

Effects of K-Yan Multimedia Instructional Strategy on Students' Retention in Woodwork Technology in Federal Colleges of Education (Technical) in North-East, Nigeria

Prof. C. A. JOHN¹, Dr. N. A. Nwankwor², Bwala. Y. B³

^{1,2}Department of Technology Education, Modibbo Adama University, Nigeria.

³Department of Woodwork Technology, Federal College of Education (Tech), Nigeria

*Corresponding Author

Received: 01 May 2023/ Revised: 10 May 2023/ Accepted: 17 May 2023/ Published: 31-05-2023

Copyright @ 2023 International Journal of Engineering Research and Science

This is an Open-Access article distributed under the terms of the Creative Commons Attribution

Non-Commercial License (<https://creativecommons.org/licenses/by-nc/4.0>) which permits unrestricted

Non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract— K-YAN multimedia instructional strategy is an emerging technology that has been gaining considerable popularity in the educational sector in developed countries in recent years. This form of technology is new in Nigeria, with Borno and Jigawa state being the first to adopt it. This study, therefore examined the effect of K-YAN multimedia instructional strategy on students' retention in woodwork technology. Area of study was North-East, Nigeria. Population of study was all NCE (T) 2 students in Federal Colleges of Education (T) in North- East, Nigeria with a population of 355 students. Sample size is 150 students; purposeful sampling was used to determine sample size of the study. The study used Quasi-experimental research designs. Three purposes, three research questions and three hypotheses were formulated to guide the study. Woodwork Achievement Test instrument (WWAT) was developed, The instrument was validated by four experts from Modibbo Adama University, Yola, Abubakar Tafawa Balewa University, Bauchi, and Federal College of Education (T) Gombe respectively. Data collected were analyzed using mean and standard deviation to answer research questions, while ANCOVA was used to test the hypotheses at 0.05 level of significance. The reliability of the instrument (WWAT) was tested at Ramat Polytechnic using 30 students, and a reliability coefficient of 0.89 was obtained. Findings from the study showed an improvement in students' retention in both groups. However, there was significant difference between the instructional approaches in favour of experimental group. The study concluded that, K-YAN multimedia teaching strategy enhances students' retention. It was recommended that K-YAN multimedia be encouraged among woodwork technology teachers, students and professional organizations. It was equally recommended that seminars, workshops and conferences for all technology teachers be organized for this new technology.

Keywords— K-yan, Multimedia, Students, Technical, Woodwork.

I. INTRODUCTION

The application of modern multimedia technology in educational training programs has demonstrated some level of impact over the Lecture method, resulting in diversified methods of teaching and learning. According to Abd-El-Aziz, et al. (2017) the pervasiveness of the use of multimedia technology and the internet in the modern instructional process is assuming a recurrent decimal of change in the field of education, particularly technology education. This is because, multimedia is more frequently becoming part of our daily lives, and its presence in education is not a mistake. As a result of these, Bartlett and Strough (2003) stated that, besides potential advantages to students, multimedia formats may offer benefits to instructors teaching multi- section causes because this type of format ensures uniformity in the lecture content across the sections.

If the philosophy of Nigeria's certificate in education (Technical) NCE (T) is to remain relevant in all areas it was meant to serve, retention of academic activities by students need to be improved. However, there are diverse factors that can hinder students from retaining what has been taught which includes: none availability of training materials, lack of equipment, lack of guidance in schools, lack of well trained technical teachers, lack of good teaching methodology and the underutilization of available technological innovations or inappropriate application of new technological skills. However, this study focuses only on the teaching method employed by teachers in Federal Colleges of Education Technical (FCET).

According to Abd-El-Aziz, Abd-El-Latif, Adekunle, and Hassan (2017) student's learning outcome connote attainment in a school subject which was usually symbolized by a score or mark on a test. Abd-El-Aziz, et al. (2017) again further stated that learning outcome depends on several factors among which are: Instructional methods, learning environment, learning material, and the learner. This may be as a result of the methods of teaching employed by the teachers since the majority of Woodwork technology teachers rely on the use of traditional chalk and talk method which is considered boring.

Knowledge Vehicle (K-YAN) multimedia applications can be used by lecturers to convey information to students such as lecture slides, assessment materials, and learning resources. It can as well be used by students to learn new skills and knowledge without the teacher's presence, making retention easier. According to the Council of Registered Engineers (CORBON, 2018) "the application of K-YAN multimedia in a classroom situation and its effect on learning outcomes cannot be overemphasized, apart from empowering teachers, it also aid teachers to focus on improving the retention.

This study intends to look at the effect of K-YAN multimedia instructional strategy on woodwork technology students with emphasis on retention of students in carcase construction, framing construction, and finishing processes. Retention is the preservation of mind which implies that the amount of knowledge acquired, retained, skill maintained and problem-solving behaviors which manifest continually demonstrate what has been learned, while what is retained is usually of interest to the learner (Kundu and Tutoo, 2012). It has always been difficult for students to reproduce or recall what has been taught to them correctly in lecture method of teaching. Retention therefore, based on the aforementioned, which implies that learned materials may improve when K-YAN multimedia is used in teaching and learning, especially with the use of slides and videos which can be transferred to the student's laptops. With this, the students' can re-play the lesson as many times as they desire at their convenience, which can eventually help in retaining what has been taught. The focus of this study, therefore, is to determine the effect of K-YAN multimedia teaching strategy on students learning outcomes in woodwork technology in Federal Colleges of Education (Technical) in North-East, Nigeria.

II. LITERATURE REVIEW

General Perspectives of Woodworking Technology in Colleges of Education

Woodworking Technology is a skill or activity of making wooden objects; it was also referred to as the parts of a house or room that are made of wood. The program in Woodwork Technology gives an individual the best possible knowledge related to wooden materials and industrial production of wood items, meeting up the needs and expectations from the wood-based industry. Combining the skills acquired with the specific knowledge in wood and wood technology makes the learner attractive and competent in the labour market. The woodwork technology program is a pronounced project-oriented profile in Colleges of Education (Technical) in Nigeria. According to Okoye and Okwelle (2014), woodwork technology like any other TVET course is practically oriented and requires highly skilled manpower, power tools, machines, and hand tools. Unfortunately, the implementation of the Technical and Vocational Education and Training (TVET) curriculum in Colleges of Education in Nigeria for skill acquisition and production of employable graduates has not been yielding the expected results in Nigeria. This was traceable to the poor funding of TVET programs which was characterized by the lack of basic infrastructure needed to facilitate teaching and training. Most of the Colleges have ill equipped workshops, inadequate training materials, lack of equipment, and use of obsolete machines and tools.

According to Okwori (2012) physical facilities such as workshops, machines and hand tools are not adequate enough in Colleges of Education in Nigeria. These inadequacies affect students' performance in both theory and practical work. Again these challenges negatively affect the quality of delivery of TVET courses (Woodwork Technology inclusive). The teachers of woodwork technology in colleges of education are made to train the woodwork students in both theoretical studies as well as practical work. According to Pam (2004), woodwork technology was part of vocational-technical education, was a type of training intended to prepare the students to be able to teach in the junior section of the technical colleges, earn a living in an occupation in which success is dependent largely on an understanding of technology as applied to modern technology and design. This type of education provides the skill, knowledge, and attitudes necessary for effective employment in specific occupations.

Woodwork Technology in Colleges of Education (Technical) therefore, involves the engagement of both woodwork teachers and students in theory and practical activities. In this respect, students will become familiar with the main aspects involved in the design and development of new and existing woodwork technology products based on customers' needs. Teachers of woodwork technology in Colleges of Education (Technical) are expected to have the knowledge of a wide range of production machinery currently use in the advanced woodworking industry and modern woodwork technology hand tools.

Chinyere (2020) observed that woodwork technology is a written course aimed to meet the need of a range of syllabus emphasizing the practical procedure, that woodwork technology was a versatile career avenue. Students start to learn when they are involved in the learning situation. At present we have woodwork technology teachers who emphasize more on theoretical aspects in the woodwork shops with no emphasis on practical work due to lack of skills in practical projects and lack of enough training materials supplied by the government. This indicates that, if woodwork technology is well taught especially in terms of practical projects in Colleges of Education, then many of the students graduating from the Colleges of Education will be competent enough to teach at the junior level of the technical colleges, engage in woodwork technology related business or open their woodwork shops instead of waiting for government work. To achieve these objectives the learners should be competent in carcase construction, framing construction, and finishing processes.

Retention is the preservation of mind which implies that the amount of knowledge acquired, retained, skill maintained and problem-solving behaviors which manifest continually demonstrate what has been learned, while what is retained is usually of interest to the learner (Kundu and Tutoo, 2012). It has always been difficult for students to reproduce or recall what has been taught to them correctly in lecture method of teaching. Retention therefore, based on the aforementioned, which implies that learned materials may improve when K-YAN multimedia is used in teaching and learning, especially with the use of slides and videos which can be transferred to the student's laptops. With this, the students' can re-play the lesson as many times as they desire at their convenience, which can eventually help in retaining what has been taught. Similarly, Reddy and Tamanna (2018) corroborated that Knowledge Vehicle (K-YAN) multimedia is a user-centered and friendly design that can assist to develop students' interest and retention as it can transform a mix of products and services into a sustainable device, while still being economically successful. The focus of this study, therefore, is to determine the effect of K-YAN multimedia teaching strategy on students learning outcomes in woodwork technology in Federal Colleges of Education (Technical) in North-East, Nigeria.

III. STATEMENT OF THE PROBLEM

Despite all efforts by the government to ensure improved quality education at the Colleges of Education (Technical) level, and to also produce quality graduates in terms of academic achievement, interest and employability. It has been observed that, there has been a persistent high rate of poor retention among woodwork students. This researcher also observed that, the prevalent method of teaching used in Federal Colleges of Education (Technical) in North-East, Nigeria particularly in woodwork technology has been the lecture method due to inadequate training materials supplied by the colleges. This method is teacher-centered and saddled with many limitations as it renders students passive and has a limited effect on students' retention. If this situation is left unattended, the consequences will be continuous poor retention among woodwork technology students.

IV. PURPOSE OF THE STUDY

The study sought to determine:

1. The effects of K-YAN Multimedia instructional strategy and Lecture method on woodwork students' retention when taught carcase construction in Federal Colleges of Education (Technical) in North-East, Nigeria
2. The effects of K-YAN Multimedia instructional strategy and Lecture method on woodwork students' retention when taught framing construction in Federal Colleges of Education (Technical) in North-East, Nigeria
3. The effects of K-YAN Multimedia instructional strategy and Lecture method on woodwork students' retention when taught finishing processes in Federal Colleges of Education (Technical) in North-East, Nigeria

V. RESEARCH QUESTIONS

The following research questions were raised to guide the study:

1. What are the post-test and pos-test delayed mean scores of woodwork students' retention when taught carcase construction using K-YAN Multimedia instructional strategy and Lecture method in Federal Colleges of Education (Technical) in North-East, Nigeria?
2. What are the post-test and post-test delayed mean scores of woodwork students' retention when taught framing construction using K-YAN Multimedia instructional strategy and Lecture method in Federal Colleges of Education (Technical) in North-East, Nigeria?
3. What are the post-test and pos- test delayed mean scores of woodwork students' retention when taught finishing process using K-YAN Multimedia instructional strategy and Lecture method in Federal Colleges of Education (Technical) in North-East, Nigeria?

VI. HYPOTHESES

The following null hypotheses were formulated and tested at 0.05 level of significance to guide the study.

- Ho₁ There was no significant difference in the mean retention scores of woodwork technology students on carcass construction in Federal Colleges of Education (Technical) in North-East, Nigeria in the experimental and control groups.
- Ho₂ There was no significant difference in the mean retention scores of woodwork technology students when taught framing process in Federal Colleges of Education (Technical) in North-East, Nigeria in the experimental and control groups.
- Ho₃ There was no significant difference in the mean retention scores of woodwork technology students when taught finishing process in Federal Colleges of Education (Technical) in North-East, Nigeria in the experimental and control groups.

VII. METHODOLOGY

The study used Quasi-experimental design with pretest-posttest and post-delayed test non-equivalent, non-randomized, experimental, and control groups.

Research Design Layout

Experimental G₁.....O_{A1}-----X₁-----O_{B1}-----O_{C1}

Control G₂.....O_{A2}-----O_{B2}-----O_{C2}

Area of the study was North-East, Nigeria. The population of this study comprised all NCE (T) II students offering woodwork trade in all Federal Colleges of Education (Technical) in North-East, Nigeria, numbering 355 students. purposive sampling technique was adopted. Instrument used for data collection was developed by the researcher called Woodwork Performance Test (WWPT) containing pre-test, post-test and delayed post-test. The (WWPT) was used to answer research question. The test was based on three topics namely: carcass construction, framing construction, and finishing processes. There were 4 validates drawn from Abubakar Tafawa Balewa University, Bauchi, Modibbo Adama University, Yola and Federal College of Education (Technical), Gombe. The instrument (WWPT) was trial tested at Ramat Polytechnic Maiduguri for reliability using 30 students. The reliability of the instrument was obtained using Pearson product correlation coefficient (test-retest). The reliability coefficient obtained was 0.89.

The scheme of work for period of administration of the instrument and subsequent collection of data was six weeks. Lesson plan for the experimental group was prepared by the researcher. The research assistants were required to abide by the rules and ethics of the research. The experimental group was exposed to treatment using the K-YAN multimedia teaching strategy while the control group was exposed to conventional or lecture teaching strategy. The independent variable was the teaching method. The dependent variable was students' retention

Row scores were obtained from the pre-test, post-test and delayed post-test were used to answer research questions 1-3 using mean and standard deviation. While ANCOVA was used to test the null hypotheses using the statistical package of (SPSS) version 22, at a probability level of 0.05 level of significance 95% confidence. The decision rule was, where $p < 0.05$ the null hypothesis was rejected but where $p > 0.05$ the null hypothesis was accepted.

VIII. RESULTS

8.1 Research Question 1

TABLE 1
MEAN AND STANDARD DEVIATION SCORES OF WOODWORK STUDENTS' RETENTION IN CARCASE CONSTRUCTION IN EXPERIMENTAL AND CONTROL GROUP

| Group | N | Post-test SD Mean | Delayed SD Post-test Mean | Mean Difference |
|--------------|----|-------------------|---------------------------|-----------------|
| Experimental | 87 | 61.97 8.56 | 59.37 8.68 | - 2.3 |
| Control | 70 | 40.41 5.17 | 37.41 5.20 | - 3.0 |

Table 1 shows an analysis of retention mean scores using the K-YAN multimedia learning method and lecture teaching method in carcase construction. The Table shows mean score of 61.97 with standard deviation of 8.56 in the post-test with a mean difference of -2.3. The control group had mean score of 40.41 and standard deviation of 5.17. In post-test delayed test, control group mean score was 37.41 with a standard deviation of 5.20 and mean difference of -3.0. This implies that students in experimental group retain more information with -2.3 as mean difference than those in control group with mean difference of -3.0. Even though both groups were negatively impacted; this might be as a result of the insurgency that took place within the period test was administered. However, there was still a clear indication that students in experimental group retain more information than those in control group.

8.2 Research Question 2

TABLE 2
MEAN AND STANDARD DEVIATION OF WOODWORK STUDENTS' RETENTION IN FRAMING CONSTRUCTION IN THE EXPERIMENTAL AND CONTROL GROUPS.

| Group | N | Post-test Mean | SD | Post-test Delayed Mean | SD | Mean Difference |
|--------------|----|----------------|------|------------------------|------|-----------------|
| Experimental | 87 | 58.09 | 5.14 | 55.27 | 5.99 | -2.82 |
| Control | 70 | 40.49 | 5.77 | 37.44 | 7.29 | -3.05 |

Table 2 showed that experimental group had mean score of 58.09 and standard deviation of 5.14 in post-test, while post-delayed test mean score was 55.27 with standard deviation of 5.99 and mean difference of -2.82. The control group had mean score of 40.49 and standard deviation of 5.77. The post-delayed mean score was 37.44 with standard deviation of 7.29 and mean difference of -3.05. This implies that experimental group retains more information in framing with -2.82 mean differences than control group having -3.05 mean differences. Standard deviation equally showed that scores in control group were not as clustered around the mean as that of experimental group. This means that students in experimental group retains more items.

8.3 Research Question 3

TABLE 3
MEAN AND STANDARD DEVIATION SCORES OF WOODWORK STUDENTS' RETENTION IN FINISHING PROCESSES IN THE EXPERIMENTAL AND CONTROL GROUPS'.

| Group | N | Post-test Mean | SD | Post-test Delayed Mean | SD | Mean Difference |
|--------------|----|----------------|------|------------------------|------|-----------------|
| Experimental | 87 | 52.82 | 5.88 | 56.42 | 6.74 | 3.4 |
| Control | 70 | 50.48 | 5.51 | 51.77 | 7.96 | 1.29 |

Table 3 showed analysis of retention mean scores using the K-YAN multimedia learning method and lecture teaching method in finishing processes. The Table showed that, means score in experimental group was 52.82 with standard deviation of 5.88 in post-test while in post-delayed test mean score of 56.42 with standard deviation of 6.74 with mean difference of 3.4. In control group post-test mean score was 50.48 with standard deviation of 5.51. While post-delayed mean score in control group was 51.77 with standard deviation of 7.96 and mean difference of 1.29. This implied that students in experimental group retain more information in finishing processes with 3.4 mean differences than those in the control group with mean difference of 1.29. Standard deviation of 6.74 in experimental group indicates that, students' scores in experimental group were more clustered around mean than scores in control group with standard deviation of 7.96. This indicates that scores in control group are not as clustered around the mean as those in experimental group.

8.4 Hypothesis 1

TABLE 4
ANALYSIS OF COVARIANCE (ANCOVA) ON MEANS OF WOODWORK TECHNOLOGY STUDENTS RETENTION WHEN TAUGHT CARCASE CONSTRUCTION USING K-YAN MULTIMEDIA AND THOSE TAUGHT USING LECTURE METHOD

| Source | Type III Sum Of Squares | Df | Mean Square | F | Sig |
|-----------------|-------------------------|-----|-------------|--------|------|
| Corrected Model | 20800.74 | 2 | 10400.37 | 206.76 | .000 |
| Intercept | 5719.43 | 1 | 5719.43 | 113.70 | .000 |
| Pretest | 228.07 | 1 | 228.07 | 4.53 | .065 |
| Treatment | 20066.37 | 1 | 20066.37 | 398.92 | .031 |
| Error | 9003.98 | 179 | 50.30 | | |
| Total | 449805.00 | 182 | | | |
| Corrected Total | 29804.73 | 181 | | | |

R Squared = .698 (Adjusted R Squared = .695)

Table 4 showed analysis of covariance (ANCOVA) for difference in retention of students taught carcass construction using K-YAN multimedia and those taught using lecture method regarding their performance mean scores. The result showed that there was significant difference in the academic performance mean scores of students taught carcass construction with K-YAN multimedia strategy and those taught using lecture method concerning their performance mean scores. This was because P-value of (0.031) obtained was less than alpha level of 0.05. Hence, null hypothesis was rejected implying that, there was significant difference in academic performance mean score of students taught carcass construction using K-YAN multimedia instructional strategy and those taught using lecture method.

8.5 Hypothesis 2

TABLE 5
ANALYSIS OF COVARIANCE (ANCOVA) ON MEANS ACADEMIC ACHIEVEMENT OF WOODWORK TECHNOLOGY STUDENTS RETENTION WHEN TAUGHT FRAMING PROCESS USING K-YAN MULTIMEDIA AND THOSE TAUGHT USING LECTURE METHOD

| Source | Type III Sum Of Squares | Df | Mean Square | F | Sig |
|-----------------|-------------------------|-----|-------------|--------|------|
| Corrected Model | 16370.63 | 2 | 8185.33 | 182.01 | .000 |
| Intercept | 4969.23 | 1 | 4969.23 | 110.50 | .000 |
| Pretest | 228.93 | 1 | 228.93 | 5.09 | .125 |
| Treatment | 16086.45 | 1 | 16086.45 | 357.71 | .001 |
| Error | 8049.00 | 179 | 49.97 | | |
| Total | 424018.00 | 182 | | | |
| Corrected Total | 24420.28 | 181 | | | |

R Squared = .670 (Adjusted R Squared = .667)

Table 5 shows analysis of covariance (ANCOVA) for difference in retention of students taught framing construction using K-YAN multimedia and those taught using lecture method concerning their performance mean scores in framing construction. Findings showed that there was statistical differences in academic performance mean scores of students taught framing construction with K-YAN multimedia strategy and those taught using lecture method regarding their performance mean scores. This was because P-value (0.001) obtained was less than the alpha level of 0.05. Hence, null hypothesis was rejected, implying that there was statistical difference in academic performance mean score of students taught carcass construction using K-YAN multimedia instructional strategy and those taught using lecture method.

8.6 Hypothesis 3

TABLE 6
ANALYSIS OF COVARIANCE (ANCOVA) ON MEANS ACADEMIC ACHIEVEMENT OF WOODWORK TECHNOLOGY STUDENTS RETENTION WHEN TAUGHT FINISHING PROCESS USING K-YAN MULTIMEDIA AND THOSE TAUGHT USING LECTURE METHOD

| Source | Type III Sum Of Squares | Df | Mean Square | F | Sig |
|-----------------|-------------------------|-----|-------------|--------|------|
| Corrected Model | 10553.20 | 2 | 5276.60 | 106.72 | .000 |
| Intercept | 37028.15 | 1 | 3702.81 | 74.89 | .000 |
| Pretest | 5394.08 | 1 | 5394.08 | 109.09 | .076 |
| Treatment | 6920.74 | 1 | 6920.74 | 139.97 | .011 |
| Error | 8850.20 | 179 | 49.44 | | |
| Total | 423041.00 | 182 | | | |
| Corrected Total | 19403.41 | 181 | | | |

R Squared = .544 (Adjusted R Squared = .539)

Table 6 shows analysis of covariance (ANCOVA) for difference in retention of students taught finishing processes using K-YAN multimedia and those taught using lecture method concerning their performance mean scores in finishing processes. Data presented showed that there was statistical differences in academic performance mean scores of students taught finishing process with K-YAN multimedia strategy and those taught using lecture method regarding their performance mean scores. This was because P-value (0.011) obtained was less than alpha level of 0.05. However, at the pre-interest stage the two groups were equivalent since the P-value of 0.766 was more than the alpha value of 0.05. Hence, null hypothesis was rejected implying that there was statistical difference in academic performance means score of students taught carcass construction using K-YAN multimedia instructional strategy and those taught using lecture method in favour of the experimental group.

IX. CONCLUSION

K-YAN multimedia instruction was found effective in retaining woodwork technology concepts like carcass construction, framing construction and finishing processes. Students taught using the K-YAN multimedia learning strategy retained more information in carcass construction, framing construction and finishing processes than their counterparts taught using the lecture method. In a nutshell, K-YAN multimedia learning represents an effective method in enabling student's retention. K-YAN multimedia teaching and learning strategy played major role in turning the woodwork environment to be creative and interactive memorable. Finally, using the K-YAN multimedia learning strategy as a teaching method reflects improved students' retention level. More so, it develops students' skill which includes communication skill, retrieval of information and becoming computer compliant. Furthermore, K-YAN multimedia learning helps the teacher to cover the syllabus within time; this was to the advantage of both the teacher and the students.

REFERENCES

- [1] Abd-El-Aziz, A. D (2013). Development and validation of auto-mechanic's intelligent tutor for teaching auto-mechanics concepts in technical colleges. Unpublished Ph.D. dissertation. Department of Vocational Teacher Education, University of Nigeria, Nsukka
- [2] Bartlett, R. M., & Strough, J. (2001). Multimedia versus traditional course instruction in introductory social psychology. *Teaching of Psychology Journal*, 1 (30), 335-338
- [3] Chinyere, S. A. (2020). Development and evaluation of instructional video for teaching and learning woodwork technology psychomotor skills in Nigerian Universities: Implication for the Production of Competent Graduates. *International Journal of Vocational and Technical Education Research*, 6(3), 9-20
- [4] Council of Registered Builders of Nigeria. (CORBON, 2019). Construction skills trainers guide. Pre-apprenticeship Programme. N-Power Build. 1st Edition
- [5] Kundu, C. L., & Tutoo, D. N. (2021). *Educational Psychology*, 1st edition, New Delhi Sterling Publishers
- [6] Okoye, K R. E & Okwelle, P. C. (2014). Technical and vocational education and training (TVET) as intervention mechanism for global competitiveness: *Journal of Perspectives from Nigeria International Knowledge Sharing Platform*, 4(4), 22-34
- [7] Okwori, R. O. (2012). Towards effective management of wood workshops in the period of economic crisis. *Journal of Science, Technology & Education*, 1(1), 54-57
- [8] Reddy. R. C.M., & Tamanna, M. S. (2018). The Knowledge Vehicle (K-YAN) Sustainable Value creation by design. <http://www.researchgate.net/publication/3282249897,216-236> IGI Global . Retrived 23rd Nov.2021.