

Leveraging the Capabilities of Digital Storytelling to Improve Students' Achievement in Map Reading in the South-West Nigeria

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Abstract

This study investigated the use of digital storytelling to improve students' achievement in map reading in Ibadan metropolis, south-west Nigeria. A digital storytelling package was developed and deployed in two modes: group-based and individual-based. The study adopted a quasi-experimental design. Three public secondary schools with senior school geography students, functional computers, and electricity were purposively selected within Ibadan metropolis to participate in the study. Participants (242) were assigned to group-based digital storytelling, individual-based digital storytelling (138), and control (126) groups. The treatment lasted for 12 weeks. Treatment had significant main effects on students' achievement in map reading ($F(2, 487) = 131.27$; partial $\eta^2 = 0.35$). Students in group-based digital storytelling had the highest adjusted post-achievement mean score (18.45), followed by individual-based digital storytelling (17.20) and control (7.65) groups. Therefore, it can be recommended that geography teachers should adopt this package to teach map reading, especially at the secondary school level of education to ensure a seamless connection between map reading activities and geographical landforms in students' immediate environments.

Keywords: digital storytelling, local media content, map reading, pre-service teachers, student achievement, conventional method

1. Introduction

Geography is a field of study that helps people interpret the dynamically changing world, as it gives detailed explanation on location of places on the earth, how geographical features are formed and how individuals interact with their environment. In other words, geography equips individuals with knowledge and skills to understand the implications of human actions on the environment. Functional geography education refers to the systematic application of geographical knowledge to problem solving efforts in the community. The discipline, therefore, remains strategic to ensure human beings function effectively and contribute immensely to the growth and development of the general society (Sofowora & Agbedokun, 2010). The purpose of geography is well articulated in the National Policy on Education and includes the acquisition of appropriate competences and knowledge required by people to contribute effectively to the overall advancement of the country (Federal Republic of Nigeria, 2014).

In Nigeria, at the senior secondary school level, geography curriculum consists of regional, human, physical geography and map reading. These subdivisions are interconnected. Physical geography deals with the natural landforms, while human and regional geography address issues which directly relate to human activities on the surface of the earth (Amosun & Oderinde, 2004). Map reading, on the other hand, deals with the representation of features on a sheet of paper and analysis of selected geographical information which could be physical, human or regional (Amosun, 2016). This implies that map reading is a strategic component of geography and acquiring skills in interpreting a map could form the basis for effective and functional geography education at all levels of education.

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Map reading deals with the representation of features on a sheet of paper and the analysis of selected geographical information which could be physical, human or regional. In other words, map reading connects other components of geography and this makes a map a strategic tool in understanding spatial relationship between man and the environment. Obondo, Jaction and Nabwire (2013) affirm that the objectives of functional geography education in the school system could not be realized without a proper understanding of a map and its symbols. A map remains an indispensable component in the teaching of social sciences, history and geography at different levels of education (Ilkay & Oztug, 2016). Map-work and spatial literacy are increasingly becoming important components of individuals' personal lives and workplaces, as diverse information regarding direction and location of places is now mapped on hand-held devices like mobile phones and GPRS tools (Larangeira & David, 2016). Therefore, map reading would continue to occupy a strategic position within the geography curriculum in different countries across the globe (Wilmot, 2004; Bednarz, 2011; Wilmot & Dube, 2015, Bello, 2020).

However, despite the importance of map reading in producing functional citizens in the society, teachers' inability to engage students in map reading activities and relate features on the map to geographical landforms in the community has been a great challenge to effective geography education, especially at the senior secondary school level. This has resulted in consistent poor performance in map reading in senior secondary school certificate examinations for some years now. The West Africa Examination Council (WAEC) chief examiners reports (2005-2018) consistently showed that candidates poorly attempted questions on the map reading aspect of geography (Eze, 2021). The reports particularly centered on the inability of geography students to identify different features on the topographical map. The same instructional challenges are confronted by many geography students across Africa. It has been reported that many geography students in South-African schools experienced challenges in identifying geographical landforms on the topographical maps (Larangeira & David, 2016; Wilmot & Dube, 2016). Also, some students might not understand that the features on the maps are the reliefs in their local communities. Thus, there seems to be disconnection between what students learn in map reading classes and the real features in their local environments (Bello, 2020). One of the main objectives of teaching map reading at this level of education is to allow students identify different features on the topographical map and be able to relate them to the geographical landforms in the society. Apparently, the poor performance of students in map reading is largely a function of their inability to connect features on the topographical map with landforms in the environment.

In this direction, teachers are finding it increasingly difficult to overcome the pedagogical problems associated with the teaching of map reading, due to the lecture method of teaching usually adopted in map reading classroom (Sofowora & Agbedokun, 2010). In most cases, this important aspect of geography is usually presented to students in a way that does not encourage questioning, critical thinking, problem solving and meaningful engagement in the classroom. This has resulted in the inability of geography students to establish a relationship between the features of the map and geographical landforms in the community, due to the boring and uneventful approach being adopted by many teachers (Falode et al., 2016).

In the light of this, there is a need for geography teachers to adjust their teaching approaches by incorporating student-centered strategies that are facilitated by technology to ensure an effective realisation of the objectives of map reading in secondary schools. This is well encapsulated in the assertion of Amosun (2016) that secondary school teachers are consistently using teacher-centred method of teaching, which has not resulted in positive outcomes. For map reading activities to become functional and productive, teachers need to change their methodologies and incorporate student-centered, ICT-based strategies to instructional tasks. In order to mitigate this problem of disconnection in instructional process, geography teachers are required to adopt a technology-based strategy that gives impetus to the relationship between classroom activities and happenings within the community. Geography is one of the subjects that students consider very difficult across the globe and this affects students' perception of different components of geography, especially map reading.

Previous studies (Smeda et al., 2014; Yang & Wu, 2012; Abdel-Hack & Helwa, 2014; Ryan & Aasetre, 2020) had concentrated on the use of technology to facilitate instruction in geography classrooms. However, there is a strong need to incorporate instructional strategy with the required capabilities to engage students in instructional content and improve their performance in the subject matter. Simon (2013) concludes that teachers need to adopt teaching strategies that would ensure students' active engagement beyond the classroom setting, while learning geography and its critical components. One of the emerging technology-based strategies that could be employed by geography teachers to surmount the challenges that hinder map reading instruction is digital storytelling (DST). This could be seen as an instructional strategy that combines the power of storytelling and the capabilities of media to effectively engage learners in teaching-learning process (Grant & Bolin, 2016).

Storytelling has been employed as an effective instrument for the exchange of ideas, norms and values among people in society. Traditionally, storytelling has been entrenched in the instructional process across different educational settings in the world (O'Byrne et al., 2018). However, there is a limit to which traditional storytelling could be used to reduce the level of abstractness in teaching-learning process. Although storytelling arouses students' interest to pay attention to the details of class activities, learners still need the support of a visual display of instructional content, in order to make learning connected to real-life situation. The major limitation of traditional storytelling is its inability to present a visual display of the story content to the audience. Students are left to imagine how the visual component of the story would look. This makes traditional storytelling less appropriate to 21st Century learners', who live in media-saturated environments, active engagement. Therefore, digital storytelling comes as a positive response to engage diverse categories of learners in teaching and learning.

2. Literature Review

Digital storytelling (DST) provides an appropriate convergent platform for traditional storytelling and technology to effectively interact to facilitate classroom activities (Adedoja & Bello, 2016). DST has been touted as a strategy that propels learning process, which focuses on self-expression, engagement and deep learning. Based on the unprecedented instructional benefits that are derivable from using DST for instructional delivery, it is important that geography teachers take full advantage of these affordances to facilitate map reading activities in the classroom. Using DST for classroom instruction could afford geography teachers the opportunities to surmount some of the obstacles that hinder map reading activities in schools. One of the problems with the conventional method of teaching map reading is that this strategic aspect of geography is usually being presented in abstract form. Studies such as Robin (2008), as well as Kotluk and Kocakaya (2017) affirm that DST reduces the level of abstractness in instructional process and geography teachers could leverage the capabilities of DST to surmount this kind of instructional challenge.

The instructional benefits of DST had been well-established in literature in different parts of the world. The strategy had been identified as an appropriate tool that caters for diverse learning needs of learners. Specifically, Smeda et al. (2014) observed that DST remains a viable tool to integrate instructional content with learning activities in Australian schools, with a view to creating more engaging and exciting learning space for students. This makes the DST an appropriate strategy to cater for the needs of students in different countries of the world.

In essence, DST could help in facilitating the realization of the objectives of teaching map reading in secondary schools. These are the capabilities that the strategy could offer in solving problems confronting map reading instructions in Nigerian schools. Geography teachers could use group-based and individual-based DST to engage learners in instructional process. Sadik (2008) asserts that DST provides opportunities for teachers to organise both group-based and individual-based learning activities to suit the learning styles of diverse learners in the classroom. In other words, group-based DST promotes collaboration and teamwork

among students, while individual-based DST allows students to study at their own pace. The digital storytelling strategy for this study was deployed in these two modes.

As the use of technological tools and technology-based strategies pervades teaching-learning space, several factors could hinder technology use in the classroom. Thus, computer anxiety and perceived relevance had been selected as moderator variables for this study due to their strategic roles in teaching-learning process. Studies affirmed that computer anxiety could play pivotal roles in instructional delivery at different levels of education (Raafat & Dennis, 2007). Teaching and learning map reading could also be affected by the perceived relevance of this concept in solving students' immediate and future challenges. Students' positive perception of any subject could go a long way in determining their level of achievement and the way how they would deploy their experience in that course to solve problems in the future. Students with low or no positive perceived relevance about a subject would experience difficulty in achieving success in the course (Mukesh & Sarita 2015). Therefore, this study examined the impact of DST on students' achievement in map reading in Ibadan metropolis, Nigeria.

Hypotheses

Three null hypotheses were tested at 0.05 level of significance, as follows:

H₁. There is no significant main effect of treatment on senior secondary school II geography students' academic achievement in map reading.

H₂. There is no significant main effect of computer anxiety on senior secondary school II geography students' academic achievement in map reading.

H₃. There is no significant main effect of perceived relevance of map reading on senior secondary school II geography students' academic achievement in map reading.

3. Methodology

This section covers the research design, selection of participants, instrumentation, procedure and method of data analysis.

3.1. Research design

This study was carried out in two stages. Stage one focused on the development of DST package to teach difficult concepts in map reading. These difficult topics were identified in the baseline study carried out by the researcher. Stage two was the implementation phase, when the package was used to teach SS II geography students in the selected schools. Pretest-posttest quasi-experimental design was adopted for stage two of the study. The package was implemented in two modes i.e. group-based and individual-based DST.

| | | |
|----------------|----------------|---|
| O ₁ | X ₁ | O ₂ Group-based DST (Experimental Group I) |
| O ₃ | X ₂ | O ₄ Individual-based DST (Experimental Group II) |
| O ₅ | X ₃ | O ₆ Control Group |

Where O₁, O₃ and O₅ are pretest measures for experimental and control groups; O₂, O₄ and O₆ posttest measures for experimental and control groups; X₁ = group-based DST mode; X₂ = individual-based DST mode; and X₃ = conventional strategy.

3.2. Selection of participants

Three senior secondary schools were purposively selected to participate in the study within Ibadan metropolis. The criteria for the purposive selection of the schools in the experimental groups included:

- (i) Availability of geography teacher and geography students in the school.
- (ii) Availability of functional computers to deliver the instruction.
- (iii) Availability of alternative power supply in case of power outage.
- (iv) Readiness of the school to participate in the study.

Also, 506 students from the three schools were assigned to group-based DST (242), individual-based DST (138) and control (126) groups, using intact class.

3.3. Instrumentation

Five researcher-made instruments were used for the study, which include:

- (i) Digital Storytelling Package (DSP)
- (ii) Map Reading Achievement Test (MRAT)
- (iii) Computer Anxiety Questionnaire (CAQ)
- (iv) Questionnaire on Students' Perceived Relevance of Map Reading (QSPMR)
- (v) Digital Storytelling Evaluation Rubric (DSTER)

Design and development of digital storytelling package

This DST package was specifically developed by the researcher to teach difficult topics in map reading at the senior secondary school level. The topics were selected from baseline study carried out to identify difficult topics in map reading in secondary schools. At the end of the exercise, six sub-topics were identified by geography teachers and students as being difficult in map reading curriculum. The topics include:

- (i) Identification of features on topographical map (Valley)
- (ii) Identification of features on topographical map (Spur)
- (iii) Identification of features on topographical map (Ridges)
- (iv) Methods of representing relief on topographical map (Contour)
- (v) Representation of river and its direction of flow
- (vi) Inter-visibility

Thus, the package was designed and developed to cover these six sub-topics.

The DST package contains local videos and pictures that explain difficult topics in map reading, such that students would be able to relate what they learn in the classroom to the landforms in their immediate environments, as could be observed in Figures 1 and 2. There are class activities within the stories to engender active engagement and full concentration during instructional delivery.



Figure 1: Screenshot from Digital Storytelling on Inter-visibility

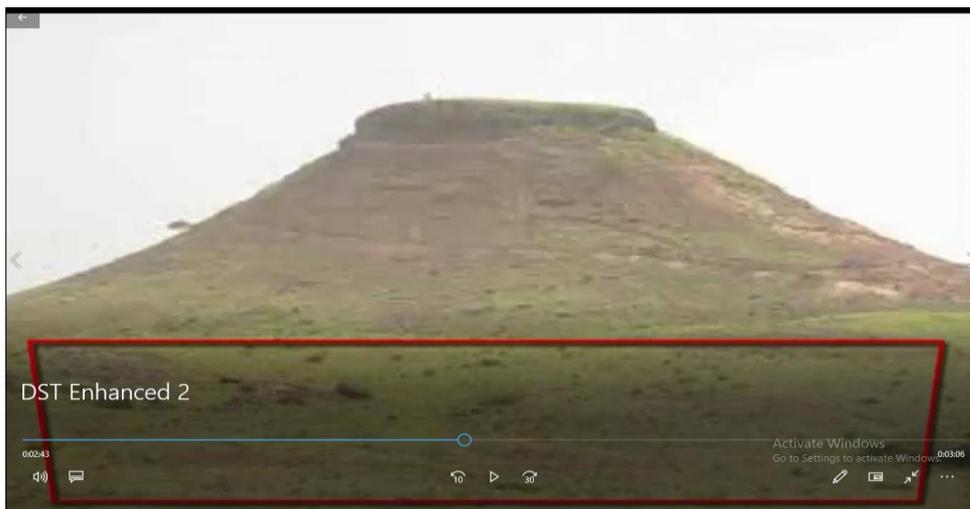


Figure 2: Screenshot from Digital Storytelling on Inter-visibility

For instance, the extract below is the digital storytelling script on Inter-visibility.

Adedayo, a senior secondary school student, lived in the ancient city of Oyo, located close to Ibadan, the capital city of Oyo State. The town is endowed with many geographical features like flowing rivers, mountains and fertile soil. He was a brilliant and inquisitive person. His best subject was geography, especially its map reading aspect, but the way his teacher usually presented different concepts in map reading left Adedayo in a state of confusion after every geography class. ...

On a particular day, Adedayo left for school with a lot of excitement and enthusiasm to attend the map reading class. However, his excitement was short-lived, as the teacher did not adequately relate the concept with the features in his town. In the classroom, the teacher had taught them the concept of inter-visibility and determination of the visibility of one place from another

on the topographical map. He defined inter-visibility as a way of determining whether one point on the map can be seen from another point. He further stated that the existence of high contour lines between two points determined the inter-visibility of one place from another. Contour lines are used to represent the relief of an area on the map and two areas on the map can only be visible if there is no high contour, representing highland, between them. He also informed that any point at the peak of a conical hill is visible to another point at the base of the hill. He showed the students different points on the topographical map that could or could not be visible, depending on the contour lines. If the contour lines between the two points are very low, that means there is no highland between them and the two places could be visible. On the other hand, if the contour lines between two points are very high, that indicates the presence of a highland or mountain between them and the two places could not be visible from each other.

To inquisitive young Adedayo, the lesson seemed so dry and not connected to real life situation. Therefore, he decided to embark on a journey of self-discovery within his environment. He wanted to understand the practical application of what the geography teacher taught them in the classroom. Situated very close to his house are the range of mountains, including conical hills and other forms of highlands. He decided to visit the place and examine these nature-endowed landforms in his immediate environment. In his mind, as he was climbing the mountain, he tried to relate the increase in altitude from the ground to the increase in the number of contour lines on the topographical map he was holding. 'If cartographers were to represent this area on a topographical map, the contour lines should be increasing, perhaps from 100m to 200m to 300m and so on' Adedayo muttered as he was panting and struggling to climb one of the mountains...

Map Reading Achievement Test (MRAT)

The test consists of sections A and B. Section A includes background information of students while section B comprises twenty-five multiple choice questions. These questions were drawn from the six perceived difficult topics identified in the baseline study. The test was given to geography teachers and other experts in the field of geography for face and content validity. The instrument was pilot-tested on 20 students, who were not part of the study to determine the difficulty index. Kuder-Richardson (K-R 21) (Glen, 2016) was used to test for the level of difficulty and reliability index of 0.80 was obtained.

Computer Anxiety Questionnaire (CAQ)

This questionnaire was used to examine issues that relate to computer anxiety among senior secondary school geography students. The instrument contains fourteen items to measure the level of computer anxiety and how this moderator variable could determine the use of computer-related technologies for learning purpose. The instrument was administered to 20 respondents who were not part of the study to determine its level of reliability. The reliability coefficient of 0.78 was obtained through Cronbach Alpha.

Questionnaire on Students' Perceived Relevance of Map Reading (QSPMR)

The instrument was designed to measure geography students' perceived relevance of map reading to their understanding of geographical phenomena in their immediate environments. It comprises ten items measured on a four-point Likert type scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). To ensure that the items in the instrument are consistently reliable, the questionnaire was administered to 20 students who were not part of the main study. The data was analysed using Cronbach Alpha and reliability coefficient of 0.82 was obtained.

Digital Storytelling Evaluation Rubric

DST evaluation rubric was used to evaluate the package (see Appendix). The minimum and maximum points for the rubric are 10 and 40 respectively. Some educational technologists were selected to score the package with the rubric and the average score for the stories was 32 points which was considered appropriate for classroom instructions. This package was then pilot-tested on some selected geography students in Oyo Town.

3.4. Procedure

The study was carried out in two stages, stage one had to do with the design and development of the DST package. Stage two was the implementation stage, when the package was used to teach students in the classroom. The first, second and third prototypes of the package were developed, of which the third prototype was eventually used for the study after the necessary corrections.

Procedure for stage two (Implementation Stage)

1st Week: Training of teachers on the rudiments of DST strategy and the ways to coordinate the classroom activities.

2nd Week: Administration of pre-test to the selected senior secondary school geography students. Pre-test on achievement in map reading was administered to the students in both control and experimental groups before the intervention.

3rd – 10th Week: DST instructional delivery to both group-based and individualized modes. Students in the control group were also exposed to map reading content through conventional method.

11th-12th Week: Administration of posttests to the geography students. Posttests on computer anxiety, perceived relevance and achievement in map reading were administered to the students in both control group and experimental groups after the intervention.

3.5. Data collection and analysis

Data were analyzed using descriptive and inferential statistics. In descriptive statistics, frequency count, percentages, standard deviation and mean score were used to analyze the demographic information of the participants. Analysis of Covariance and Estimated Marginal Means were also used as inferential statistical tools. The level of decision was 0.05 level of significance.

3.6. Results and Analysis

The results of the assessment of the three research hypotheses raised to guide the conduct of the study are presented below:

H₀1. There is no significant main effect of treatment on senior secondary school II geography students' academic achievement in map reading.

Table 1. Analysis of Covariance (ANCOVA) of post-achievement by treatment, computer anxiety and perceived relevance

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. | Partial Eta Squared |
|--|-------------------------|-----|-------------|---------|--------|---------------------|
| Corrected Model | 10341.488 ^a | 18 | 574.527 | 93.850 | 0.000 | 0.776 |
| Intercept | 6061.000 | 1 | 6061.000 | 990.076 | 0.000 | 0.670 |
| Pre-Achievement | 1.115 | 1 | 1.115 | .182 | 0.670 | 0.000 |
| Treatment | 1607.276 | 2 | 803.638 | 131.276 | 0.000* | 0.350 |
| Computer anxiety | 34.766 | 2 | 17.383 | 2.840 | 0.059 | 0.012 |
| Perceived relevance | 8.038 | 2 | 4.019 | .657 | 0.519 | 0.003 |
| Treatment x Computer anxiety | 2.650 | 3 | 0.883 | .144 | 0.933 | 0.001 |
| Treatment x Perceived relevance | 3.871 | 2 | 1.936 | .316 | 0.729 | 0.001 |
| Computer anxiety x Perceived relevance | 45.619 | 4 | 11.405 | 1.863 | 0.116 | 0.015 |
| Treatment x Computer anxiety x Perceived relevance | 9.129 | 2 | 4.564 | .746 | 0.475 | 0.003 |
| Error | 2981.294 | 487 | 6.122 | | | |
| Total | 137288.000 | 506 | | | | |
| Corrected Total | 13322.783 | 505 | | | | |

R Squared = 0.776 (Adjusted R Squared = .768) * denotes significance at $p < 0.05$

Table 1 showed that there was significant main effect of treatment on SS II geography students' achievement in map reading ($F_{(2, 487)} = 131.276$; $p < 0.05$, partial $\eta^2 = 0.350$). The effect size is 35.0%. This means that there was a significant difference in the mean post-achievement scores of SS II geography students in map reading. Thus, hypothesis 1 was rejected. In order to determine the magnitude of the significant main effect across treatment groups, the estimated marginal means of the treatment groups was carried out and the result is presented in Table 2.

Table 2. Estimated marginal means for post-achievement by treatment and control group

| Treatment | Mean | Std. Error | 95% Confidence Interval | |
|---------------------------|-------|------------|-------------------------|-------------|
| | | | Lower Bound | Upper Bound |
| Group Based (GB) | 18.45 | 0.258 | 17.942 | 18.956 |
| Individualized Group (IG) | 17.20 | 0.388 | 16.438 | 17.964 |
| Control Group (CG) | 7.65 | 0.471 | 6.723 | 8.573 |

Table 2 revealed that SS II geography students in Group-Based (GB) treatment Group had the highest adjusted post-achievement mean score (18.45), followed by Individualized Group (IG) (17.20), while the Control Group (CG) had the least adjusted post-achievement mean score (7.65).

Table 3. Bonferroni post-hoc analysis of post-achievement by treatment and control groups

| (I) Treatment | (J) Treatment | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval for Difference ^d | |
|----------------------|----------------------|-----------------------|------------|-------|---|-------------|
| | | | | | Lower Bound | Upper Bound |
| Group Based | Individualized Group | 1.248* | 0.466 | 0.023 | .128 | 2.368 |
| | Control Group | 10.801* | 0.537 | 0.000 | 9.511 | 12.091 |
| Individualized Group | Group Based | -1.248* | 0.466 | 0.023 | -2.368 | -.128 |
| | Control Group | 9.553* | 0.611 | 0.000 | 8.085 | 11.021 |
| Control Group | Group Based | -10.801* | 0.537 | 0.000 | -12.091 | -9.511 |
| | Individualized Group | -9.553* | 0.611 | 0.000 | -11.021 | -8.085 |

Table 3 revealed that the post-achievement score in map reading of SS II geography students exposed to Group-Based (GB) mode was significantly different from their counterparts taught using Individual-based Group (IG) mode and Control Group (CS). Furthermore, post-achievement score of SS II geography students taught using individualised strategy was significantly different from those exposed to control strategy. This implies that group-based and individual-based strategies were the main sources of significant differences in the experiment.

H₀2. There is no significant main effect of computer anxiety on senior secondary school II geography students’ academic achievement in map reading.

Table 1 showed that there was no significant main effect of computer anxiety on SS II geography students’ achievement in map reading ($F_{(2, 487)}=2.840, p>0.05, \text{partial } \eta^2=0.012$). Thus, hypothesis 2 was not rejected. This indicated that computer anxiety had no effect on SS II geography students’ achievement in map reading.

H₀3. There is no significant main effect of perceived relevance on SS II geography students’ achievement in map reading.

Table 1 showed that there was no significant main effect of perceived relevance on SS II geography students’ achievement in map reading ($F_{(2, 487)} = 0.657, p>0.05, \text{partial } \eta^2 = 0.003$). Hence, hypothesis 3 was not rejected.

3.7. Discussion

The findings from the study indicated that there was significant main effect of treatment on SS II geography students’ achievement in map reading. In other words, students who were exposed to DST performed better in map reading than students in the control group. The inherent potentials of DST to actively engage students and stimulate their interest could have been responsible for this improvement in students’ achievement after the experiment. Some of the critical factors that had been documented in literature to be responsible for students’ poor achievement in map reading are the problems of engagement and

inability to connect map reading activities with geographical features in students' immediate environment. DST combines multi-media resources to engage learners in instructional content and makes learning connected to real-life situation (Bower, 2015; O'Byrne et al, 2018).

This finding from the current study is in line with the report of Smeda et al. (2014), who carried out a research on the effectiveness of digital storytelling in some Australian schools. Their findings revealed that Australian teachers and students confirmed that DST improved the learners' engagement with instructional content and created a constructivist learning environment for effective teaching-learning process. Also, Kervin and Mantei (2016) found that digital storytelling allowed Australian students to connect classroom instruction with their immediate environment.

The package used for the current study was developed with local media content within learners' immediate environment. The package was developed to cater for the needs and aspirations of Nigerian secondary school students. In other words, the videos and pictures used to develop the package were sourced from within the learners' geographical location and this made map reading concepts more realistic to the students. This could have engaged students in the subject matter and resulted in improved performance.

These findings corroborate Yang and Wu (2012) who examined the influence of digital storytelling strategy on English students' critical thinking, motivation and academic achievement in secondary school. The results showed that students in DST mode had a higher performance in terms of enhanced critical thinking abilities and improved motivation to learn instructional content, than the participants in lecture-type mode who only listened to instruction through the conventional approach. The students in the treatment group were able to watch secondary school students exploring the landforms in the community and that could have had a positive impact on their level of understanding, as they had been better positioned to relate and internalize the concept being taught in map reading classroom. Also, the DST package included class activities that were inserted within the story to engage students in the instructional content. This could have motivated students to pay maximum attention to the details of the content while watching the package. Students could sometimes be carried away with the euphoria of using technology to learn and thus pay less attention to the content of the story. Therefore, incorporating class activities within the story could have encouraged students to give required attention to the details of instructional content and as such, geography teachers were able to progressively monitor the rate at which their students learnt in the classroom.

Findings also revealed that geography students in group-based mode scored higher grades than their counterparts in the individual-based mode. The strategic roles of collaboration and teamwork had been emphasized in classroom setting to promote all-inclusive instructional delivery and improved the students' performance at all levels of education. The level of achievement attained by the students in the group-based mode could be due to the power of collaboration and interaction that gave impetus to sharing the ideas among the students in the group. The participants in this group were able to interact and discuss the content of the story and class activities therein. This could have engendered cross-fertilization of ideas and collective decision making within the instructional space. When the students viewed the content from different perspectives, the members of the group had a proper understanding of the instructional content in the package.

This finding gives empirical credence to other findings on the effectiveness of group-based instruction to improve students' achievement in the classroom. Uwameiye (2016) affirms that students in the cooperative learning mode recorded an improved level of achievement in home economics after the experiment compared to the participants in the conventional mode. Also, Gull and Shehzad (2015) remark that cooperative learning activities had a positive impact on academic achievement of students in an education course. These are the pointers to the fact that group-based activities could promote interaction and teamwork, which could improve the performance of students in classroom activities.

Besides, the finding from the current study reported that there was no significant main effect of computer anxiety on SS II geography students' achievement in map reading. In other words, the level of computer anxiety had no significant influence on achievement in both the experimental and the control groups after being exposed to map reading instruction. This could be due to the fact that students in the 21st century live in media-saturated environments and are increasingly adopting the use of technology for different purposes. Technology has permeated all areas of human endeavors, thus, teachers and students need to adjust their approaches and dispositions to function effectively in the modern society. Therefore, the students' achievement in map reading might not depend on whether they fear interacting with computers or not. Students could have been left with no other choice than to execute instructional tasks in the classroom, regardless of their dispositions to the use of computers, since technologies like mobile phones, I-pads and computers have become parts of their daily lives. Sam et al. (2005) assert that in this age of all-pervading use of technology and digital tools in most parts of the world, examining the relationship between computer anxiety and computer use should be made redundant while considering students' performance in instructional content.

Lastly, the findings of the current research showed that there was no significant main effect of perceived relevance on SS II geography students' achievement in map reading. The significant improvement in students' achievement might be due to DST strategy adopted for the study. This indicates that students' achievement in map reading could not have been influenced only by perception. In other words, perceived relevance could be considered as a means to an end, but not an end in itself. Even if students perceive map reading as being relevant to understanding their environments, such perception needs to be complemented with appropriate teaching strategy that would make learning more realistic to the students and connected to real-life situation. However, this finding contradicts the report by Audrey and Choy (2015) who found that students' perceived relevance of marketing education has a significant influence on their performance in the course. The difference in the findings might be due to the capabilities of local media content used in the digital storytelling package. This could have engaged students with the content and therefore impacted positively on the achievement of students beyond the mere issue of perception. It could also be noted that the study by Audrey & Choy (2015) did not use any instructional package or resource to deliver the content to the students.

4. Conclusion and Recommendations

The persistent decline in the performance of students in map reading and their inability to relate features on the map to the landforms in the community have become a worrisome issue among geographers across the globe. As a result of these instructional challenges, scholars have advocated for the need to enrich map reading activities with engaging learning strategies that could sustain the interest of learners and make the concept connected to real-life situation. Thus, DST has been found to be effective in improving geography students' achievement in map reading. The result underscores the effectiveness of this strategy in engaging learners in instructional process, thereby resulting in improved performance in map reading. Apparently, geography teachers need to adopt a pragmatic approach to demystify perceived difficult topics in map reading by leveraging the capabilities of DST strategy in instructional delivery process. This would go a long way in making map reading more interesting and reducing the rate of abstractness associated with the concept in secondary school. On the last note, geography teachers need adequate training for the acquisition of requisite skills to develop their DST packages to teach other aspects of the subject.

Recommendations

The following recommendations are made, based on the findings from this study:

- Geography teachers should integrate DST strategy into map reading classroom, as it has proven to be effective in reducing the level of abstractness associated with the teaching and learning of this concept at the secondary school level.



- Geography teachers should be trained on the rudiments of creating DST for effective classroom instruction.
- Group-based DST could be a viable strategy in improving students' achievement in instructional content.
- Educational stakeholders should provide adequate facilities for teachers to integrate this strategy into teaching-learning process.

Statements on open data, ethics and conflict of interest

- a. The data can be used by schools, institutions and organizations working at improving the study of geography in schools
- b. Consent was received from the participants in the study
- c. There is no conflict of interest

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APPENDIX

DIGITAL STORYTELLING EVALUATION RUBRIC

This researcher-made rubric is designed to evaluate digital storytelling package by teachers and students across all levels of education.

| Criteria | Definition of the criteria | Needs Improvement 1 | Average 2 | Good 3 | Excellent 4 |
|---|--|--|---|--|---|
| The Overall Purpose of the Story | Aim(s) and Objective(s) of the story. | It is difficult to figure out the purpose of the story. | The content fairly revealed the purpose of the story. | Establishes a purpose early enough and maintains focus for a substantial part of the story. | Establishes a purpose early on and maintains a clear focus throughout. |
| Dramatic Question | Question which makes the main point of the story. | Little effort is made to answer the dramatic question. | A dramatic question is hinted at but not clearly established within the context of the story. | A dramatic question is asked but not clearly answered within the context of the story. | A meaningful dramatic question is asked and answered within the story context. |
| Pacing of Narrative | The rate at which the events proceed. | No attempt to match the pace of the narratives to the story line. The rhythm is either too fast or too slow. | Tries to make an accurate order for the events, but it is often noticeable that the pacing does not fit the story line. | The order of the events matches story line and relatively engaging for the audience. The rhythm is sometimes fast or slow. | The order of the events matches the story line and helps the audience really "get into" the story. The rhythm is neither too fast nor too slow. |
| Creation of Story around the Content | The ability to create stories around different contents in the curriculum. | Little effort is made to create story around the contents. | Makes attempt to create story around the content with relevant multimedia content (ex. photo with video), but it needs more work. | Creates story around a substantial part of the content and relevant multimedia contents are mixed(ex. photo with video) | Content is clearly relevant to the story and multimedia contents match different parts of the story. |
| Grammar and Language Usage | Complexity of the language | Repeated errors in grammar and language usage greatly distract the audience from the story. | Grammar and language usage are typically correct but some errors are present in the story. | Grammar and language usage are typically correct with minimal errors in the story. | Grammar and language usage are correct and contribute to clarify the digital story. |

| | | | | | |
|-------------------------------------|--|---|--|---|--|
| Technological Competence | Competence in the use of different features in the digital tool platforms like effect, transition and animation. | No transitions, effects, animations, and editing tools are used throughout the story. | Some transitions, effects, animations, and edits are used and/or appropriate to the subject matter | Most transitions, effects, animations, and edits are used and they are appropriate to the subject matter. | Transitions, effects, animations, and edits are utilised and they are quite appropriate to the subject matter. |
| Image Quality | The quality of image and its alignment with the text | The images/pictures are blurred and overlap the text. The images cannot be clearly seen by the audience throughout the story. | Images are blurred and overlap the text in some sections of the story. | Images/pictures are clear throughout the story but there are some overlaps. | The images are consistently clear and there are no overlaps throughout the story. |
| Emotional Content | The range of emotions | Audience has little emotional engagement. | Audience lapse in emotional engagement. | Audience is emotionally engaged throughout the digital storytelling. | Audience is deeply and emotionally engaged throughout the digital storytelling. |
| Voice Quality | Clarity of the voice throughout the story. | The voiceover is practically not audible throughout the story. | The voice quality is poor in substantial parts of the story. | Voiceover is clear enough in major parts of the story. | The voice clarity is absolutely fantastic and audible enough throughout the story. |
| Economy of the Story Details | Optimization of the content and quality. The length of the story. | The story needs extensive editing. It is either too short or too long to be interesting and sustain focus. | The story needs editing. It is rather too long or too short in more than one section. | The story composition is typically good, though it seems to drag somewhat in one or two sections | The story is told with the right amount of details. It is neither too short nor too long throughout. |
| Final Score | | | | | |

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Note: The maximum score is 40 while the minimum score is 10.