An analysis of the Design Technology curriculum implementation at Public Universities in Zimbabwe

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***Abstract*: The qualitative study analysed the implementation of the Design Technology curriculum in the Zimbabwean public universities. The study was precipitated by the low uptake of the Design Technology curriculum by many public universities in the country after its introduction in 2015. The study analysed the challenges Public universities of Zimbabwe face in implementing the Design Technology curriculum. The study included one public university, 1 faculty Dean, 1 departmental chairperson and 10 Design Technology lecturers. Purposive sampling technique was used in the selection of the University and respondents who were lecturers, Dean and chairperson of the university department. Data were collected through Google Form questionnaires, interviews semi-structured observations and focus group discussions. The Concerns Based Adoption Model (CBAM) guided and informed the analysis of findings. Findings indicate that there is curriculum implementation infidelity that stems from lack of subject specific training and content, lack of lecturer participation in curriculum planning decisions, low student enrolment, poor funding, lack of collaboration, lack of resources and lack of staff development programs. The study recommends in-service training for lectures, lecturer involvement in curriculum planning decisions, teaching of the Design Technology curricula across all levels of education in the country, government and funding channels, engagement in collaborative activities with other universities and staff development workshops as strategies to ensure faithful implementation of the DT curricula.**

***Key words*: Design and Technology, Curriculum implementation, Curriculum fidelity, curriculum alignment.**

I. INTRODUCTION

The setting of Zimbabwean Public Universities' curricula is swiftly changing to comply with changes in societal, industrial, cultural, and environmental needs. These changes saw the introduction of the Design Technology (DT) curricular to be taught across all levels of university curriculum that is undergraduate, masters and doctoral studies. Design Technology curricula was ushered in as a new cross cutting issue in most if not all university learning areas and most notably as a stand-alone discipline in the Zimbabwe Public Universities (ZPUs, pseudo name) curricula. University DT curricular was designed as an integral means to impart relevant design skills in students, which will enable them to address existing and emerging societal, industrial, cultural and environmental problems of varying nature for sustainable development of people's lives. These drastic changes in curricular require Higher Education institutions of learning, ZPUs in particular and lecturing staff in the DT discipline to implement the curriculum with fidelity bearing attention to its drive and most prominently its design. The fact that at the time of conducting the study, Zimbabwe had almost 12 public universities mandated to implement Design Technology curricular but only one of them was striving to offer the discipline at undergraduate, masters and PhD level, justifies the need for a study of this nature to be conducted to analyse the impediments ZPUs encounter in their determination to faithfully implement the curricular.

There is little to no significant research that has been conducted so far to explore the how ZPU are implementing the new DT curriculum. In light of this view, (Wiles & Bondi, 2014) argues that, lecturers require to possess skills and knowledge to implement curricula. A good curriculum ought to facilitate the students' need as well as the markets' need, (Mufanti, Nimasari, Gestanti, and Susanto, 2019), and as formal organizations, universities have to assume a central position that should improve the quality of the curriculum and its implementation. Understanding the barriers to complete implementation of a new curriculum could provide education administrators with tools to address lecturer concerns and could provide vital training for successful implementation (AIR, 2016). In this case ZPUs and their lecturers need to be heavily armored, with skills, styles, courage and wisdom to implement the emerged DT curriculum with fidelity. Today's ZPUs and lecturing staff are compelled to roll from the edge to the center in their mandate for sustainable and fidelity implementation of the DT curricular. Lochner, Conrad, and Graham (2015), concurred that, lectures are central to whether a curriculum is delivered consistently, effectively, and with efficacy to enable the support of student progress and growth. ZPUs are thus, confronted in their mandate as institutions of higher learning with mammoth task to engage lecturers in the designing and evaluating of the DT curricula with the sole purpose of cultivating its quality and implementation.

Statement of the problem

The Zimbabwe Council for Higher Education (ZIMCHE) ushered in the new Minimum Body of Knowledge (MBK's) in 2020 five years down since its initial introduction in 2015. The MBK's were to be implemented across all ZPUs which

encompass among others, the teaching of DT curricular across all levels of university education. Since then only one Public University (PU) in the country had taken the initiative to implement the DT curricular- MBK's. The fact that only one institution of Higher learning introduced the DT curricular for learners reveal that there could be hindrances faced by stakeholders, lecturers in particular, hence the study explore the impediments faced by universities lecturing staff in the fidelity implementation of the DT curricula.

Research questions

The study analysed the challenges faced by ZPUs in implementing the DT curriculum and is guided by the following research questions (RQS).

RQS1. How are lecturers/faculties prepared in implementing the Design Technology curriculum?

RQS2. What are the challenges Universities face in implementing Design Technology curriculum?

RQS3. What form of staff support can be harnessed for fidelity implementation of the DT curriculum?

II. LITERATURE REVIEW

Design Technology Curriculum.

Design Technology is a learning area taught across all levels in the Zimbabwean Education system either from grade 1 to university. This learning area is a combination of Building Technology (BT), Textile Technology Design (TTD), Technical Graphics (TG), Food Science Technology (FST), Wood Science Technology (WST), Metal Work (MT) technical learning areas among others to form one body of knowledge. Just like in Science Technology Engineering Mathematics (STEM) education, Science, Technology, Engineering and Mathematics learning areas were merged to form a single body of knowledge with the view to mold a learner with a powerful knowledge base. Beneker and Vaart (2020) laments that, combining learning areas produce a student with central knowledge of transforming the world by seeing the real natural and societal knowledge. In this case, combining technical learning areas into DT can have the same advantage that is central and paramount in fostering behavioral change in students, an influential knowledge base for social transformation mirrored in their capability to address current and evolving societal glitches. Beneker and Vaart (2020) adds that, combining of more elements makes knowledge more powerful and thinking process is widened and broadened to solve societal problems. A study by Oldakowski and Johnson (2018), which combined Geography, Mathematics and Science in teaching climate change, revealed a benefit of significant improvement in America's K12 learners overall performance. A similar study contacted by Oldakowski and Johnson (2018), on combining entrepreneurial competencies and mathematical competencies, showed that learners with a sound problem-solving, creative and reflective attributes are produced in the Swedish primary school. However another study in Austrian education by Greimel-fuhrmann (2014), posits that, combining Business Administration, Business Mathematics and Accounting into Business Practice made learners to have difficulties in finding out the identity and comprehend the learning area. In the same study, teachers were reported having considerable difficulties in understanding the main ideas of the new learning area. Combining Computer Design and Societal reflection established that, there is a need for scaffolding and more support for the learner (Tuhkala, 2019). Conclusions from the above literature depicts that the discourse of combining technical learning areas into DT can have double faced effects hence absurd and questionable in that some studies divulge latent benefits while in contrary others maintain that it's of no significant use in the support of evocative learning. Thus, the thrust of the current study is to analyze the implementation challenges of DT curricular in the ZPUs-a curricular that merges technical areas into a single holistic body of knowledge.

Curriculum implementation

Implementing is putting the curriculum into practice and ensuring that it effectively meets the intended goals, (Mulenga, 2020). Implementing the DT curriculum faithfully, therefore demands positioning its approved courses into conclusion in the determination to assist corresponding students acquire the projected knowledge, skills, ideas and experiences. The implementation process in this view cannot kick start without the student and lecturer as the central figures. Fidelity implementation of the DT university curricular takes off as the student gains the supposed knowledge, skills, ideas and experiences to issue later in life. Implementation takes place as the learner acquires the planned or intended experiences, knowledge, skills, ideas and attitudes, (University of Zimbabwe, 1995: 8) that are aimed at enabling the same learner to function effectively in a society. In addition to the central figure which is the student, fidelity implementation of the DT curricular in the ZPUs cannot be achieved without the participation of heartfelt, self-dedicated, diligent and hardworking agents in this case lectures, Departmental Chair and Faculty Dean. These go-betweens of DT curriculum implementation must unveil an enormously high level of professionalism and competence in their instruction for fidelity implementation of the said curriculum. Professionalism in instruction thus refers to symbiotic interactions between stakeholders either lecturer-learners interaction, lecturer-lecturer interaction, supervisor-lecturer interaction or supervisor-student interaction. Such interactions of go-betweens in DT curricula implementation results in unprejudiced instruction and fitting teaching of all learners. Effective interaction in the DT lecture rooms therefore calls for the agents of curriculum implementation to be masters of the subject content they teach through relevant training in the subject content, in-service training and collaboration with peers and administrators which appears to be a nightmare in the ZPUs DT curricula. It was for this reason that Matiru, Mwangi and Schlette (1995, p.2 in Mulenga, 2020), rightly advanced the view when making reference to university lecturers in Kenya that: "Only a handful of lecturers have been professionally trained in the art of teaching". The assumption has all along

been that the possession of a PhD degree was all that an aspiring lecturer needed in order to be able to teach in a university, (Matiru, Mwangi and Schlette 1995, in Mulenga, 2020), the rest one imbibed through osmosis. The implementation of the new teaching, learning, and assessment strategies require coordination and increased input from the faculty members, students, and other stakeholders, (Mahboob and Evans, 2015).

Curriculum Fidelity

Implementing a curriculum with fidelity is one of the major accountabilities of a university and its go-betweens, lectures and supervisors inclusive. Curriculum fidelity involves implementing the curriculum faithfully and keeping attentive to its determination and design. The study focused on challenges faced by lecturers in implementing the DT curriculum. The analysis also focused on migratory strategies that can be adopted to overcome the challenges. When a curriculum is implemented with fidelity, accurate checks can be set to analyse whether the curriculum has met its intended objectives, which can then provide a better measure of student performance (Budack, 2015). Lecturer fidelity sways on learner achievement and effective implementation of a curriculum hence the need for a research of this kind.

Curriculum alignment

Fidelity in the implementation of any curricular is achievable at most; if content imparted say at Advanced level matches and develops on the concepts taught a lower level say Ordinary level. In such a case, a curricular is referred to as properly aligned since it will license and scaffold learners to progress readily from one level to the next. Early et al., (2014); Wiles and Bondi, (2014); aver that, having curricular and instructional alignment between grade levels is necessary to support student achievement and to meet learning objectives; in turn, alignment is supported when teachers choose to implement the curriculum with fidelity. On the other hand, misalignment of the Zimbabwean DT curricular and instructional practices exist as what is taught at university level is inconsistent and does not match well, what is taught in the primary and secondary levels of education. Prevalence of such a scenario, results in learning gaps, which therefore hinder implementation of the curriculum with fidelity. At Ordinary level learners major in a single technical learning area while the university DT curricular compels learners to do more than one technical learning areas merged as one body of knowledge resulting in learning gaps emerging from topics derived from learning areas not done before. Early et al. (2014) and Wiles and Bondi (2014) showed low student performance and gaps in the knowledge necessary for the following grade level. Early et al., (2014), revealed that, a lack of fidelity with the curriculum hinders alignment between classes in the same grade and grade levels and creates instructional inconsistencies among teachers. Tweedie and Kim (2015) identified areas of misalignment, as perceived by students; their findings called attention to areas not covered in the curriculum that then created learning gaps.

III. RESEARCH METHODOLOGY

The study employed the qualitative design approach within the interpretivist paradigm to generate an in-depth and comprehensive data (Creswell, 2014; Mufanti and Susilo, 2017; Simon and Goes, 2011). The research was a case study of one public university in Zimbabwe. Purposive sampling technique was used to select respondents' for this study. Sampled participants were those directly involved in the implementation of the DT curriculum. The sampled were: the Dean of Faculty of Science and Technology Education, Chairperson of Department of Design Technology and 10 lecturers in the department. The identity of the participants was preserved through use of pseudo codes for ethical reasons. Data were generated using a Google Form questionnaire whose link was shared with the respondents via email. Data triangulation was realized through use of a semi-structured observations, interviews and focus group discussions. The narrative descriptive style analysis was used. Participant validation was employed for credibility and validity assurance of the findings (Nyumba, Wilson, Derrick, and Mukherjee, 2018).

IV. FINDINGS

The study analysed the implementation of the DT curricula in the Zimbabwean public universities context and findings of the study show that the main problem is that, the curricula is not implemented with fidelity across ZPUs in the country. Responses from interviews, questionnaire and observations, revealed the following thematic components: why lecturers were not prepared to implement the DT curricula with fidelity, impediments to fidelity implementation of the DT curricula in the ZPUs, and support that can be rendered for fidelity implementation of the DT curriculum in the ZPUs.

RQS 1: Universities' preparedness to implement the Design Technology curriculum.

Study results showed that lecturers in the university were not prepared to faithfully implement the DT curriculum. Participants entrusted to teach DT in the university has this say in their interview and questionnaire responses either they alluded to the following:

> *As lecturers' mandated to teach DT, most of us fail to execute the duties faithfully since we are not trained in the discipline before. Being not subject specialists, most of us lack subject specific content, pedagogical and instructional skills, and student assessment skills relevant for the DT discipline. (DT Lecturer 1)*

Participants further reiterate that:

> *We did one technical subject like Art and Design at diploma, degree and masters level hence the other technical areas like Building Technology, Technical Graphics, and Textile Technology Design among others, included in the DT curricula are grey areas to some if not all of us. This affects our confidence, moral, zeal and preparedness to faithfully implement the DT curricula*

introduced in our university department as from year 2015. (DT Lecturer 2)

These sentiments by participants clearly reveal that justice do not prevail as far as the fidelity implementation of the university DT curriculum calls for since its inception in 2015 at the institution.

One of the other drives affecting our preparedness to faithfully implement the DT curricula is our acute deficiencies in subject specific content since we did not specialise throughout our education. (DT Lecturer 3)

Participants further laments:

Lack of training in the area taught to equip us with relevant content; sometimes hurt us to the nerve as many a time we appear as novices and amateurs in front of innocent students waiting to receive the content and mentoring from us. (DT lecturer 5)

Participants also concurred that:

We were not involved and even consulted in the DT curricula planning process. This impact on our readiness to implement this curriculum as we feel it's not our curricular. (DT Lecturer 4)

RQS2: Impediments and challenges in the implementation of the Design and Technology curriculum.

Impediments to fidelity implementation of the DT curriculum are more or less similar across most if not all public Universities of the country and the Sub Saharian African universities as a whole. (Mulenga, 2020) concur that, the majority of Sub Saharian African Universities share the same challenges which negatively affect quality curriculum implementation. The following is a presentation of results alluded to by participants as they responded to **RQS2** in both the questionnaire and interview session:

Generally all participants concur that:

Student uptake of university DT programs is significantly low since its introduction affecting the viability of classes. Very small numbers are enrolled for both the in-service degree programs and none has been enrolled for conventional pre-service degree program since it was introduced at the university department in 2015. Respondents opined that the integration of many Technical learning areas into DT curricula impacts on student enrolment since they lack background information in more than one technical learning area from their high school learning experience were they are supposed to major in one of the many. Subjects further highlighted that the DT curriculum was ill-planned since there is notable glaring misalignment from Early Childhood (ECD) to Higher Education in the country. (Faculty Dean)

A lack of fidelity with the curriculum hinders alignment between classes in the same grade and grade levels and creates instructional inconsistencies among teachers (Early et al., 2014), and Wiles and Bondi (2014) showed low student performance and gaps in the knowledge necessary for the following grade level.

Poor funding was also identified by most participants as one of the greatest impediment to fidelity implementation of the DT curriculum in the ZPUs. Faithful implementation of the DT curriculum requires large sums of money either its capital intensive. Capital is required for the construction of specialist laboratories, lecture rooms, training of personnel, purchase of modern equipment, computers and relevant software's for Computer Aided Design (CAD) and Computer Aided Manufacture (CAM) and subsequently research. (Departmental Chair)

However, most institutions of higher learning had archaic and outdated workshop equipment which could not be replaced due to lack of financial resources (Mulenga and Chileshe, 2020). This cost factor, coupled with the prevailing economic situation greatly impede on the fidelity implementation of the DT curriculum in ZPUs since government and affected ZPUs are incapacitated to fully fund the system. Mulenga (2020) points out that, no wonder most universities on the continent especially just run like secondary schools by concentrating on teaching and mostly providing programs which do not require expensive infrastructure especially those in the arts. A number of public Universities in Africa have been supported largely by their governments, but these universities have been grossly under-funded and this has invariably led to the quality being adversely affected, (Mulenga, 2020), no wonder it is not strange to see some of these institutions characterized by dilapidated and old infrastructure, overcrowded lecture theatres, incessant strikes and student unrest. It is quite disheartening that, sometimes universities in the country are found operating in these incomplete, dilapidated infrastructures which a risk to human security and also life are threatening.

Respondents' in the current study also strongly argued that, there is need to train lecturers in both content and skills, if they are to faithfully implement the DT curriculum.

Training empowers and capacitates us with curriculum development and implementation skills. (DT Lecturer 10)

The need for training and professional development largely emerged as a serious concern for lecturers since they all highlighted that:

….as we teach DT, none of us received specific training in the discipline. (DT Lecturer 5)

Lecturers therefore calls for the need or capacity to design developmentally appropriate learning tasks that are aligned to curricular expectations, (Jess et al, 2016). Focus of training and professional development requires an emphasis on teaching, (Jess et al, 2016), how best to interpret the curriculum so that students' needs will be aligned with appropriate instructional practices.

Participants also lamented that:

> *We lack collaboration opportunities with peers both at local and global scale and is one of the greatest challenges hindering fidelity implementation of the DT curricular at our university. They further highlighted that collaboration if availed to us adequately, will invariably enrich our content, methodological and instructional approaches and assessment techniques for the curricular improvement in those skills, and subsequently impact positively on quality teaching and faithful implementation of the DT curricular in the Universities of the country. Collaboration affords us the opportunity to share subject matters with the more knowledgeable peers' world over. (DT Lecturer 6)*

Respondents generally reported that:

> *No staff development sessions have been organized and conducted for DT implementation by the departmental chair, faculty dean and the university 7years now from its introduction in 2015 to date. (DT Lecturer 3)*

Staff development progams are a vital and paramount tool in educational settings, as they have the power to enrich lecturers' pedagogical skills, assessment skills, and content and among others build confidence in human resources to implement new curricula with fidelity. Staff development programs cannot be spared in university DT teaching since they are a mother of Professional Learning Communities (PLC's). The professional learning community (PLC) model gives universities a framework to build lecturer capacity to work as members of high-performing, collaborative teams that focus on improving student learning (Rentfro, 2007). In a PLC University, DT lecturers work as a team in assessing student work, curriculum planning and implementation, and allocation of teaching loads; and any other duties to be executed in the Faculty and Department. When effectively implementing PLC, each lecturer takes responsibility and becomes in charge over every learner in the Department hence the notion "our" students and not "my" students' syndrome.

RQS3. Required support for Design and Technology curriculum implementation.

Generally, all participants felt that they need some scaffolding or support to faithfully implement the university DT curricula. The overall day to day management of University faculties and departments is the chief responsibility of faculty Deans and Departmental chairs respectively. Therefore, fidelity implementation of the DT curricular in the ZPUs cannot be effected successfully without active participation of administrators in the allocation of teaching courses, timetabling, provision of teaching and learning resources, organizing in-service training for staff and setting a tone conducive for the implementation process. These managers are entrusted to manage efficiently and effectively to ensure that curriculum goals are met (Abd. Razak and Abdulla, 2003) in Salwana et al (2018). Consequently, Deans and chairpersons should be equipped with sound skills of curriculum management and leadership which is a key recipe for effective and efficient fidelity implementation of the DT curricula. The success or failure of University DT curricula implementation is to a larger extent attributed to the competency of Faculty Dean and Departmental Chair. Specifically, University managers are responsible for ensuring effective organizational operations and achieving the goals set (Baruah et al, 2015). Accordingly, the responsible Deans and Chairpersons for the DT learning area in Universities countrywide must have well-coordinated knowledge, skills and expertise to facilitate and successfully monitor the implementation of the DT planned curriculum innovation. However, DT curriculum implementation failure in most universities of the country is attributed to lack of skills and knowledge by management, who are in this case appointed to managerial positions without specific skills training for the management and implementation of curricula. Observations, from the university under study, indicate that Lecturers are appointed, promoted and upgraded to Chairmanship and eventually Deanship positions on account of seniority, rotational basis or undergoing a selection interview not considering seriously skills requirement or even specific skills training for the managerial post. In view of the above, participants' of the study all agreed that;

- *The Faculty dean and departmental chairperson assign us (departmental lecturers) to allocate each other courses and in most cases courses become too many for a lecturer making the load unbearable. Too many courses reduce time we had to prepare for course activities and tasks as well as assessment activities and this adversely impact on our preparedness and eventually effectiveness. (DT Lecturer 7)*
- *Administrators also task us in timetabling though on rotational basis and this increase the burden on the lecturer. This also further strain our time resources to focus on the core business of teaching and assessment of students work. (DT Lecturer 8)*
- *Resources for DT implementation are quite inadequate at our university. The university and administrators could not provide us with teaching resources like laptops, relevant softwares, specialist laboratories, projectors, data bundles among others. Shortage of these essential teaching resources made our teaching activities tedious and campasome hence impacting on our preparedness to take curricular innovation on board. (Departmental chair)*
- *Since 2015 when the DT curricula were introduced at the university, we did not receive any form of in-service training or staff development to enrich our implementation skills at the same time nurturing our confidence in facing the uphill task at hand. (DT Lecturer 2)*
- *A sound tone is not set for the university DT fidelity implementation process at our university. (DT Lecturer 5)*

V. DISCUSSION

The study explored the implementation of the DT curricula at a university in Zimbabwe, specifically looking at the barriers that impede on the fidelity implementation of the curriculum

innovation. Results indicate that the DT curriculum at the university is not implemented faithfully due to a number of obstacles faced by both the university and lecturers. In fact results show a high level of unpreparedness by lectures and the university in implementing the curricula with fidelity. Most if not all lectures teaching DT at the university are not subject specialists either they did not receive any prior form of training in the area yet fidelity implementation of this curricula is hinged on lecturer preparedness and university readiness to adopt the innovation. Despite all lecturers of the department having earned at least a master's degree, they are seemingly not qualified to teach the discipline since they did not major in the area. Thus, they indicated that they were novices and amateurish, lacking content, assessment skills, and confidence to faithfully implement the newly emerged university innovation. The study therefore reveals that lecturer qualification is a central and key factor for fidelity implementation of the new emerging innovation changes in the university setting.

Fidelity implementation of the university DT curricula is to a larger extent determined by the availability of instructional resources. Findings of the current study show that, resources for teaching the university DT innovation program are in acute shortage. Resources included among others computers, softwares, projectors, specialist laboratories, data, and human resources. Lack such resources, impeded on fidelity implementation of the DT curricula innovation in the university setting. High cost of acquiring these essential resources is the main obstacle faced by universities and lectures in their effort to faithfully implement the curricular program. Since the introduction of the DT curricula at the university in 2015, resources procurement is still lagging behind technical progress and it's a cause of concern that cannot be defeated due to persistent, unstable currencies and harsh economic conditions affecting the country. To alleviate shortages of resources, participants felt that the DT curricula be funded by Zimbabwe Manpower Development Fund (ZIMDEF) in the construction of specialists laboratories, procurement of teaching and learning materials alongside funding of lecturer in-service training and staff development workshops to capacitate implementers with requisite technical skills and know how much needed for fidelity implementation of the curricula. University management should also initiate the development PLC in which implementers will be accorded the opportunity to collaborate and share with colleagues' local and abroad issues pertaining their DT curricula content, teaching and student assessment.

Of note, in this study was also a low student enrolment figures and uptake of the DT curricula programs both at degree and masters level in the university. This was a clear reflection of lack of awareness and confidence in the prospective students. Moreso, this could also be attributed to lack of curriculum alignment across all levels of education in the country. Even if the updated curriculum rolled in 2017 by the Ministry of Primary and Secondary Education (MoPSE) ushered in the teaching of DT from primary to secondary education, about 6 years down the line now in 2022, most if not all public schools made no significant progress towards its introduction. This misalignment, therefore impacts on students uptake of the university DT learning programs.

VI. CONCLUSION

To conclude, basing on the voices of participants and observations by researchers, lecturers at the university display little or no readiness/preparedness to implement the DT curricula due to lack of subject specific content, pedagogical and assessment skills. This stems from the fact that they did not receive prior training in the learning area. Lack of preparedness to implement the DT curricula is also triggered by obstacles such as lack of resources, lack of in-service training, lack of administrative support, poor funding, lack specialist laboratories, low student uptake of the curricula, lack of collaboration with peers, among others. This study reveals inconsistences in the implementation of the DT curricula in the ZPUs.

VII. RECOMMENDATIONS

This study recommends that ZPUs craft and implement extensive in-service training programs. Adequate funding should be availed for DT for construction of specialist laboratories as well procurement of appropriate and adequate teaching and learning materials. Lecturers, as curriculum implementers should be involved at every level.

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