KHAIRUN International Journal of Contemporary Librarianship
ISSN: XXXX-XXX
MAIDEN EDITION
DOI: https://doi.org/10.5281/zenodo.12949241

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KIJCL @ 2024

DEVELOPING A SYLLABUS FOR LINKED DATA EDUCATION IN NIGERIAN LIBRARY & INFORMATION SCIENCE (LIS) SCHOOLS: A SURVEY

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Abstract

Linked Data is transforming the information world to a more discoverable environment through the interconnection of various platforms of information via the semantic web. This brings about great opportunities to the LIS arena, particularly in the area of cataloguing/metadata/resource description and discoverability in terms of competitive advantage in the knowledge economy. As a result, library schools in Nigeria must begin to introduce the concept to potential librarians to prepare them for the workplace that is going to be ruled by Linked Data. This study was conducted to find out what cataloging educators and practitioners consider necessary to be included in the syllabus for linked data training in Nigeria with emphasis on course content, teaching materials and educator competence. Descriptive survey was used for the study. The population of the study comprise of six hundred and fifty (650) cataloguers (including practicing cataloguers and cataloguing educators). Simple Random Sampling technique was used to select two hundred and seventeen (217) cataloguers as sample for the study. The response rate for the study was 85.7%. The instrument for data collection was the questionnaire. Data was analyzed using descriptive statistics with tables and simple percentages. Findings of the study revealed that over 90% respondents agreed that the syllabus for linked data education in Nigeria should cover Linked Data concepts, cataloging relationships, and significance in libraries with entity-relationship cataloging, key RDA entities, attributes, shared library metadata schemas, Web Ontology Language application, and identifiers usage among others. Findings also revealed that the teaching materials and infrastructure for Linked Data education should comprise information resources on Linked Data principles and structures, practical tools like AACR2, RDA Toolkit, MARC21, BIBframe and library metadata schemas for demonstrations. Additionally, it should provide access to controlled

KHAIRUN International Journal of Contemporary Librarianship
ISSN: XXXX-XXX
MAIDEN EDITION
DOI: https://doi.org/10.5281/zenodo.12949241
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vocabularies, thesauri, and facilities for practical learning of data encoding standards as well as a fully equipped laboratory with internet connectivity and steady power supply for effective learning among others.

Keywords: Syllabus development; Linked Data education; Linked Data training; Nigerian LIS schools;; Curriculum design; Linked Data training

Introduction:

The contemporary era offer opportunities for different types of data and documents to be shared within a continuum of space and time. One of such technologies is the Linked Data. Linked data occurs when the web is used to create connections between data occurring in different formats, originally stored and maintained in various databases by different organizations and distributed across different geographic locations (Bizer, Heath & Berners-lee, 2009 cited in Pereira, Siqueira, and Dietze, 2017). A primary objective of Linked Data is to extend the web of documents, where HTML documents are interconnected, through hyperlinks to a web of data, where data may be connected directly following the Linked Data principles (Bizer, Heath & Berners-lee, 2009). These principles involve: using URIs (Uniform Resource Identifiers) as names for things; using HTTP URIs to enable people search for these names; provide useful information when someone searches for a URIs using recommended standards (RDFs-Resource Description Framework, SPARQL-Simple Protocol and RDF Query Language); affix links to other URIs so that additional information can be discovered (Berners-lee, 2006). The guidelines advocate for naming entities with URIs, utilizing HTTP URIs for improved searchability, ensuring relevant information retrieval through standards like RDFs and SPARQL, and incorporating links to other URIs for expanded exploration of information.

Linked Data permits communities to reach a consensus on meaning for their data and share the said data in a massively networked information space (OCLC Research, 2021). Presently, librarians are exploring how library data housed in databases that were hitherto comprehensible

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only to libraries can become broadly understandable collections of facts through connecting entities and relationships, making it possible for library data to be linked with that of communities outside Library & Information Science professions. This is for the sole purpose of boosting the visibility and relevance of libraries, while also conferring the library's authority upon the work of others (OCLC Research, 2010).

According to Cagnazzo (2017) this portends that "we are approaching the end of the cataloguing record containing purely library-provided data, and we are moving towards more enriched data, coming from various resources". Thus, the need arises for library data to be structured in ways that are more flexible and widely applicable (Coyle in Cagnazzo, 2017). To that effect, Wallis (2013) insists that "We are moving from cataloguing to catalinking". This implies that Linked Data is the new cataloguing.

The big picture is that Linked Data is bringing massive opportunities to the LIS arena, particularly in the area of cataloguing/metadata/resource description in terms of competitive advantage in the knowledge economy. Logic therefore, dictates that library schools, particularly in Nigeria must begin to introduce the concept to potential librarians as early as possible to prepare them for the workplace that is obviously going to be ruled by Linked Data. This study investigated cataloging educators and practitioners in Nigeria to find out what they consider necessary to be included in the syllabus for Linked Data_training with emphasis on course content, teaching materials and educator competence.

Objectives of the Study:

1. To determine the course contents to be included in the syllabi for Linked Data education in Nigerian Library & Information Science schools.

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2. To identify the teaching materials and infrastructure to be provided for Linked Data education in the schools under study.
3. To determine the competences (knowledge, skills and attitude) required by linked data educators/instructors for teaching linked data in the schools under study.

Statement of the Problem

One of the core activities of libraries is to disseminate and share information to users. The contemporary world offers the opportunity to explore information in digital/electronic forms through internet and other digital tools available. Linked Data gives room for discoverability and access to a broad spectrum of information through a shared process which enables systems interact through the process of interoperability (Cagnazzo, 2017; Rasmussen-Pennington, 2016; Byrne &Goddard, 2010). Linked Data increases the visibility of library resources and interoperability with non-library systems and help libraries create an open and global pool of shared data that can be used to describe resources, with a limited amount of redundant effort compared with current cataloguing processes (Adetomiwa 2020; Baker, 2011).

Libraries strive to share information among themselves and other cultural institutions through the attainment of a universal bibliographic control and linked data offers the opportunity to do that with ease. As a result of the benefits of Linked Data to libraries and its relatively new occurrence as a concept in the field of librarianship, particularly in Nigeria, it becomes pertinent for library schools to incorporate the subject into the syllabi of cataloguing/metadata domain to educate potential librarians about it as early as possible. It is against this background that this study titled "developing a syllabus for linked data education in Nigerian Library & Information Science (LIS) schools: a survey" was conducted to find out what cataloging educators and practitioners in Nigeria deem necessary to be incorporated in the syllabus for linked data training. The study particularly looked into areas that include course content, instructional materials and facilities as well as educator competence.

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Methodology

Quantitative research methodology was adopted for the study. The survey research design was used for the study. The population of the study comprised six hundred and fifty (650) cataloguers registered in the Nigerian Library Association (NLA) Cataloguing, Classification & Indexing Section (which includes both practicing cataloguers and cataloguing educators/instructors). Simple Random Sampling technique was used to select two hundred and seventeen (217) cataloguers (one third of the entire population) as sample for the study. One hundred and eighty six (186) instruments were returned which gave the study a response rate of 85.7%. The instrument for data collection was the questionnaire. The study collected data from respondents through self and electronic means. Data was analyzed using descriptive statistics with tables and simple percentages.

Data Presentation and Analysis Key:

S/A: Strongly agreed

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A: Agreed
D: Disagree

S/D: Strongly Disagreed
F: Frequency

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Table 1. Course Contents to be included in the Syllabus for Linked Data Education in Nigerian LIS Schools.

S/N	VARIABLE	S/A F %	A F %	D F %
1.	**The concept of Linked Data; Components of Linked Data; Relationship between linked data and cataloguing (metadata); Significance of linked data in libraries/information management; should feature in the syllabus**	**137 (73.66%)**	**35 (18.82%)**	**7 (3.76%)**
2.	Systems and processes used for creating bibliographic records, metadata and linked data feature in the syllabus	123 (66.13%)	51 (27.42%)	9 (4.84%)
3.	The shift in focus from format-based display standard (e.g. AACR2) cataloguing to entity-relationship model (Resource Description and Access RDA) cataloguing that laid the foundations for sharing data across and beyond library domain (i.e. enabled linking of data) should feature in the syllabus. RDA entities, attributes and relationships such as WEMI (Work; Expression; Manifestation; Item); FISO (Find; Identify; Select; Obtain) should also feature in the syllabus.	109 (58.6%)	71 (38.17%)	0 (0%)
4.	Application of conceptual frameworks, models, principles & standards such as RDF (Resource Description Framework) W3C Semantic Web standards; RDFS (Resource Description Framework Schema); FRBR (Functional Requirement for Bibliographic Data); FRAD (Functional Requirement for Authority Data); FRAR (Functional Requirement for Authority Records); FRSAD (Functional Requirements for Subject Authority Data); International Council for Documentation Conceptual Reference Model (CIDOC CRM); RDA, AACR2 and more within a bibliographic system should be featured in the syllabus	108 (58.06%)	75 (40.32%)	0 (0%)
5.	Application of shared library metadata schemas/structure standards such as DublinCore Metadata Element (DCME) Set; Machine Readable Catalogue (MARC) 21; Metadata Encoding and Transmission Standard (METS); Preservation Metadata (PREMIS); Visual Resource Association (VRA) Core; European Broadcasting Union (EBU) Core; Metadata Object Description Schema (MODS); Encoded Archival Description (EAD); Public Broadcasting (PB) Core Music Encoding Initiative (MEI) Schema; Online Information eXchange (ONIX) metadata schema; Music Encoding Initiative (MEI) Schema; Text Encoding Initiative (TEI) Schema; should all be featured in the syllabus for Linked Data. They showcase which sets of element rules apply within a context; define rules for machine validation and provide structure for presentation	87 (46.77%)	84 (45.16%)	4 (2.15%)
6.	The syllabus should feature Application of Web Ontology Language (OWL) to facilitate ontology development and sharing via the web as well as application of Simple Knowledge Organization Systems (SKOS) to provide a bridge between different communities of practice within Library and information sciences and between those communities, and the Semantic Web	96 (51.61%)	66 (35.48%)	12 (6.45%)
7.	Application of identifiers (such as Uniform Resource Identifiers (URIs), Uniform Resource Name (URN) and Uniform Resource Locator (URL) and communication protocols/protocols for internet data transfer (such as Hypertext Transfer Protocol (HTTP) should be included in the syllabus	78 (41.94%)	87 (46.77%)	6 (3.23%)

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S/N	VARIABLE	S/A F%	A F%	D F%
8.	Application of content standards such as Resource Description and Access (RDA); International Standard Bibliographic Description (ISBD); Anglo American Cataloguing Rules (AACR); Cataloguing Cultural Objects: Cataloguing Cultural Objects and their Images (CCO); Archives, Personal Papers and Manuscripts (APPM); Describing Archives: a Content Standard (DACS); all of which ensures for consistency in the use of terminologies by providing minimum standards for adequate description should feature in the syllabus for Linked Data	99 (53.23%)	60 (32.26%)	15 (8.06%)
9.	Application of encoding formats and data exchange standards (eg: MARC 21; (XML) Extensible Markup Language; (SGML) Standard Generalized Markup Language; Hypertext Markup Language (HTML); Simple Protocol and RDF Query Language (SPARQL) should be included in the syllabus	85 (45.7%)	71 (38.17%)	18 (9.68%)
10.	Application of Data Value Standards such as classification schemes (LC, DDC, UDC); controlled vocabularies/term lists/list of subject headings (Library of Congress Subject Headings (LCSH), Sears List of Subject Headings (SEARS), Faceted Application of Subject Terminology (FAST), Book Industry Standards and Communications (BISAC)); thesauri (Getty Thesaurus of Geographic Names (TGN), Thesaurus of Graphic Materials (TGM), Medical Subject Headings (MeSH); Art & Architecture Thesauri (AAT); Rare Book and Special Collections Materials (RMBS) thesauri); authority files (Library of Congress Name Authority File (LCNAF); Union List of Artist Names (ULAN) should feature in the syllabus for Linked Data	107 (57.53%)	61 (32.8%)	5 (2.69%)
11.	Conversion or cross walking of record/document from one metadata standard to another (e.g., MARC-to-XML) should b feature in the syllabus	78 (41.94%)	72 (38.71%)	18 (9.68%)
12.	The syllabus should feature the Application of Search Engine Optimization (SEO) to enable enhanced visibility of libraries.	90 (48.39%)	66 (35.48%)	6 (3.23%)
13.	The syllabus should feature methods of data reuse as related to linked data	91 (48.92%)	65 (34.95%)	12 (6.45%)
14.	The syllabus should feature trends and developments on linked data such as the BIBframe, Sinopia and Wikidata projects	79 (42.47%)	72 (38.71%)	14 (7.53%)
15.	The syllabus should include copyrights issues, establishing reliability and provenance of data as it affects Linked Data	99 (53.23%)	75 (40.32%)	5 (2.69%)

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Table 2: Teaching Materials and Facilities to be Provided for Linked Data Education in Nigerian LIS Schools

S/N	Variable	S/A F %	A F %	D F %	S/D F %
1	Information resources on Linked Data and related subjects. Examples like textbooks that discuss the principles and structures of linked data, including RDA, DDC, LCC, LCSH and MARC 21 and other associated standards.	125 (67.20)	49 (26.34)	7 (3.76)	5 (2.6%)
2	Tools such as AACR2, RDA Toolkit; MARC21; BIBFRAME; OPAC; CCO, DACS etc., should be provided for practical sessions/classes. Also, Classification schemes (LC, DDC, UDC); Authority files such as LCNAF, and other local authority files) should be made available.	150 (80.65)	27 (14.52)	3 (1.61)	6 (3.2%)
3	Library metadata schemas such as DublinCore Metadata Element Set; Machine Readable Catalogue (MARC) 21; Metadata Encoding and Transmission Standard (METS); Preservation Metadata (PREMIS); Visual Resource Association (VRA) Core; European Broadcasting Union (EBU) Core; Metadata Object Description Schema (MODS); Encoded Archival Description (EAD); Public Broadcasting (PB) Core should be provided for practical demonstrations and activities.	111 (59.68)	63 (33.87)	6 (3.23)	6 (3.2%)
4	Thesauri for subject headings determination (Getty Thesaurus of Geographic Names (TGN), Thesaurus of Graphic Materials (TGM), Medical Subject Headings (MeSH); Art & Architecture Thesauri (AAT) should be made available for practical demonstration and activities	119 (63.98)	43 (23.12)	10 (5.38)	14 (7.5%)
5	Controlled vocabularies/term lists/list of subject headings (e.g FAST, LCSH, SEARS) should be provided for practical class activities	121 (65.05)	54 (29.03)	5 (2.69)	6 (3.2%)

*Corresponding Author: Victoria Sokari (June) 2024

KHAIRUN International Journal of Contemporary Librarianship
ISSN: XXXX-XXX
MAIDEN EDITION
DOI: https://doi.org/10.5281/zenodo.12949241
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6	The syllabus should include facilities that enable practical learning of data encoding and data exchange standards (e.g., MARC 21; (XML) Extensible Markup Language; (SGML) Standard Generalized Markup Language; Hypertext Markup Language (HTML); Simple Protocol and RDF Query Language (SPARQL)	125 (67.20%)	51 (27.42%)	3 (1.61%)	7 (3.76%)
7	Fully air-conditioned laboratory with networked workstations	129 (69.35%)	44 (23.66%)	7 (3.76%)	6 (3.23%)
8	Internet connectivity with adequate bandwidth and "always on" connection.	156 (83.87%)	25 (13.44%)	3 (1.61%)	2 (1.08%)
9	ICT Infrastructure: telecom power systems, networking systems, and UPS and data center infrastructure	149 (80.11%)	36 (19.35%)	0 (0.00%)	1 (0.54%)
10	Computer systems and accessories	134 (72.04%)	30 (16.13%)	12 (6.45%)	12 (6.45%)
11	Steady Power supply	141 (75.81%)	21 (11.29%)	14 (7.53%)	10 (5.38%)

Table 3: Competences (Knowledge, Skills and Attitude) required by Instructors for Teaching Linked Data in Nigerian LIS Schools.

S/N	ITEMS	S/A F %	A F %	D F %	S/D F %
1	A Link Data educator/instructor working in a Nigerian university must, in terms of qualification, have a minimum of a Master's degree in Library and information sciences	144 (77.42%)	36 (19.35%)	6 (3.23%)	0 (0%)
2	It is important for a Link Data educator/instructor to be a qualified teacher	90 (48.39%)	69 (37.10%)	27 (14.52%)	0 (0%)
3	A Link Data educator/instructor must demonstrate keen interest and high level enthusiasm for the subject.	129 (69.35%)	51 (27.42%)	6 (3.23%)	0 (0%)
4	A Linked Data educator/instructor must have in-depth knowledge about data standardization and Content standards (eg: RDA guidelines, AACR2,etc)	93 (50.00%)	75 (40.32%)	18 (9.68%)	0 (0%)

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5	A Link Data educator/instructor must have in-depth knowledge on structure standards (e.g., Dublin Core, MODS, MARC, RDA Element Sets, BIBFRAME, EAD, VRA Core)	118 (63.44%)	62 (33.33%)	6 (3.23%)	0 (0%)
6	A Link Data educator/instructor must have in-depth knowledge about data encoding, format, and exchange standards (eg: MARC, XML, SPARQL); value standards (eg: LCSH, LCGFT, LCMPT, LCC, DDC, RDA Value Vocabularies)	116 (62.37%)	67 (36.02%)	3 (1.61%)	0 (0%)
7	A Link Data educator/instructor must have in-depth knowledge about and understand conceptual models for library data (e.g., FRBR, RDF).	87 (46.77%)	92 (49.46%)	7 (3.76%)	0 (0%)
8	A Link Data educator/instructor must have in-depth knowledge about methods and approaches for metadata creation, editing, analysis, and transformation (e.g., Using tools such as OCLC Connexion), Sinopia, Wikidata	91 (48.92%)	83 (44.62%)	12 (6.45%)	0 (0%)
9	A Link Data educator/instructor must be up to date about trends on the subject matter.	114 (61.29%)	60 (32.26%)	12 (6.45%)	0 (0%)
10	A Link Data educator/instructor must be up to date about trends on the subject matter.	114 (61.29%)	60 (32.26%)	12 (6.45%)	0 (0%)
11	A Linked Data educator must have in-depth knowledge about how Link Data fits in within the broader Library and cultural heritage context (e.g., the use of metadata to support sharing of data)	121 (65.05%)	59 (31.72%)	6 (3.23%)	0 (0%)
12	A Link Data educator/instructor needs to cover the syllabus with emerging issues and strategies on linked data.	131 (70.43%)	49 (26.34%)	6 (3.23%)	0 (0%)
13	A Link Data educator/instructor must demonstrate strong oral and written communication skills; Build and maintains collegial relationships; Listens with genuine interest and an open mind.	99 (53.23%)	69 (37.10%)	18 (9.68%)	0 (0%)
14	A Link Data educator/instructor must be initiative, flexible and adaptable	126 (67.74%)	42 (22.58%)	18 (9.68%)	0 (0%)
S/N	VARIABLE	S/A F %	A F %	D F %	S/D F %
15	A Link Data educator/instructor must be committed to lifelong learning	89 (47.85%)	72 (38.71%)	27 (14.52%)	0 (0%)

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16	A Link Data educator/instructor must maintain professional curiosity demonstrated through maintenance of awareness of literature and research on the subject area; involvement with professional organizations; and advocacy for Linked Data	126 (67.74%)	54 (29.03%)	6 (3.23%)	0 (0%)
17	A Link Data educator/instructor must have problem-solving abilities, manage projects, manage workflows, think critically and sustain attention to details.	133 (71.51%)	48 (25.81%)	7 (3.76%)	0 (0%)
18	A Link Data educator/instructor must be able to design and conduct assessments and evaluation	111 (59.68%)	66 (35.48%)	9 (4.84%)	0 (0%)
19	A Link Data educator/instructor must be skilled in assessing and supporting students by using technology to improve teaching and learning.	116 (62.37%)	67 (36.02%)	3 (1.61%)	0 (0%)

Discussion of Findings

The first objective of the study examined the contents to include in the syllabus for Linked Data education in Nigerian Library & Information Science schools. The researchers drew several conclusions from the results presented in Table 1 above regarding the first research objective. First, the data revealed that majority (90%) respondents agreed that the items in the survey should be included in the syllabus. These items include concept and significance of Linked Data, processes, systems and standards for making bibliographic records and metadata using linked data principles like RDF, semantic web, RDA, Dublin Core, MODs, VRAs among others. In their training modules, the EUCLID project (2012 to 2014) and the American Library Association's Fundamentals of Metadata Core courses of 2021 acknowledged the inclusion of similar subject matters. Though some of these courses were constructed to address specific workplace learning needs, the researchers reasoned that developing an applicable and relevant syllabus specific to Nigerian LIS linked data education, while considering literature suggestions must give in to modifying and streamlining some of the existing training courses to formal education settings.

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Blaney (2017) argued that learning about those subject matters mentioned above provides the learner with a "solid grounding in the fundamental principles of Liked Data". It is crucial to begin any studies associated with Linked Data with the subject matters mentioned because it enables students to gain a thorough knowledge of how the topics relate to one another and to construct an exemplar that will serve as a guide throughout their education and careers.

The second objective investigated the teaching materials and infrastructure that should be provided for Linked Data education in the schools under study. The results presented in Table 2 showed that majority (90%) of respondents agreed with the mentioned teaching materials and infrastructure including information resources and tools like textbooks that discuss the principles and structure of linked data and related subjects, RDA toolkit, BIBframe, library metadata schemas, thesauri, facilities that enable practical demonstration and participation in learning data encoding and data exchange standards, internet among others. It can be deduced from the responses that the respondents are aware of the strategic role those items play in enabling an effective implementation of the syllabus. This is in line with Blaney (2017); Library Association's Fundamentals of Metadata Core courses (2021).

The third objective surveyed the competencies (knowledge, skills, and attitude) that linked data educators/instructors required to teach linked data in library schools in Nigeria. The results presented in table three disclosed that over 90% of the respondents chose strongly agreed and agreed on the competencies mentioned in the questionnaire including that the linked data instructor: must have a minimum of Master degree in Library and Information Sciences and be a qualified teacher; should have in-depth knowledge about data standardization, content and structure standards like Dublin core, RDA, BIBframe; should have knowledge about methods of metadata creation, editing analysis and transformation; should build and maintain collegial relationships, listens with genuine interest with an open mind among others. This extent of agreement emanates from respondents' insights on how deficiencies in knowledge, skill, and

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attitudes impede effective syllabus implementation in Nigerian library schools regarding technology-based subject matters. As a result, Dobreski, Zeng, Kovari & Qin (2020) suggested that GLAM institutions "need professionals versed in linked data technologies and practices". Educator competency is pertinent in studies about Linked Data education in LIS schools in Nigeria. This is because they equip and prepare potential work force with the necessary knowledge and skills for the labor market.

Conclusion and recommendation

Linked Data is transforming the information world into a more discoverable environment through the interconnection of various information platforms via the semantic web. Linked Data brings about great opportunities to the LIS arena, particularly in cataloguing and metadata to enhance resource description and discoverability. It provides room for competitive advantage in the knowledge economy. As a result, library schools in Nigeria must begin to introduce the concept to potential librarians in order to prepare them for the workplace that will be ruled by Linked Data.

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ISSN: XXXX-XXX
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