

DESIGN AND DEVELOPMENT OF *SMART-LINK* APPLICATION FOR ENHANCING INFORMATION SHARING AMONG UNDERGRADUATE STUDENTS OF INDUSTRIAL DESIGN, AHMADU BELLO UNIVERSITY, ZARIA

Zirra, B. G.¹, Azi J.I.², Dakyes S.U.³, Eze C.⁴, Abdullahi A.M.²,

1. Department of Industrial Design, University of Maiduguri,

2. Department of Industrial Design, Ahmadu Bello University, Zaria,

3. Dakyes, S. U. Department of Industrial Design, Federal University, Lafiya,

4. Eze, C. Department of Mass Communications, Ahmadu Bello University, Zaria,

Abstract

The integration of mobile technology has revolutionized the dissemination of information across various sectors of human endeavour, including higher education. This study proposes the development of an Android application tailored to enhance information dissemination and information sharing among undergraduate students of industrial design at Ahmadu Bello University, Zaria. The envisioned application aims to facilitate access to course materials, foster communication among peers and faculty members, and provide updates on the latest trends in the field of graphic communication. Leveraging the widespread use and intuitive interface of Android devices, the application seeks to streamline accessing of information and sharing it within the academic community. To assess the efficacy of the proposed application, a survey utilizing a 5-Point Likert Scale was conducted with a sample of 124 students of the Department of Industrial Design, ABU, Zaria. The survey results informed iterative refinements to the application design, ensuring alignment with the needs and preferences of the target audience. The cumulative frequency yielded a mean score of 4.7, indicating a strong agreement with the application's utility within the Likert Limits of Scale from which conclusions and recommendations were proposed.

Key Words: Android, Graphic User Interface, Information Dissemination, Information Retrieval.

Introduction

The proliferation of Android-based mobile devices has ushered in a new era of multifunctional applications that harness the capabilities of these devices. Android, an open-source operating system (OS) built on the Linux Kernel and developed by Google, offers users a wealth of features and functionality at affordable prices. Karim and Agarina (2006) noted the rapid expansion of applications built on Android technology, spanning from children's programs to advanced tertiary usage, while incorporating fundamental principles of graphic design and programming languages.

As Android devices continue to permeate various facets of daily life, their potential to revolutionize education, particularly in higher institutions, becomes increasingly evident. One such area ripe for innovation is the dissemination of information among undergraduate students, where the seamless integration of Android applications can streamline access to educational resources and foster collaboration within academic communities. This study aims to explore the development of an Android application tailored specifically for undergraduate students of Industrial Design at Ahmadu Bello University, Zaria, Nigeria.

Through an iterative development process informed by insights from review of literature and user feedback, the study endeavours to create a robust and intuitive application that enhances

the learning experience for Industrial Design students. By embracing the potential of Android technology, this research contributes to the ongoing evolution of educational practices and information dissemination strategies in higher education settings.



Figure 1: Typical Android Icon

Source: <https://www.google.com/search?q=android&tbn>

The Android logo is an immediate visual cue, signifying a technologically advanced yet approachable assistant robot. The emblem embodies readiness to assist as a vigilant guide through various tasks and processes. This symbolism fosters a sense of trust and accessibility, communicating that assistance is readily available.

The first version of the robot as depicted by Figure 1 was black and white, but that did not stop it from becoming an international symbol. Irina Blok a Graphic designer used simple geometric shapes as building blocks for the icon. The torso is an asymmetric square, the head is a semi-circle, the antennae are small thin lines, the eyes are white circles, and the limbs are wide stripes with rounded ends. From a banal set of elements, a memorable logo has turned out, with which all Internet users are now familiar (<https://logos-world.net/android-logo/>)

Das *et. al.* (2003) emphasised that in the era of technology, people are using smartphones for their everyday needs like entertainment, communication, and educational needs. Various organizations are developing android based mobile apps for their needs and using them for different purposes.

The Android brand strives to be as inclusive as possible because it introduces an open operating system that reaches billions of active users. The Operating System (OS) is designed for various devices, including smartphones, TVs, watches, cars, tablets, and other equipment.



Plate 1: Typical Android Interface
Source: Screen Shot by Researcher 2023

In recent times, the Android Application (App) and usage have been on a geometric increase. Ejayi, Ejayi, and Salako, (2021) posit that the growth in the use of android applications has made it the most popular smart device operating system in use presently. Students of higher institutions of learning particularly are also becoming accustomed to the use of applications such that they prefer everything available for them to be posted on their mobile device if possible (Ejayi, *et al.* 2021). Android has over 76% of the mobile operating system since December 2018 which is quite significant and making it the most used electronic devices globally.

Visual communication designs and resources are developed to be disseminated to a particular group of audience with the intention of meeting out to their specific information needs. Cheng, *et al.* (2013), observe that Information dissemination is an important social process in today's information-centered communities, and most of the communication infrastructures have been developed in the last three decades mainly to allow disseminating different types of information across various communication channels.

Information needs are diverse and constantly changing and they vary across different strata of needs. However, information need is characterized mostly by the information seeking behaviour of the person in need of information. Fatima and Ahmad, (2008) asserts that information seeking behaviour involves a set of actions that an individual, such as an undergraduate student to express information needs, seeks information, evaluates and selects information and finally uses this information to satisfy his or her information needs.

In an attempt to provide some useful, practical and technology driven dissemination approach, the multimedia development processes are explored with the purpose to inform students specializing and following careers in the field of graphics and multimedia. To enable them garner skills and knowledge needed as well as the resources available to achieve their academic and professional pursuit during and after graduation.

Statement of Problem

The various visual information and communication resources disseminated in Industrial Design are mainly courses delivered through lectures, tutorials and special projects. However, an

indexed interactive application for sharing of information to undergraduate students of Industrial Design and Graphic Design in particular has however, not been developed despite the number of users that chat and social network on the Android OS and other social media platforms. Adetirin and John (2016) observed that Nigerian students use social media blogs a lot and it consume most of their precious time that could have been used for more academic pursuit.

Despite the proliferation of digital tools, there are still challenges faced in accessing and sharing curated academic resources efficiently. A dedicated *SmartLink* Application could bridge this gap by integrating structured data retrieval with seamless sharing features, tailored to the needs of design students.

Therefore, this study sought to design and develop a unified application with interactive properties to possibly ease how students of industrial design access and share specific information on academic needs in the field of graphics and multimedia design.

The aim of the study is to design and develop a unified android application to unify as well as ease access to information and sharing of information among undergraduate students of Industrial Design. The design aims to promote a collaborative learning through a visually optimized platform and also demonstrate how graphic design principles, elements as well as User Interface (UI) and User Experience (UX) practices can improve educational tools. The objective of this study is to design and develop an effective Graphic Application to inform and update undergraduate students of Industrial Design in their academic pursuits. The research question was drawn from the objective of this study; how can an effective and unified android application be developed to inform and update undergraduate students of Graphics Design on issues pertaining to their academic pursuits?

Digital applications designed with optimum interactive interface and aesthetic systems significantly aid access to information, retrieving of information, online learning, relevant information sharing, online advertising and social networking and also enhance the levels of feedback to support a functional improvement of information needs particularly among undergraduate students of industrial design as well as prospective students.

The proposed prototype application (Smart-link) serves as a digital study room for graphics students to retrieve information specific to graphics, partake in tutorials, read manuals, share design ideas, view lecture timetables as well as getting information on special design trends.

Interactive and interaction designs focus mainly on system based and user based concerns cutting across multilateral disciplines. The scope of this study is however, limited to a user-based unified Android application (*Smart-link*) for presenting the information needs specific of 300 and 400 level undergraduate students of the Department of Industrial Design, Ahmadu Bello University, Zaria specializing in graphic design.

Literature Review

The review of literature discusses the history of communications, the fundamental theories and concepts of Visual Communications (VC), Information Retrieval, Information sharing, visual communications Model, Elements and Principles of Layout Design, Android Applications and concepts relevant to developing applications. Works from Karim and Agarina (2006), Kurt (2021), Branch and Kopcha (2014). While Adetimirin and John (2016) further agree that these instructional design models provide guidelines for smart layout.

The elements and principles of design combined with design models are the core imputes in all multimedia designs. Graphic design, being the art and science of choosing and arranging formal visual elements such as lines, colours, shapes, texts and forms to convey a message to an audience has not only been saddled with the responsibility of design and development of products and utilities but also with the means of getting the designs across to reach specific audience timely and efficiently.

Models of communication are largely referred to the conceptual processes used to explain how humans communicate information. The demands to generate high quality products, while simultaneously reducing design and development time have made designers apply the use of models in design. Some notable Instructional Design (ID) models that inspire design processes include; ADDIE, ASSURE, the Dick, Carey & Carey model, Rapid Prototyping (RP) methodology, Kemp Design Model, The Kirkpatrick Model, TPACK Model, Gagne's Nine Events of Instruction Bloom's Taxonomy, Flipped Classroom but to mention a few. These models describe the ID process as a structured and orderly step-by-step activity, characterized by a progressive advancement through Analysis, Design, Development, Implementation and Evaluation. The Rapid Prototyping methodology improves a quick realization of ideas into functioning units, that significantly shorten design time that leads towards achieving a successful final product. Kurt (2021) observed that these instructional design models provide guidelines to organize appropriate pedagogical scenarios to achieve instructional goals. Instructional design practices often create instructional experiences to help facilitate learning most effectively. Similarly, Driscoll and Carliner (2005) added that "design is more than a process; that process, and resulting product, represent a framework of thinking".

Instructional design models describe how to conduct the various steps. These steps involve instructional design process. The models help graphic designers and educators to guide, plan and develop the overall process.

Branch and Kopcha (2014) supports this assertion by adding that "instructional design needs to be an iterative process of planning outcomes, selecting effective strategies for teaching and learning by choosing relevant technologies, identifying educational media and measuring performance".

In designing multimedia resources, StoltzfusCheckmark (2021) argues that the introduction and popularization of Graphic User Interfaces (GUI) is one of the most important factors that made computer and digital technologies more accessible to average, less tech-savvy users. GUIs are, in fact, created to be intuitive enough to be operated even by relatively unskilled personnel who have no knowledge of any programming language. Rather than being fundamentally machine-centered, GUIs are the standard in software application programming because their design is always user-centered.

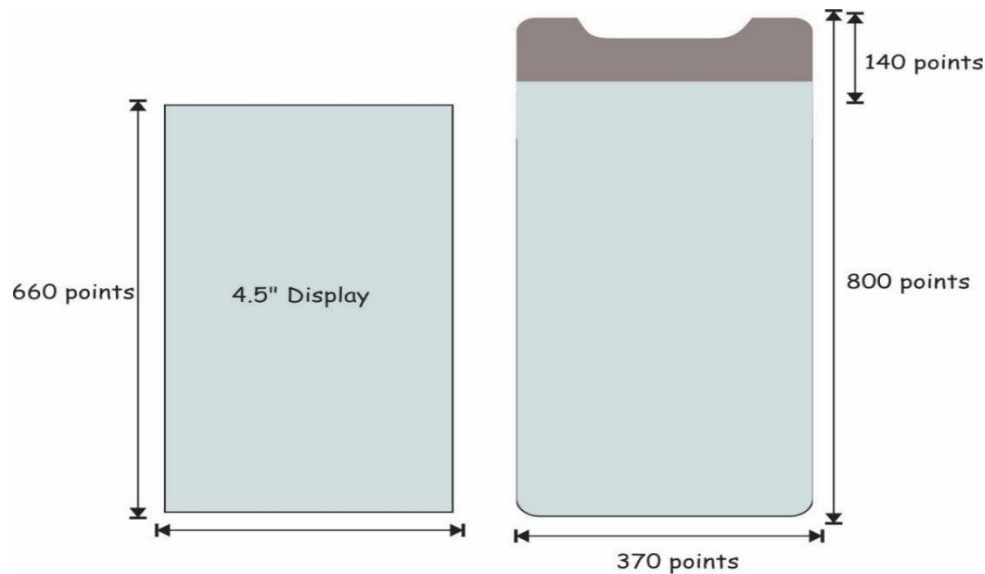


Figure 2: Typical Android Layout Interface
Source: Design by Researcher (2023)

In UI designs, Information is presented to the user through visual interfaces that can be manipulated without the user imputing or writing of commands and codes. The user directly interacts with visual elements of the interface by touching or clicking. These elements include buttons, icons, menus, that react in accordance with the written codes in the programme to support the user's action.

How users interface with digital devices such as mobile phones, tablets and computers is constantly being redesigned and reinvented to meet new needs and user demands. The same application software or operating system may present different or slightly different GUIs as it is patched and evolves. Even if the core of the application and its functions stay the same, the appearance might be modified according to user needs or to improve user experience.

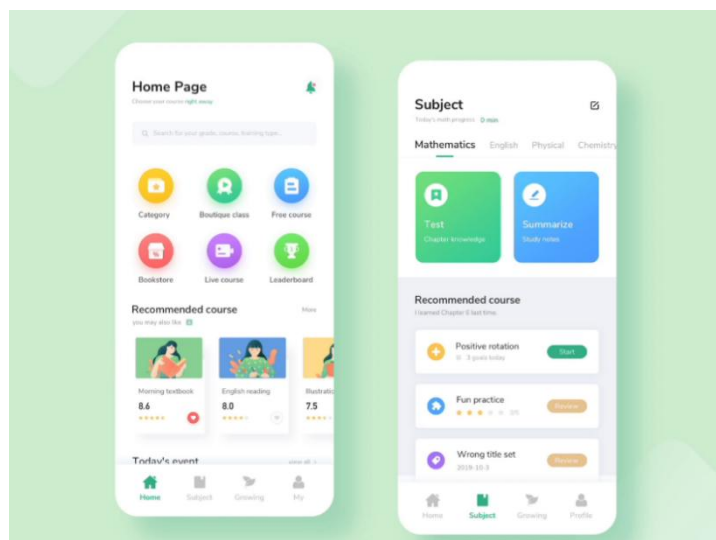


Figure 3: Android Interface Design
Source: Screen Shot by Designer (2023)

These ingenuities by developers have brought users from the keyboard to the mouse and trackball, touch screens and voice commands. A visual language evolved as GUI has become commonplace in both operating systems (OSs) and software applications. Such advancements

in GUI have made those with limited computer skills learn how to use computer applications for word processing, finances, inventory, design, artwork or hobbies.

The evolution of graphic design as a practice and profession has been closely bound to technological innovations, societal needs, and the visual imagination of practitioners. Meggs (2019), opined that graphic design has been practiced in various forms throughout history; noting that, examples of graphic design date back to manuscripts in ancient China, Egypt, and Greece. As printing and book production developed in the 15th century, advances in graphic design developed alongside in subsequent centuries, with compositors or typesetters often designing page layouts as they set the type.

Visual communication designs and resources are developed to be disseminated to a particular group of audience with the intention of reaching out to their specific information needs. Cheng, *et al.* (2013), observe that Information dissemination is an important social process in today's information-centered communities, and most of the communication infrastructures have been developed in the last three decades mainly to allow disseminating different types of information across various communication channels. Recent advances in disseminating information have been stimulated in order to accommodate emerging trends in terms of increasing volumes and service demands of disseminated information.

Information needs are diverse and constantly changing and they vary across different strata of needs. However, information need is characterized mostly by the information seeking behaviour of the person in need of information. (Fatima and Ahmad, 2008) asserts that information seeking behaviour involves a set of actions that an individual, such as an undergraduate, takes to express information needs, seeks information, evaluates and selects information and finally uses this information to satisfy his or her information needs.

Methodology

This study explored the Design and Development Research (DDR) methodology. Sahir *et. al.* (2012) acknowledges the justification of the DDR being a pragmatic resource in modern approaches to online designs by testing theories and validating resources.

The procedure adapted for this study include the Research design, Population of the study, Sampling method, Instruments for collection of data and the procedure for data analysis.

The population of this study comprised undergraduate students of Industrial Design Department, Ahmadu Bello University, Zaria and practicing graphic designers, to assess and test for significant levels of information retrieval, usage and sharing pertaining to the mode of academic resources relevant for undergraduate scholarship in the field of Industrial Design. The population of the study was constituted from 144 respondents (comprising 124 specializing students and 20 practicing graphic designers for responses pertaining to design summations, formations and evaluations were sought from 20 graphic design professionals during the formative design phase).

Sample and Sampling Techniques

The sample size of the population was drawn from 20 practicing graphic designers and 48 specializing graphics design students (made up of 24 from 300 and 24 from 400 level) but only 43 of these students as well as were available for conducting this study.

A purposive sampling technique was used in this study due to the specific nature of the study population. Crossmn (2020) suggests that a typical purposive techniques guides researchers

studying a phenomenon that relates to typical members of the effected population. From a purposive selection, perceptions and comments were analysed.

Relevant data were sought from Industrial Design students. Direct observation, questionnaires and interviews were the in. Information such as modes of circulating information, retrieving specific information on university programmes relating to arts, design and cultural studies, mode of entry, registration procedures of the university and other information on e-publications materials.

At the stages of development, several design procedures were followed. The first steps were thumb nail sketches. The sequence of thumbnails and colour swashes for the GUI layouts are displayed on Figures 4 and 5 while Plate 2 is a capture of the design rendering using CorelDraw X17. The other graphic design software employed in the design procedure are Adobe Photoshop and Adobe illustrator as well as Unity Game engine for coding of the layouts and text components. The designs on Plate 3 are the completed versions of the interfaces to be coded in the App development using the unity game engine where other icons such as back button, close button and so forth.

Similarly, respondents were asked for opinions pertaining to the looks of the startup icon, the general layout, the simplicity and clarity of visuals, legibility of fonts and the relevance of the visuals in the contents of the GUI.

The process of designing the Android application (*Smartink 1.0*) started from freehand and thumb nail sketches all the way to computer refined interfaces to suggest appealing look and feel of the overall design. The freehand drawings of the interface layouts are presented below.

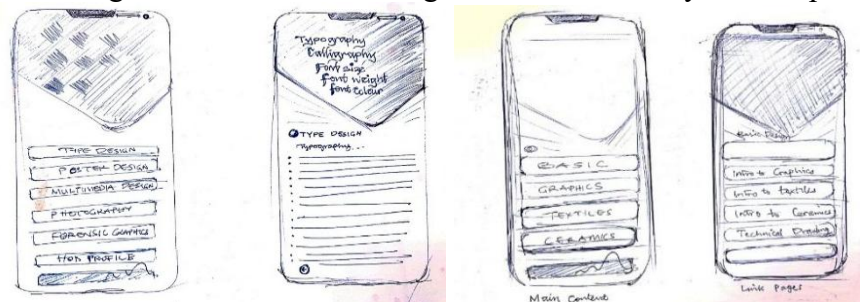


Figure 4: Thumbnail Sketches for Proposed App
Source: Researcher (2022)

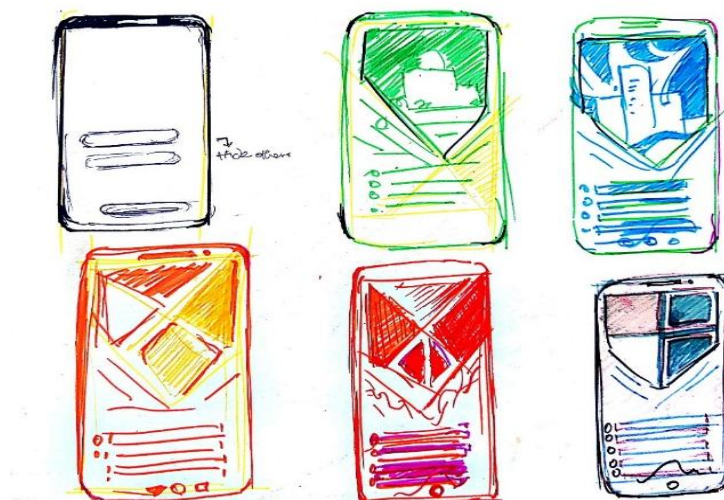


Figure 5: Color Swatches of Interface for Proposed App
Source: Researcher (2022)

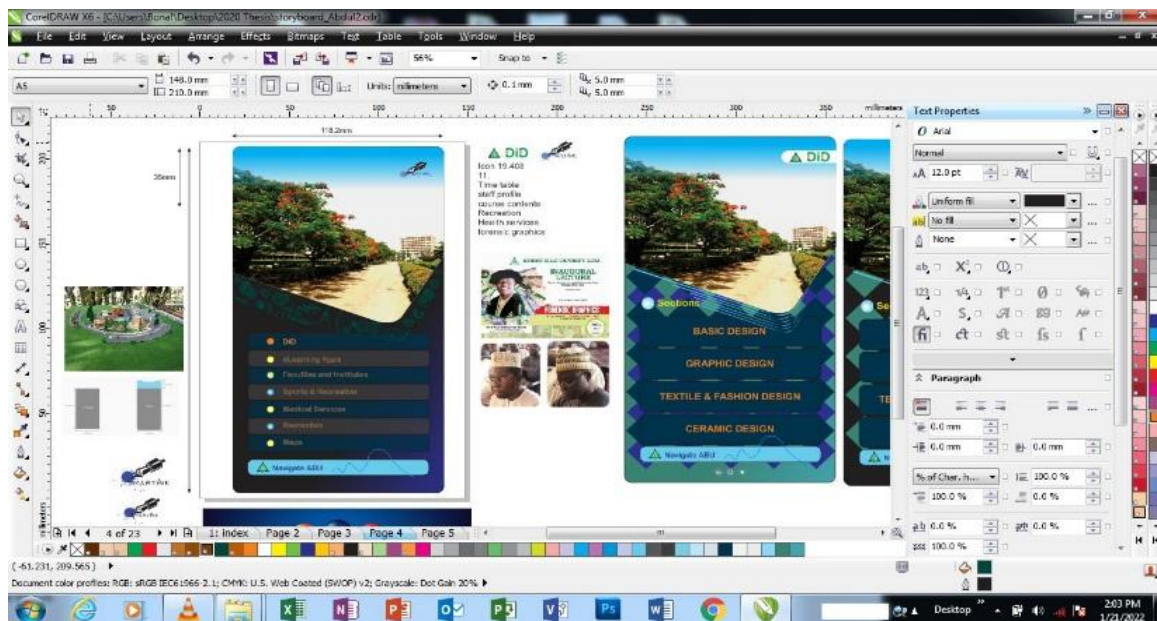


Plate 2: Screen Shot of Interface Layout Design
Source: Workspace by Researcher (2023)

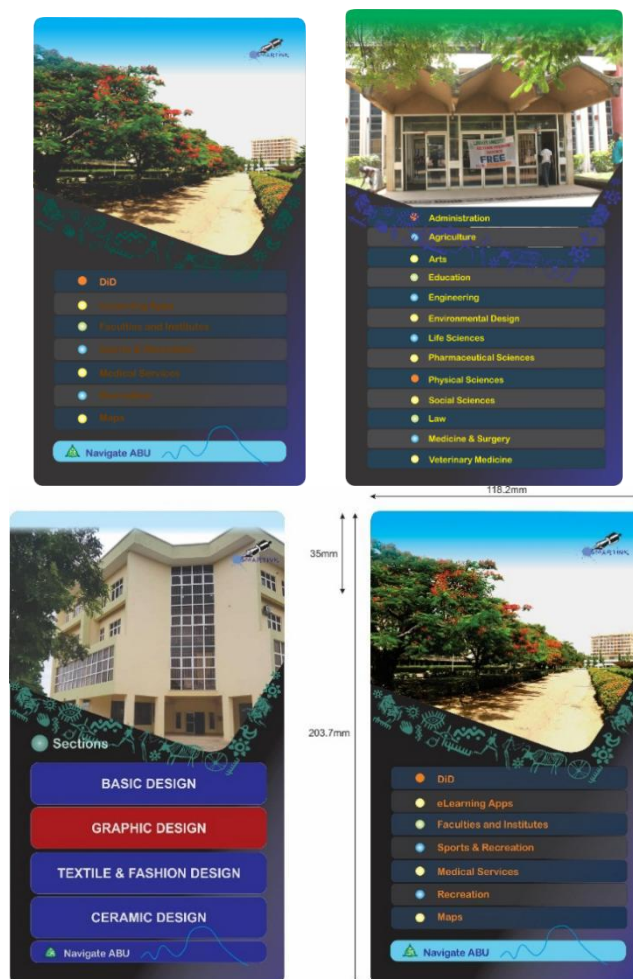


Plate 3: Refined Interface Layouts
Source: Work by Researcher (2023)

Results Presentation and Analysis of Data

The respondents evaluated the Application (Smart-ink 1.0) idea in rankings using the Likert scale approach. In order to support the data collected, a validation test of the research instruments was carried out. The Likert scale results was used to evaluate the responses of designers and the undergraduate students of the Department of Industrial Design. The key procedures used for determining this was the Likert Scale Analysis which ranged from the 1st rating to the 5th. Whereby 5 represents strongly agree, 4 suggests agree, 3 represents undecided while 2 and 1 represent disagree and strongly disagree respectively. The overall results demonstrated the existence of an acceptable outcome of mean values in the category of 4.0 to 4.9 between the evaluation the first version of *Smartink 1.0*. from the limits of scale, these values (4.0 -4.9 mean) shows that the results are in the range of Agree and Strongly Agree according to the provisions of the Likert Scale analysis.

This study explored the Design and Development Research (DDR) methodology which allows an enhanced analysis of combining both the qualitative and quantitative approaches as well as giving room for the application of design theories and models.

Research Question: How can an effective Android application be designed and developed to guide and inform undergraduate students of graphics design?

The following aspects were considered: Design elements, Design Models (ADDIE and Rapid Prototyping), Design Theories, Design and Development and Coding (Unity Game Engine, C#).

Formative Evaluation

The evaluation of responses from twenty professional practicing designers suggests that the graphic components adapted in the interface design are in conformity with the basic principles and elements of design. 4 of the designers agreed to the appropriate use of colours while 15 strongly agreed that the colour usage was in line with general design practices using the colour wheel and color swatch combinations.

Table 1: Likert Scale Limits of Analysis

Limits of Scale	Qualitative Description
4.50 - 5.00	Strongly Agree (SA)
3.50 - 4.00	Agree (A)
2.50 - 3.00	Undecided (U)
1.50 - 2.00	Disagree (D)
0.50 - 1.00	Strongly Disagree (SD)

Table 2: Design and Development of Effective GUI Components on Android Application to guide and Inform Undergraduate Students of Graphics Design

S/No	Statement	Mean	Interpretation
1.	Identification of the Startup Icon	4.4	Agree
2.	Arrangement of Graphic Icons	4.7	Strongly Agree
3.	Clarity, Simplicity and relevance of contents	4.8	Strongly Agree
4.	Legibility of fonts used in the contents	4.6	Strongly Agree
5.	Relevance of Photographs to contents of each Interface	4.9	Strongly Agree
6.	Use of colours for arousing interest in the application	4.8	Strongly Agree
	Cumulative Mean	4.7	Strongly Agree

Table 2 showed that respondents agreed that the *Smartink* application has a relevant outlook in its presentation with an average mean of 4.7. The responding students agreed that the startup icon can easily be identified. The aspect of clarity, simplicity and relevance of contents scored a mean score of 4.8 which suggests strongly agree. It was strongly agreed that the Graphic icons used in the interfaces are legible and not overcrowded with a mean score of 4.6 while the mean of the relevance of content uploaded is 4.8. The respondents agreed that both the use of photographs are relevant. Going by a mean score of 4.9 the result suggests a strongly agreed result. Similarly, it was strongly agreed that the use of color in the interface design is capable of arousing interest with a mean of 4.8. the cumulative mean of 4.7 from the opinions of the respondents implies that the GUI is presented in a clear, concise and engaging approach.

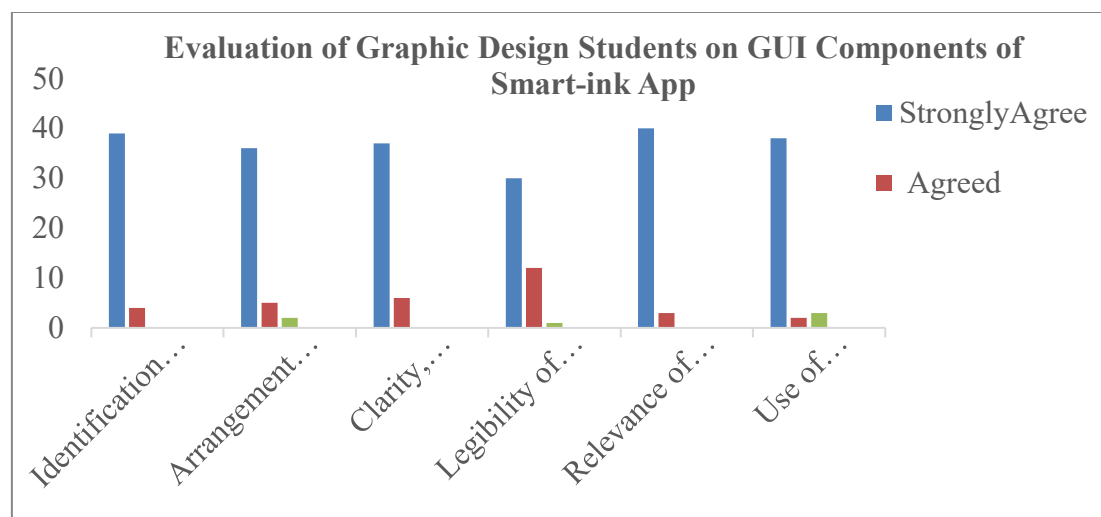


Figure 6: Evaluation of Graphic Design Students on GUI Components of Smart-ink App

Findings, Conclusion and Recommendations

The analysis of the study was conducted using the 5-point Likert scale to achieve the results of perceptions from the population. The population included two groups of respondents, including specializing students in 300 and 400 level of graphics design and professional graphic designers who have been in the design practice.

The study found that Android applications are tools that should be continually explored in educational and other diverse practices. The analysis from the professional point of view of the designers showed that the concept of the proposed *Smartlink 1.0* development is timely in today's digital environment.

The results showed that the use of mobile devices by students to access information on social and academic pursuits is on an increasing scale.

In conclusion, the analysis pointed to the assertion that the *Smartlink* application provides an optimised performance in aiding the conventional studio practices to evaluate usability: ease of use, user satisfaction, attractiveness, interactivity, learnability and information sharing among students of Industrial Design in Ahmadu Bello University, Zaria.

Recommendations

1. The design and development of Applications involve a process of collaboration between designers and developers therefore there is a need in involve the expertise of seasoned graphic designers, developers, programmers, social behaviorists, educationists and administrators of institutions to ensure a prolific outlook of the final product.
2. Students of graphics design and more particularly, specializing students in the field of graphic design should inculcate the use of digital resources and modern technologies designed for the purposes of enhancing their educational pursuits.
3. Graphic designers and developers should leverage on the use of design and communication theories, models as well as a proper use of the elements and principles of design to ensure a standard road map for presenting digital applications.
4. Departments and institutions should adopt the use of modern digital tools to augment the conventional methods of learning and sharing of academic information.

References

- Agarina, M., Karim, A. S., & Sutedi, S. (2019). User-centered design method in the analysis of user interface design of the Department of Informatics System's website. In *Proceedings of the International Conference on Information Technology and Business* (pp. 218–230). Department of Information System, IIB Darmajaya. <https://jurnal.darmajaya.ac.id/index.php/icitb/article/view/2098>
- Branch, R. M., & Kopcha, T. J. (2014). Instructional design models. In J. M. Spector, M. D. Merrill, J. Elen, & M. J. Bishop (Eds.), *Handbook of research on educational communications and technology* (4th ed., pp. 77–87). Springer. https://doi.org/10.1007/978-1-4614-3185-5_7
- Chinetha, K., Daphney Joann, J., & Shalini, A. (2015). An evolution of Android operating system and its version. *International Journal of Engineering and Applied Sciences*, 2(2), 30–33. https://www.ijeas.org/download_data/IJEAS0202022
- Crossman, A. (2020, March 19). Understanding purposive sampling: An overview of the method and its applications. ThoughtCo. <https://www.thoughtco.com/purposive-sampling-3026727>
- Das, P. K., Paul, H. S., & Tultul, M. H. (2023). Development of a mobile application: From university website to mobile app. *International Research Journal of Computer*

and Communication Technology, 5(2), 213–220.
<https://irojournals.com/jucct/V5/I2/07.pdf>

- Ejiyi, C. J., Deng, J., Ejiyi, T. U., Salako, A. A., Ejiyi, M. B., & Anomihe, C. G. (2021). Design and development of Android application for educational institutes. *Journal of Physics: Conference Series*, 1769(1), Article 012066. <https://doi.org/10.1088/1742-6596/1769/1/012066>
- Fatima, N., & Ahmad, N. (2008). Information seeking behaviour of the students at Ajmal Khan Tibbiya College, Aligarh Muslim University: A survey. *Annals of Library and Information Studies*, 55(2), 141–144. <https://nopr.niscpr.res.in/handle/123456789/1775>
- Fordjour, R., Badu, E. E., & Adjei, E. (2010). The prospects and challenges of information retrieval by university students: A case study of post graduate students of the University of Ghana, Legon [Conference poster]. Joint 3rd African Association of Agricultural Economists (AAAE) and 48th Agricultural Economists Association of South Africa (AEASA) Conference, Cape Town, South Africa. <https://ageconsearch.umn.edu/record/96831>
- Liu, M., Jones, C., & Hemstreet, S. (1998). Interactive multimedia design and production processes. *Journal of Research on Computing in Education*, 30(3), 254–280. <https://doi.org/10.1080/08886504.1998.10782226>
- Nwobasi, R. N., Uwa, E. O., & Ossai-Onah, O. V. (2013). Information needs and seeking behaviour of students in two universities in Imo State, Nigeria. *Library Philosophy and Practice (e-journal)*, Article 966. <https://digitalcommons.unl.edu/libphilprac/966>
- Stoltzfus, J. (2021). Graphical user interface (GUI). Educational Technology. <https://educationaltechnology.net/instructional-design-models-and-theories/> (Note: Original entry appears to reference this site; no direct match for "StoltzfusCheckmark" found—likely a typo or misattribution. If this is incorrect, verify source.)
- Tam, K. (2008). *How does visual communication work?* [Workshop materials]. School of Design, Hong Kong Polytechnic University. <http://www.edb.gov.hk/attachment/tc/curriculum-development/kla/arts-edu/pd/visual%20communication.pdf>