerian Colleges of Education might be linked to a number of factors yet to be identified empirically. This study investigated some predictors of College of Education Trainee Teachers' competence in production of instructional graphics.

Purpose of the study

The purpose of this study is to investigate the contribution of trainee teachers' creative arts experience, information technology experience and attitude on instructional graphic production competence.

Hypotheses

$H_0$1: There is no significant relative contribution of trainee teachers' creative arts experience, information technology experience and attitude on instructional graphic production competence

$H_0$2: There is no significant joint contribution of trainee teachers' creative arts experience, information technology experience and attitude on instructional graphic production competence.

Methodology

This study employed survey research design and a population that consisted of all Trainee Teachers in Southwest Nigeria Colleges of Education. The sample comprised of one thousand two hundred (1200) trainee teachers. Three Public Colleges of Education were randomly selected in three randomly selected Southwestern states. Four hundred participants were purposively selected in each College of Education as a result of the nature of the study which is direct observation and rating of the trainee teachers' competencies in the Educational Technology Laboratory. Only two hundred (200) level students were purposively selected because Educational Technology is offered as a course at that level which would expose them to "Design and Production of graphic Materials".

The instruments used to collect data for the study was a researcher developed questionnaire and a rating scale. The questionnaire meant for response of the trainee teachers was divided into section A, B, C, D and D. Section A sought for personal information, e.g., gender, department, area of course of study, information technology experience, institution etc. Section B consists of

10 items designed to measure creative art experience of the participants. Creative Experience Questionnaire (CAEQ) is a 4-point likert scale with scoring system ranging from Strongly Agree (SA) to Strongly Disagree (SD). Its validity was confirmed by experts, pilot survey was done for reliability and this yielded correlation coefficient value of 0.72. Section C consists of 10 items designed to measure information technology experience. Information technology experience questionnaire (ITQ) is a 4-point likert scale with scoring system ranging from Strongly Agree (SA) to Strongly Disagree (SD). Its validity was confirmed by experts, pilot survey was done for reliability and this yielded correlation coefficient value of 0.78. Section D consists of 10 items designed to measure trainee teachers' attitude towards graphic production. The attitude towards graphic production questionnaire (AGPQ) is a 4-point likert scale with scoring system ranging from Strongly Agree (SA) to Strongly Disagree (SD). Its validity was confirmed by experts, pilot survey conducted for reliability and this yielded correlation coefficient value of 0.69.

A self-developed instrument named "Teachers' Competence in Graphic Production Rating Scale (TGPRS)" was also used to collect data. Section A sought demographic information about the respondents such as gender, information technology experience, department institution and course of study. Section B measures trainee teachers' competence in design and production of instructional graphics. The 30 item measure covered visual elements of graphic design, principles of graphic design and computer graphic tools. It was constructed on a 4 - point likert scale in which the observers rated only one column of Highly Competent (4) - meaning the person is an expert with excellent mastery of the basic techniques; Averagely Competent (3) - meaning the person is an intermediate with average mastery of the basic techniques; Low Competent (2) - meaning the person has limited mastery of the basic techniques; and Not Competent (1) - meaning the person has no mastery of the basic techniques. It was given to experts for face and content validity, while its reliability was determined by given it to six (6) Experienced Educational Technology Lecturers

who observed and rated twenty trainee teachers in a College of Education outside the scope of the study. These raters were given similar orientations on how to administer the observation instruments on the respondents. Their ratings were compared using inter-rater reliability Scott's pi (π) in order to ascertain the level of agreement among the raters. The inter-rater reliability values obtained ranged between 0.71 and 0.80 thus, an average reliability value of 0.76 in this case was considered adequate for the study.

Six research assistants were used, in which two were selected in each institution for observation and rating of the students who produced a graphic instructional material as a project being individually developed. Two hundred (200) participants were randomly assigned to a research assistant. The research assistants (Lecturers) made the trainee teachers to develop lesson plan on a topic in their respective teaching subject and this was accompanied with relevant graphic instructional materials that were rated after completion. They were also directed to have little interaction with the trainee teachers in form of question and answer during submission to ascertain that the project was independently produced. The exercise lasted for a semester and this was monitored closely by the researcher. During submission, the research assistants gave a copy of the questionnaires meant for the students to respond and submit with similar coded number on the rating scale and the questionnaires for easy collation. The hypotheses were statistically analyzed with multiple regression.

Results

$H_0 1$: There is no significant relative contribution of trainee teachers' creative arts experience, information technology experience and attitude on instructional graphic production competence.

Table 1. Relative contribution of independent variables on trainee teachers' instructional graphic production competence

Model	Un-standardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	T	Sig.
(Constant)	32.562	0.753		52.261	.002
Teachers' creative art experience	3.241	2.872	0.683	4.631	.000
Teachers' information technology experience	2.648	4.265	0.539	3.535	.001
Teachers' attitude	4.831	3.271	0.023	6.316	.000

Table 1 above revealed significant contribution of each of the independent variable to instructional graphic production competence of College of Education trainee teachers. Teachers' creative arts experience (B = 0.683, t = 4.631, P < 0.05), teachers' information technology experience (B = 0.539, t = 3.535, P < 0.05) and attitude on instructional graphic production competence (B = 0.023, t = 6.316, P < 0.05). Although, all the independent variables significantly contributed to competence in instructional graphic production, but teachers' attitude towards instructional graphic production was the strongest predictor, followed by teachers' creative arts experience and information technology experience.

$H_0 2$: There is no significant joint contribution of trainee teachers' creative arts experience, information technology experience and attitude on instructional graphic production competence.

Table 2 below results revealed trainee teachers' creative arts experience, information technology experience and attitude taken as a whole significantly predicted instructional graphic production competence. (F_{1198} =31.048, P < 0.05).The result further showed that the independent variables accounted for 68.4% of the variance in the production competency while 31.6 was due to chance. Therefore, the postulated null hypothesis is rejected in favour of the alternative hypothesis.

Table 2. Multiple regression summary of joint contribution of trainee teachers' creative arts experience, information technology experience and attitude on instructional graphic production competence

ANOVA Model	Sum of Square	Df	Mean Square	F	Sig.	Remark
Regression	637.129	1	78.754	31.048	.001	Rejected
Residual	20858.714	1198	2.472			
Total	21495.843	1199				

$R = 0.587$; $R^2 = 0.684$; Adjusted $R^2 = 0.316$; Std. Error $= 6.2166$

Discussion

Hypothesis one states that there is no significant relative contribution of trainee teachers' creative arts experience, information technology experience and attitude on instructional graphic production competence. The T calculated ratio of 4.631, at 0.05 level of significance is an evidence that creative art experience significantly contributed to instructional graphic production competence. The findings corroborate Swan (2017) and Kay (2018) who reported that creative arts experience significantly influenced students' creativity, innovativeness and artistic skills. The reason for this result might be that significant number of the respondents had previous experience in cultural and creative arts classroom which they now applied in 'graphic design' which is a course in Educational Technology. It must be noted that in Nigerian basic education curriculum cultural and creative arts is a core subject which made the experience general to all students.

The findings revealed that information technology experience significantly contributed to trainee teachers' instructional graphic production competence. The T calculated ratio of 3.535, at 0.05 level of significance is an evidence that information technology experience significantly predicted trainee teachers' instructional graphic production competence. This finding is in agree-

ment with Colman (2018) and Brownell (2019) who found significant contribution of information technology experience on improvisation of instructional media. The reason why the result showed significant contribution of information technology experience might be because their prior experience in computer studies while in primary and secondary schools might have influenced their competency in instructional graphic production. In Nigerian primary and secondary schools, computer studies is a core subjects, thus, all students in tertiary institutions must have previous experience in the use of computer for graphic design and other activities.

The finding shows that trainee teachers' attitude significantly contributed to instructional graphic production competence. The T calculated ratio of 6.316, at 0.05 level of significance is an evidence that trainee teachers' attitude towards the training significantly contributed to instructional graphic production competence. This finding supports the work of Kimm & Goldman (2017) who found that teachers' disposition towards creative ideas significantly influenced instructional material improvisation. Mandey (2018) reported that teachers with positive attitude towards art and design were found to be significantly aware of the importance of instructional media in teaching. The reason why the results showed significant contribution of attitude toward the competency might be simply psychological because they have positive disposition and this will reinforce their level of motivation, self-confidence, self-esteem, self-efficacy and locus control. It was revealed that although all the independent variables significantly contributed to trainee teachers' competence in instructional graphic production but teachers' attitude towards the course was the strongest predictor, followed by teachers' creative art experience and information technology experience.

Hypothesis two showed the effectiveness of the combination of teachers' creative arts experience, information technology experience and attitude in predicting instructional graphic production competence. The F calculated ratio

of 31.048 is significant at 0.05 level of significance is an evidence of the influence of the combination of the independent variables on the dependent variable. The result of this study is in agreement with Kay (2018), Mandey (2018) and Brownell (2019) observation that previous experience and training have significant influence on instructional material improvisation. This means that when educational technology lecturers are training teachers on instructional graphic production they should take note of students' background in cultural and creative arts, computer studies and the attitude towards the intended skill to be acquired because without right disposition students may not be cognitively ready for the training.

Conclusion

This study investigated the predictors of trainee teachers' competence in instructional graphic production among College of Education Students in Southwest, Nigeria. Findings revealed that trainee teachers' previous experience in creative arts significantly contributed to competent in graphic production. The reason for this may be that developing ability to make graphic representation of ideas through sketching and drawing is part of basic education in Nigeria. Also, some students may have artistic talent and as such they could naturally exhibit those abilities without much training. Trainee teachers' information technology experience was found to significantly contribute to competence instructional graphic production competence. This mean that they are highly proficient in the use of graphic packages to develop teaching materials and this might have been influenced by their previous knowledge in computer studies in primary and post primary classrooms. Some students are naturally gifted with ICT skills and as such can exhibit these abilities without much training. The result also showed that trainee teachers' attitude was the highest predictor that significantly contributed towards acquiring instructional graphic production competence and this might have been as a result of personal commitment for bridging skill deficits and performance gaps.

Recommendations

(A) Educational technology lecturers who are preparing the trainee teachers in instructional graphic development should leverage on students' background in cultural and creative arts in order to help them acquire the skills, after all pedagogical content should be presented from simple to complex and parts to whole.

(B) Though, most students coming into tertiary institution have previous information technology experience through computer studies in primary and post primary level, their skills in graphic packages must be improved so that they can independently develop usable and effective instructional materials.

(C) Students coming into educational technology classroom must be motivated to develop interest in creative activities as required skills for teachers to be real professionals.

(D) In design of teacher education programme emphasis should be laid on teachers' sense of creativity in design, developing, utilization and evaluation of effective instructional materials.

(E) Emphasis should be given to micro-teaching exercise where trainee teachers will be able to showcase the instructional materials developed by them using graphic elements, graphic principles and computer graphics.

(F) Lecturers teaching educational technology should be encouraged by their respective institutions to attend training/workshops on the use of computer graphics packages in form of training the trainers.

REFERENCES

Adamu, A.A. (2005). *History of art classroom in Nigeria*. Maiduguri: Kingwell Publishers.

Adelabu, O.S & Idowu, S.O. (2011). Pursuit of industrial design career in Nigeria: an appraisal of the current trend. *J. Industrial Design*, *1*(9), 67-75.

Akinsanya, A.K. (2020). The role of drawing in graphic design process. *J. Fine & Creative Arts Studies, 11*(4), 158-172.

Ametordzi,S., Osei-Poku, P. & Eshun, E.F.(2012). Pedagogical situations and learning outcomes in graphic design in selected senior high schools in the Kumasi Metropolis of Ghana. *Int. J. Innovative Res. & Development*, *1*(2), 178-191.

Barnard, M. (2015). *Graphic design as communication*. London: Routledge.

Brownell, R. (2019). Barriers in using technology. *Computer & Education*, 5(2), 50-63.

Colman, H. (2018). Teaching with media. *Rev. Educ. Res., 67*, 180-212.

Cotton, J. (2020). Digital proficiency and teachers. *Educ. Tech.,* 35(3), 13-19.

Fatuyi, R.B. (2005). *General concepts, philosophy and psychology of industrial design*. Akure: BSIV Publishers.

Felder, R.M. & Silverman, L.K. (1988). Learning and teaching style in engineering education. *Engineering education*, *78*, 674-681

FRN [Federal Republic of Nigeria]. (2012). *Nigeria certificate in education minimum standards for general education*. Abuja: National Commission for Colleges of Education.

FRN [Federal Republic of Nigeria]. (2013). *National policy on education.* Lagos: NERDC Press.

Kay, O. (2018). Influence of teachers' characteristics on students' academic performance. *Design Issues, 7*(1), 20-22.

Kimm, K. & Goldman, F. (2017). Factors influencing effective utilization of instructional materials by teachers. *Educ. Tech. & Soc.*, *11*(3), 114-126.

Kolb, D.A. (1984). *Experiential learning*. Hoboken: Prentice Hall.

Mandey, H. (2018). Teachers and educational resources. *Educ. Tech. J., 8,* 51-67.

Mangal, S.K. & Mangal, U. (2010). *Essentials of educational technology*. New Delhi: PHI Learning.

Mbahi, A.A. (2005). *Art teachers*. Maiduguri: University of Maiduguri.

Olanleyin, O.S. (2013). Problems of using graphic visuals in teaching practice. *J. Educ. Studies, 15*(5), 52-64.

Olori, A.L. (2010). *Introduction to educational technology*. Ijebu Ode: Bosun Press Ltd.

Osamah, A.A. & Ziad Waleed, M.A. (2015). Standards of multimedia graphic design in education. *J. Educ. & Practice, 6*(17), 102-110.

Rouse, W.B. (2019). Human-computer interaction in the control of dynamic systems. *Computing Surveys*, *13*(1), 51-64.

Swan, B. (2017). Factors influencing instructional material improvisation skills of teachers. *Design Issues, 10*(1), 1-13.

Tailor, C. & Kelly, J. M (2018). Predictors of students' performance in mathematics. *Computers & Education, 49,* 1147–1160.

Timm, Y. & Martin, G. (2020). Relationship between school factors and teachers use of instructional media. *Design Studies.* 3(5), 461- 478.

Ward, J. & Blessing, B. (2018). Interactive recognition of hand printed characters for computer input. *IEEE Computer Graphics & Application*, *5*(7), 24-37.

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