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## **Development and Utilization of Interactive Digital Manual for Academic Engagement and Assessment in General Studies among Undergraduate Students in University of Ilorin, Kwara State, Nigeria**

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### **Introduction**

In the evolving landscape of higher education, the integration of digital technologies into teaching and learning has become essential for improving students' academic engagement and performance. At the University of Ilorin, General Studies (GNS) courses remain compulsory for all undergraduates and serve as foundational courses designed to develop critical thinking, communication skills, civic responsibility, and entrepreneurial competence. Despite their importance, evidence suggests that many undergraduates demonstrate low commitment to these courses, as reflected in irregular lecture attendance, limited class participation, poor engagement with assignments, and an overall indifferent attitude toward GNS content. The large enrolment nature of GNS courses, often involving thousands of students across faculties, further contributes to minimal interaction between lecturers and



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students. This situation encourages passive learning and reduces meaningful academic engagement. Research has consistently shown that student engagement, behavioural, emotional, and cognitive, is a strong predictor of academic achievement and persistence (Fredricks et al., 2004; Harbours et al., 2015). When students are actively involved in learning activities, demonstrate interest, and invest effort in academic tasks, learning outcomes significantly improve. However, outdated, inconsistent, or less interactive instructional materials have been identified as major deterrents to effective participation in GNS courses (Bello et al., 2023).

Digital interactivity offers a viable solution to this challenge. Studies such as Adedokun-Shittu et al. (2021) and Wilson and Harris (2021) reveal that interactive digital tools enhance motivation, critical thinking, collaboration, and active participation. Digital pedagogy, which emphasizes the thoughtful integration of multimedia, automated assessments, and interactive learning elements, aligns with the learning preferences of contemporary digital-native students (Tran et al., 2020). Interactive digital platforms also allow for self-paced learning, instant feedback, personalized engagement, and flexible assessment processes, thereby improving both learning experiences and performance outcomes. Given these realities, there is a compelling need to modernize the delivery of GNS content at the University of Ilorin through the development of an Interactive Digital Manual. Such a manual will integrate multimedia resources, interactive exercises, discussion prompts, and automated assessments to foster deeper understanding, improve attendance and participation, and decongest conventional assessment processes. Therefore, this study seeks to develop an Interactive Digital Manual tailored specifically to General Studies courses at the University of Ilorin to enhance undergraduates' academic engagement, improve learning outcomes, and align GNS content delivery with 21st-century educational demands.

### **Statement of the Problem**

The University of Ilorin in Nigeria faces a dual challenge related to the delivery of General Studies content and the overcrowded conditions at its Computer-Based Test (CBT) centres. The students have identified Institutional, lecturer-based, and student-based problems as contributing to their unfavourable disposition toward the course. Among the institutional issues are: an un conducive learning environment, poor infrastructural and teaching facilities, inconsiderate timing, etc. Lecturers' issues include lateness to class, uncontrolled class, poor motivation, unclear class schedule of class, poor teaching approach, and impromptu cancellation of class, among others. Students' causes involve lack of smartphone for a virtual class, the outdated content of the GNS, irrelevant course to their discipline, obsolete contents, peer influence, poor access to the internet, an inconsistent module of delivery, availability of instructional text module, assumption that class attendance and participation is not necessary, overconfidence to pass the despite truancy and non-challant to the course (Bello, 2023). This has made the current General Studies material prove inadequate, lacking the dynamism needed for active engagement and thorough comprehension among students. Simultaneously, the university grapples with a surge in student numbers during assessment periods, causing congestion and logistical strains at its CBT centres. The rigid structure of current assessment practices exacerbates the issue, leading to peak activity periods that further burden these centres. This initiative seeks to tackle these challenges by developing and implementing an Interactive Digital Manual for General Studies. This digital resource not only aims to enhance academic engagement but also serves as a pivotal tool in decongesting the CBT centres through embedded assessment in the digital interactive manual. By leveraging technology to create an immersive learning experience, the project aims to revolutionize the way General Studies content is delivered and assessed. Through the integration of interactive elements and the adoption of flexible



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assessment methodologies, the project aims to decongest CBT centers by redistributing assessment activities across a broader timeframe. This holistic approach intends to address the challenges associated with overcrowded CBT centers while concurrently elevating the overall quality of General Studies education at the University of Ilorin.

### **Purpose of the study**

The main focus of this study was to examine and to develop a student-centered digital manual for improved engagement in GNS courses in Universities in Nigeria. Specifically, the study:

1. Collaborated with students to develop improved GNS content for the digital manual;
2. Conducted a usability test of the interactive digital manual;

### **Research Questions**

1. How can students be effectively involved in the development of improved General Studies (GNS) content for a digital manual in Nigerian universities?
2. What is the effectiveness of the usability testing process for the interactive digital manual in terms of student engagement and usability?

### **Literature Review**

The literature review has been organized around the following subheadings:

#### **Higher Institution and General Studies**

The university, as the highest level of education, is not solely for degree acquisition but for intellectual development, research advancement, and societal transformation. Its core mandate includes training minds capable of solving societal problems, promoting research, and ensuring curriculum quality and relevance (Bande & Olatunji, 2019). This philosophy underpins the establishment of General Studies (GNS), which aims to produce balanced, socially responsible, and employable graduates. In alignment with Sustainable Development Goal 4 (Quality Education), GNS courses broaden students' knowledge beyond their disciplines, enhance communication skills, promote civic awareness, and cultivate critical thinking necessary for national development. The UN 2023 report elucidated that while 86 per cent of individuals use the Internet in countries providing data, many lack the required digital skills to be able to fully benefit from it or avoid its dangers, with communication/collaboration skills being the most prevalent, followed by problem-solving, safety, and content creation. However, recent trends in teaching-learning processes and students' performance in GNS appear to contradict these foundational objectives. The COVID-19 pandemic, prolonged industrial actions, and economic challenges disrupted academic activities and exposed weaknesses in digital readiness, ICT skills, and online engagement. Although institutions adopted online and blended learning approaches, limited digital competence, poor interaction, and inadequate engagement strategies reduced learning effectiveness. Research emphasizes that effective engagement in higher education, whether physical or online, requires behavioural, emotional, and cognitive dimensions supported by meaningful student-student, student-instructor, and student-content interactions (Moore, 1993; Fredricks et al., 2004). Inadequate communication, delayed feedback, weak instructional strategies, and poor technological integration can negatively affect participation and motivation in General Studies courses. Therefore, there is a pressing need to strengthen digital transformation and interactive course delivery to restore the foundational goals of General Studies in higher institutions.

#### **The Rise of Digital Learning**

The integration of digital technologies into education has transformed traditional teaching approaches, creating more interactive, flexible, and student-centred learning environments. Digital tools such as e-books, multimedia resources, and interactive platforms enable educators to design materials that accommodate diverse learning styles while enhancing participation and engagement.



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In university settings, particularly within General Studies (GNS) courses, digital learning presents significant opportunities to improve content delivery and academic involvement. Interactive digital manuals have gained attention in higher education due to their ability to promote active learning. Studies indicate that features such as quizzes, simulations, embedded multimedia, and instant feedback increase students' engagement, comprehension, and retention of concepts (Smith, 2018; Jones et al., 2019). Unlike traditional print materials, digital manuals support adaptive and personalized learning, allowing students to progress at their own pace and access additional resources where needed (Clark & Mayer, 2017). This fosters a learner-centred environment that accommodates varied academic abilities and preferences. Furthermore, digital manuals enhance accessibility and flexibility by providing 24/7 access to course materials, supporting online and blended learning models (Diaz & Carnal, 2021). They are also cost-effective and sustainable, as digital formats reduce printing costs and allow for timely content updates (Martin, 2019). Importantly, interactive platforms generate data on student participation and performance, enabling continuous improvement of instructional strategies (Lopez et al., 2022). Immediate feedback and automated assessment features further strengthen learning outcomes by helping students monitor their understanding in real time.

#### **Models of Interactive Digital Manuals**

Developing an interactive digital manual for teaching GNS to promote students' academic engagement requires the following paramount components:

1. Dynamic Content for Digital Interactive Manuals
2. Design Principles for Interactive Learning
3. User Experience and Interface Design
4. Interactivity in Digital Learning
5. Gamification and Learning
6. Assessment and Feedback in Digital Manuals
7. Case Studies and Best Practices
8. Challenges and Future Directions

#### **Stages of Developing an Interactive Digital Manual for Teaching General Studies**

Developing an interactive digital manual involves the following stages:

- 1) Needs Assessment: Identify learners' needs, review curriculum requirements, and assess available technology infrastructure.
- 2) Curriculum Design: Align content with the GNS curriculum, organize into modules, and define clear learning objectives.
- 3) Interactive Content Planning: Determine suitable interactive elements, design navigation structure, and ensure content is engaging and standards-aligned.
- 4) Multimedia Development: Create videos, animations, graphics, and ensure accessibility features for diverse learners.
- 5) Technology Selection: Choose appropriate platforms or LMS tools and ensure compatibility across devices.
- 6) UI/UX Design and Usability Testing: Develop an intuitive interface and refine it through user feedback.
- 7) Assessment and Feedback Integration: Embed quizzes and assignments aligned with objectives, and provide mechanisms for instant feedback and self-assessment.
- 8) Pilot Testing: Test with a small group, collect feedback, and refine the manual.
- 9) Implementation and Training: Deploy the manual and train instructors and students on its use.
- 10) Continuous Improvement: Monitor engagement, gather ongoing feedback, and update content



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and features regularly.

By following these stages, educators can create an interactive digital manual for teaching General Studies that aligns with educational standards and provides an engaging learning experience.

### **Theory of Social Constructionism**

Social constructionism is a sociological theory that views knowledge as shaped through social interactions and language rather than as objective truth. Individuals' perceptions and understanding of the world are constructed through communication with peers, lecturers, and institutions. In the context of developing an interactive digital manual for General Studies at the University of Ilorin, this theory is relevant because it highlights how students' attitudes and engagement are socially influenced. The digital manual should therefore promote meaningful interactions, collaboration, and co-construction of knowledge. Moreover, social constructionism recognizes that knowledge is dynamic, suggesting that the digital manual must be adaptable to students' evolving needs and learning preferences. Applying this framework ensures the manual supports collaborative learning and reflects the socially constructed nature of knowledge.

### **Methodology**

#### **Research Design**

The study adopted a mixed-method design using a Design and Development Research (DDR) approach to develop the interactive digital manual. Quantitative data were collected through a researcher-designed Google Form survey to gather students' opinions on interactive features for the manual. Qualitative data were obtained through focus group discussions with lecturers and students to refine and improve General Studies (GNS) content.

#### **Instrumentation**

Two instruments were used: (1) a researcher-constructed survey titled "Appraisal of General Studies Digital Interactive Course Contents" and (2) the developed interactive digital manual (React App). Open-ended and structured questions were used to collect relevant data on course content and engagement. The instruments were validated by experts in Educational Research and Educational Technology. A pilot test was conducted among 200- and 300-level students, using pre- and post-tests to assess comprehension after interacting with selected modules.

#### **Population and Sample**

The population comprised all undergraduates of the University of Ilorin, while the target population included 200- and 300-level students offering GNS courses across seventeen faculties. Using multi-stage sampling (stratified and proportionate techniques), 1,332 students were selected from an estimated population of 24,000, based on a 95% confidence level and 2.5% margin of error. GNS content authors were also engaged through workshops for content review and integration into the digital manual.

#### **Development of the React App**

The digital manual was developed using JavaScript and Node.js for backend operations, MySQL for database management, and Bcrypt for secure authentication. OpenAI integration enabled automated question generation. The frontend was built with React, incorporating multimedia features, animations, audio support (text-to-speech), embedded videos, timed assessments, and automated grading. The system allows students to access weekly content, complete assessments, track performance, and submit appeals. Administrators can upload content, monitor results, manage appeals, and regulate student access. The platform was hosted on Truehost servers.

#### **Procedure for Data Collection**



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Permission was obtained from relevant faculty authorities before distributing the survey link through student platforms. Ethical considerations were strictly observed.

### Procedure for Data Analysis

Quantitative data were analyzed using SPSS (Version 23.0), while qualitative data were analyzed using Atlas. ti (Version 8.0).ti (Version 22.0).

### Presentation of Results

**Research Question 1:** How can students be effectively involved in the development of improved General Studies (GNS) content for a digital manual in Nigerian universities?

To answer this question, the survey results of the need assessment of the level of relevance of contents of GNS 211 and 212 by the students and the need for more relevant contents, 2698 students across all the 16 faculties responded and the data was presented in figure 1 below

1. Identify from the Contents of Philosophy, Logic and Nigerian Culture (GNS 211) those that are relevant to your course of study, and wished should be retained.

1,945 responses

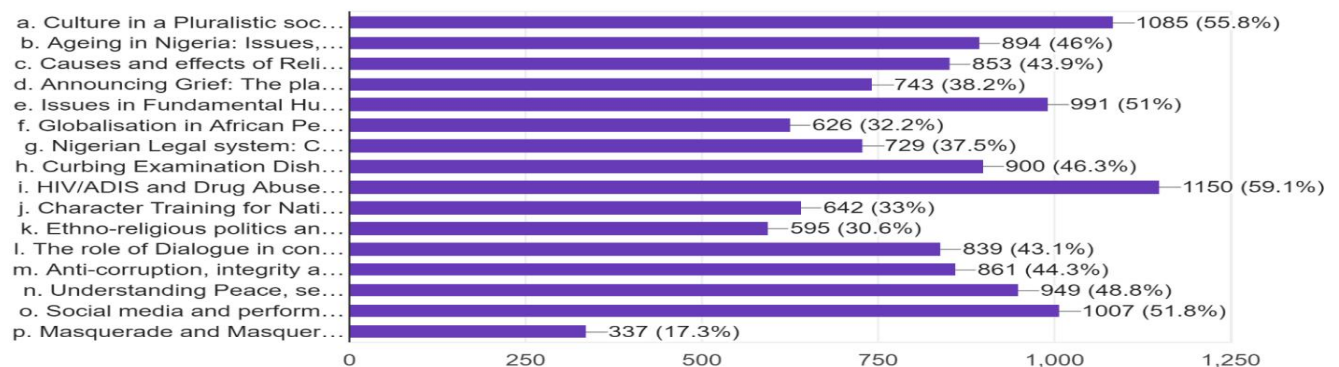


Figure 1: Bar Chart on Students' Response towards GNS 211 contents that are relevant.

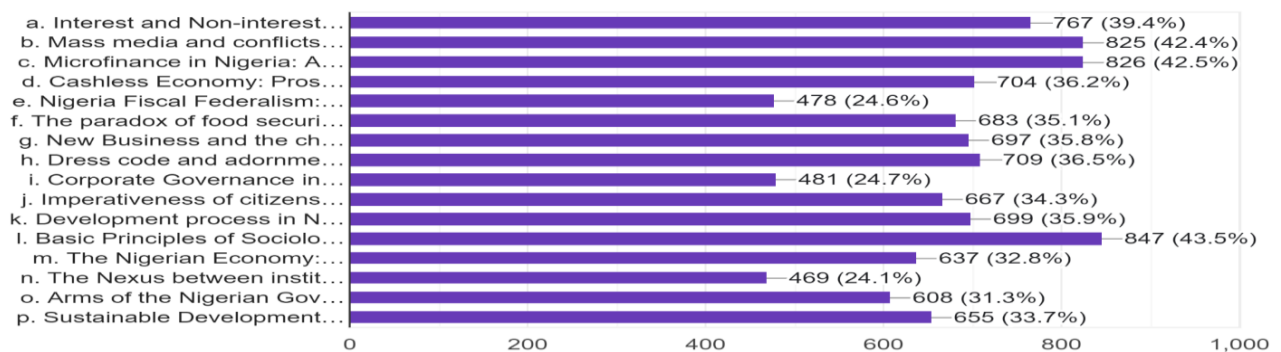
From Figure 1 above, the highest percentage response is 59.1%, while the lowest percentage response is 17.3%. The average of all percentage responses is 42.4%. Hence, a benchmark of 40% is used to select the content that is most relevant to the students' course of study and should be retained. Based on this decision, all contents that have above 40% is taken as those relevant to the students' course of study and should be retained. These contents are: HIV/ADIS and Drug Abuse education (59.1%); Culture in a Pluralistic society: A case study of Nigeria (55.8%); Social media and performance of students in Nigeria Tertiary institution (51.8%); Issues in Fundamental Human Rights (51%); Understanding Peace, security and Development (48.8%); Curbing Examination Dishonesty through value education (46.3%); Ageing in Nigeria: Issues, challenges and prospects (46%); Anti-corruption, integrity, and societal development in Nigeria (44.3%); Causes and effects of religious violence in Nigeria (43.9%); The role of Dialogue in conflict resolution (43.1%)

On the other hand, the contents that had below 40% are to be replace meaning that they were not indicated as being relevant to their course of study. These contents are: Announcing Grief: The place of strategies Communication (38.2%); Nigerian Legal System: Concept of Justice and Rule of Law (37.2%); Character Training for National Values: A Religious Consideration (33%); Globalisation in

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African Perspective (32.2%); Ethno-religious politics and political development in Nigeria: A Historical Approach (30.6%); Masquerade and Masquerader: Theatrical Producing for Traditional Cultural Festivals (17.3%). In furtherance of the result of the analysis of students’ responses, the following relevant contemporary issues with their contents were indicated as important, which can be used to replace those contents that were not relevant: Bribery and corruption; Business management and Entrepreneurship; Empowerment and Skills acquisition; Human trafficking; Technology and Artificial intelligence; Social interaction, networking and media communication; Culture and Social Changes; Nigeria Rule of law and legal system; Mental health and Emotional Intelligence; Home management and Family life education; Nationalism and Tribalism

**4. Which of the following Contents of Introduction to Social Sciences and Citizenship Education in GNS 212 is relevant to your course of study, and wished should be retained**  
 1,945 responses



*Figure 2: Bar Chart of Students' Responses towards GNS 212 Content that is Relevant.*

From Figure 2 above, the highest percentage response is 43.5%, while the lowest is 24.1%. The average of all percentage responses is 34.5%. Hence, a benchmark of 30% is used to select the content that is most relevant to the students’ course of study and should be retained. Based on this decision, all contents that have above 30% is taken as those relevant to the students’ course of study and should be retained. These contents are: Basic Principles of Sociology and Anthropology (43.5%); Microfinance in Nigeria: An overview (42.5%); Mass media and conflicts in Nigeria (42.4%); Interest and Non-interest Banking: The Issues and the Controversies (39.4%); Dress code and adornment on campuses: issues and challenges (36.5%); Cashless Economy: Prospects and challenges (36.2%); Development process in Nigeria (35.9%); New Business and the challenges of doing Business in Nigeria (35.8%); The paradox of food security in Nigeria (35.1%); Imperativeness of citizenship education to the Nigerian students (34.3%); Sustainable Development in Nigeria: Prospects and Challenges (33.7%); The Nigerian Economy: History and Policies (32.8%); Arms of the Nigerian Government and Constitution of the Federation (31.3%)

On the other hand, the contents that had below 30% are to be replace meaning that they were not indicated as being relevant to their course of study. These contents are: Corporate Governance in Nigeria (24.7%); Nigeria Fiscal Federalism: Lessons of Experience (24.6%); The Nexus between institutions and Corruption: Lessons for Nigeria (24.1%)

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Considering the result of the analysis of students' responses, the following relevant contemporary issues with their contents were indicated as important, which can be used to replace those contents that were not relevant: Human trafficking; Leadership and Management; Inflation and deflation; Youth empowerment; Economic growth and development; Human rights law

**Research Question 2:** What is the effectiveness of the usability testing process for the interactive digital manual in terms of student engagement and usability?

A usability test was conducted



Figure 2: The usability test results:

The usability test of the interactive digital manual developed for undergraduates at the University of Ilorin has provided significant insights into its functionality, user-friendliness, and overall impact on academic engagement. The results indicate that the manual performs well across all measured metrics, showcasing its potential as a valuable educational tool.

**Task Completion Rate:** The manual achieved an average success rate of 92.55%, with many participants attaining 100% completion, demonstrating intuitive design and alignment with user expectations.

**Time Efficiency:** Tasks were completed within an average of 2.8 minutes (ranging 2.4 to 3.2 minutes), reflecting the manual's clear layout and logical structure.

**Error Rate:** Minimal errors were recorded, with an average of 0.9 per task, suggesting that the manual guides users effectively and that errors were mostly minor navigation issues.



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**User Satisfaction:** Participants gave an average score of 8.05/10, indicating high satisfaction. Satisfaction was consistent across demographics, confirming the manual's inclusivity and broad appeal. The usability test demonstrated the manual's strong performance in terms of efficiency, accessibility, and engagement. Suggestions for improvement include refining navigation and introducing personalization features to allow adaptive and individualized learning experiences.

## Discussion of Findings

The development of the GNS digital manual reflects a significant step in modernizing educational practices. The findings indicate that aligning course content with students' academic and professional aspirations enhances relevance, motivation, and engagement. For example, topics like HIV/AIDS Education and Basic Principles of Sociology and Anthropology were highly valued due to their real-world applicability. Conversely, less relevant traditional content, such as Masquerade and Masquerader, was appropriately replaced with contemporary topics reflecting societal and technological realities, such as AI, Mental Health, and Entrepreneurship. Usability testing underscored the manual's accessibility, interactivity, and intuitive design. High task completion rates, low errors, and strong satisfaction scores confirm its effectiveness as a learning tool. The results align with established usability principles emphasizing simplicity, consistency, and adaptability (Nielsen, 1994; Kearsley & Shneiderman, 1999). Overall, the GNS digital manual enhances educational quality by fostering engagement, inclusivity, and independent learning. It demonstrates how thoughtful integration of technology, content relevance, and user-centered design can address systemic gaps in higher education. Continuous refinement, particularly regarding navigation and personalization, will further strengthen its impact.

## Conclusion

The development and adoption of the GNS digital manual demonstrated its transformative potential in addressing key gaps in General Studies education. By aligning content with contemporary issues and emphasizing usability, the manual effectively enhanced student engagement, attendance, and learning outcomes. Students found the manual intuitive and relevant, appreciating its features such as multimedia content, self-assessment tools, and adaptive learning pathways. These innovations promoted active participation, independent learning, and inclusivity, marking a significant step toward modernizing education in Nigeria. While the results were overwhelmingly positive, the findings also highlighted areas for improvement, including enhanced navigation and personalization options. The study underscores the importance of continuous evaluation and adaptation to ensure the long-term success and scalability of such digital interventions.

## Recommendations

To ensure the sustained effectiveness, relevance, and scalability of the GNS digital manual, the following recommendations are proposed. These strategies are designed to address identified gaps, build on the manual's successes, and enhance its role in fostering inclusive, engaging, and transformative learning experiences for students in Nigeria and beyond:

1. *Curriculum Realignment:* Replace outdated content with contemporary and relevant topics such as artificial intelligence, mental health, entrepreneurship, and sustainable development to better reflect current societal and professional demands.
2. *Enhanced Interactivity:* Expand interactive features, including gamification and collaborative tools, to further engage students and cater to diverse learning styles.



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3. *Customization Options:* Introduce personalization features that allow students to tailor their learning experiences, such as adaptive difficulty levels and user-specific content recommendations.
4. *Regular Feedback Mechanisms:* Implement continuous feedback loops from students and instructors to refine the digital manual based on real-time needs and experiences.
5. *Broader Implementation:* Scale the adoption of the digital manual to other universities in Nigeria, emphasizing its role in fostering sustainable and inclusive education practices.
6. *Monitoring and Evaluation:* Establish a robust monitoring and evaluation framework to assess the manual's long-term impact on learning outcomes, student engagement, and institutional goals.
7. *Technological Updates:* Regularly update the digital manual to incorporate advancements in technology and educational methodologies, ensuring its relevance and effectiveness over time.

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