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Integration of Augmentative and Assistive Technology for Boosting Linguistic and Communicative Competence of Bi/Multilingual Autistic Children in Nigeria and South Africa

ABSTRACT: The use of AAT (Augmentative and Assistive Technology) in teaching and learning towards enhancing the linguistic and communicative acts of children with autism cannot be underestimated in both formal and informal education when systematically done. The aim of this study was to explore teachers' perspectives on integration of augmentative and assistive technology to boost linguistic and communicative competency of autistic children in the course of teaching them L1 and/or L2 and other concepts at school. Qualitative research design was adopted, and data was collected through semi-structured interviews from (n=10) educators comprising (n=6) language educators and (n=4) general subject educators, and responses were subjected to content analysis based on the generated themes. The findings revealed that despite educators' level of education and teaching experiences, the majority of them were unaware of the importance of certain augmentative and assistive technology, as well as how to integrate this technology into the teaching language and other concepts to children with autism, which in turn may enhance language learning and social communication. One of the recommendations is that there should be continued deployment of augmentative and assistive technology in boosting language and communication competence of learners with autism in Nigeria and South Africa.

KEY WORDS: Augmentative and Assistive Technology; Linguistic and Communicative Acts; Language Teaching and Learning; Autism Spectrum Disorder.

INTRODUCTION

Language development-cum-practices entailing both expressive and receptive tasks are part of the main features of treating, educating, and interacting with children with ASD (Autism Spectrum Disorder). Parents tend to be worried more when their L1 differs from the predominant language used in special schools and clinics, due to the

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notion that bi/multilingualism may be detrimental to the language development of these children (Seung, Siddiqi & Elder, 2006; Bird, Lamond & Holden, 2012; Yu, 2013). Parents and educators thereby often maintain one language in dealing with these children (Kremer-Sadlik, 2005; Lam, 2015).

ASD as a neurodevelopmental disorder is characterized by impairments in social-communication and stereotypical behavior; however, this disorder does not affect two individuals at the same degree across the globe; and a number of researches have established that no difference in their pragmatic skills (Lam, 2015); and in other linguistic skills of both monolingual and bilingual children with autism (Ohashi *et al.*, 2012; Petersen, Marinova-Todd & Mirenda, 2012; Hambly & Fombonne, 2014; Reetzke *et al.*, 2015).

Many children with autism in Africa are raised by bi/multilingual parents and are also being taught by educators who largely stand against raising and teaching autistic children bilingually forgetting that exposing these children to multiple languages has no effect on their linguistic development and learning as well. Such exposure is *rather capable to lead to intense verbal ability* (Hambly & Fombonne, 2014; Lam, 2015); *enhanced social-communication skills among of the autistic children as many of them do employ larger communicative gestures than their monolingual peer with ASD* (Valicenti-McDermott *et al.*, 2013); and *striving for communication repairs after breakdowns* (Comeau, Genesee & Mendelson, 2007).

Meanwhile, the impact of assistive technology to language teaching and learning engagements as well as boosting linguistic and communicative competence of the bi/multilingual autistics at school and home has not received much attention from the context of most African countries despite that the continent is plural-linguistics, and housing millions of school-aged children with autism. The estimation of prevalent rate of autism has been put at 11.5% and 33.6% among African children with developmental disorder (Seif-Eldin *et al.*, 2008; Abubakar, Ssewanyana & Newton, 2016); therefore, their language and communication competence should be held as significant as their other wellbeing.

Teaching and Learning Linguistic and Communicative Competence. After a child is diagnosed with ASD (Autism Spectrum Disorder), attaining linguistic and communicative competence (though to different degree) is a crucial aspect of further intervention whether or not such child received or missed the initial joint and shared attentions, which can reinforce his/her linguistic, and communicative practices. At school age, however, efforts of attaining this level lie heavily on educators as daily job or being single-handedly raising the child among other constraints affects many parents (Lindsey, 2005).

This is in line with [A.S. Dickerson et al. \(2014\)](#)'s view that fathers in healthcare and finance jobs are likely to have children with autism, while parents in technical jobs may be linked to social and communication impairments ([Dickerson et al., 2014](#)).

Meanwhile, in the course of dealing with children with autism, it has been observed that educators (other crucial caregivers have enormous tasks making their learners with autism enhance skills in L1, L2, or L3. From classroom observation made in another study, the lead researcher has found that in Nigeria and South Africa, educators at school of autism or having a separate unit for educating children with autism seldom employ augmentative and assistive technology to deliver their language lessons or other lessons.

In language and communication related activities, the use of traditional language teaching methodologies, such as Grammar Translation Method, Direct Method among others have received much attention. These methods may entail flashcard for vocabulary, rote techniques for teaching reading or lexis and speech sounds, and a few schools employ audiovisual materials. This suggests that the two countries in this study might have abundance users of computer, smartphones and other related technology, but also having educators who are seldom trained on how to impart knowledge effectively to children with developmental disabilities.

In this context, [C. Fernández-Batanero & M. López \(2018\)](#) have reported that primary school teachers lack knowledge and training on the number of technological tools which can be used to teach learners with disabilities ([Fernández-Batanero & López, 2018](#)).

Boosting Language and Communication through Augmentative and Assistive Technology. The impact of ICT (Information and Communication Technology) on education and national development cannot be overemphasized in the 21st century ([Arzal & Chen, 2017](#)). The use of technology is daily increasing, penetrating people's daily lifestyle, and institutional practices. ICT has reached the classrooms and language educators and other educators of children with developmental disorders like autism may be slowly or not yet following the trends. Similarly, as ICT grows, computer programmes like *Mindsnack* for language games, *Google translate* for translating written and voice messages, and *Duolingo* for language practicing and testing are readily available for language educators and language learners, and they have furthermore created and offered another means of learning and practicing several languages ([Kukulska-Hulme, 2010](#); [Alm, 2017](#)). Specifically, augmentative and assistive technology is found useful and thereby essentially needed for children with autism.

Both strategies from AAC (Augmentative and Alternative Communication) strategies are capable of providing individuals with serious speech and language disabilities with a means to have a voice and express themselves. However, most educators may have personal ICT knowledge or training, but how to integrate it into L1 and L2 teaching and/or to enhance linguistic and communicative skills may be not be considered vital to their pedagogic activities.¹

Studies have indicated that ICT training is predicated on factors, such as age and gender of the teaching staff with a finding that level of competencies differ with male teachers having better technological competency, but the female teachers have more likelihood to integrate into teaching various ICT tools than their male counterparts (Ilomäki, 2011; López *et al.*, 2013; Fernández-Batanero & López, 2018). It was also confirmed that younger teachers, and recently graduated, have more confidence to integrate the ICT into their teachings, due to their high level of knowledge (Cabero & Martín, 2014; Alqurashi, Gokbel & Carbonara, 2017; Gudmundsdottir & Hatlevik, 2017; Fernández-Batanero & López, 2018).

AT (Assistive Technology) may be any service, which helps a person with disability to be able to directly select, acquire, and use any assistive technology device (NASET, n.d.). Similarly, according to A. Ford-Lanza (2020), the AAIT (Association of Assistive Industry Technology) has also described AT as day-to-day living, learning, and work enhancing equipment, product, system and/or software program that are designed for individuals with disabilities (Ford-Lanza, 2020). While varied assistive technologies are needed for different disabilities, essentially the benefit is mainly to augment or improve the capabilities of people with disabilities to function better (Holt, 2017; Ford-Lanza, 2020).

Augmentative and assistive technology based on ICT revolution has brought some relief to teaching and learning, and professionals and caregivers of children with autism will find various computer programmes, smartphones, and other related gadgets helpful for enhancing behavioural, and communicative skills. Children with autism are said to be pleased with using computer or iPad and other animated objects (20); therefore, devices with computer programmes like *Duolingo*, *FluentU*, *Head's Up*, *Study Blue* have been designed and being updated regularly for language learning and teaching which in turn may be employed to boost language and communication of children with autism if effectively integrated into language teaching.

¹See, for example, News on "Assistive Technology: A Support for Children with Autism Spectrum Disorder". Available online at: <https://upbility.net/blogs/news/assistive-technology-a-support-for-children-with-autism-spectrum-disorder> [accessed in Durban, South Africa: September 3, 2025].

Furthermore, the totality or part of augmentative and assistive technology can reduce boredom, make learning accessible in and out of the classroom, and make learning languages to be more engaging. Additionally, experts have maintained that benefits of AAC (Augmentative Alternative Communication) and AT (Assistive Technology) in academic setting benefit learners with autism in such a way that they can understand their environment better; improve their expressive communication skills; increase their social interaction skills; to improve their attention skills; increase motivation skills; organization skills; organization skills; and improve self-help skills (Holt, 2017; Ford-Lanza, 2020; *Ibidem* with footnote 1).

The integration also allows educators to teach and learners beyond depending on textbook, paper and pen, and thereby have another means of engaging in language learning through interactive, new, and unmapped means (Linder, 2017). With the augmentative and assistive technology language concepts, such as vocabulary, phrases and grammatical, speech sounds, pronunciation (through the audio mechanism), naming, picture reading (through picture mode) etc. can be effectually taught to children with autism, and to a certain degree, they too can work it out.

This approach, though is not one-size-fits-it-all, but such integration is capable of boosting their linguistic and communicative competence, and this is line with some studies by applied linguists who have shown that *functional and meaningful tasks can enhance language learning* (Branden, 2015); and *that technology has been proven to be authentic and natural avenues for realizing task-based principles of learning done* (Doughty & Long, 2014).

Meanwhile, children with autism too can enjoy these opportunities if well explored. There are several perspectives to linguistic and communicative competence, it is employed here as the ability of individual to attain certain knowledge (in relation to one's exposure measured by intelligence quotient or cognitive capability) in pragmatic, grammatical, discourse, and strategic rules of practicing language and communication (Hymes, 1966, 1971, and 1972; Coseriu, 1988).

METHOD

Study Design. The research design adopted for this study is purposive sampling method, but this method adhered to homogenous sampling technique, whereby one particular subgroup are focused and in which there is similarity in all members sampled in terms of their occupation, education, and work experiences (Saunders & Lewis, 2012; Hennink, Hutter & Bailey, 2015). This method was found suitable for this study as it ensured collection of rich information through semi-structured interviews from appropriate participants, that is, (n=10) educators who were either teaching language or combined subjects to learners with autism.

Table 1:
Demographic Information of the Participants Showing Their Work Experience,
Number of Languages Spoken, and Qualifications

Nationality	Identification Codes	Gender	Teaching Experience	Qualification	Language Profile
Nigeria	NGEDU 1	Female	2	NCE	English, and Yoruba
	NGEDU 2	Female	3	B.Ed.	English, and Igbo
	NGEDU 3	Male	7	B.Ed.	English, and Yoruba
	NGEDU 4	Female	5	M.Sc	English, and Yoruba
	NGEDU 5	Male	4	B.A.	English, and Yoruba
South Africa	SAEDU 1	Female	2	B.Ed.	English, and isiZulu
	SAEDU 2	Male	5	B.Ed.	English, isiXhosa, and isiZulu
	SAEDU 3	Female	7	Hons.	English, and isiZulu
	SAEDU 4	Female	2	M.Ed.	English, isiZulu, and Sepedi
	SAEDU 5	Female	3	PGDE	English, and isiZulu

Notes: NGEDU = Nigerian Educator; SAEDU = South African Educator.

Participants of the Study. The (n=10) participants of this study comprised (n=4) language educators recruited from (n=2) special schools with autism unit in Lagos, Nigeria; (n=2) language educators from 2 autism centres at Pietermaritzburg, and 4 general subject educators were recruited from (n=1) special school of children with autism in Durban, South Africa. The criteria used for their selection include having language or special education qualifications from recognized higher institution, and having at least two years of active teaching engagement with children with autism, and they must have been active users of computers and smartphones in the last 2 years.

The participants (language educators and all-subject educators-that is, those who teach their learners all subjects including English language), must be at least bilingual and be fluent in both languages. Both language educators and general subject educators were involved as many primary schools including special schools in Nigeria and South Africa use class educators to handle different subjects including literacy, numeracy, and other learning activities. While 4 participants from Nigeria spoke English (as L2) and Yoruba (as L1) fluently; 1 spoke English (as L2) and Igbo (as L1). All participants from South Africa were proficient in English (as L2) and isiZulu (as L1). Some demographic information of the participants is presented in table 1.

Data Collection and Analysis. Data was collected through semi-structured interviews. The interview took place both telephonically and

in person between December 2019 and July 2020. The interviews were audio-recorded, transcribed, and anonymized. The interviews were also subjected to coding after which relevant themes were sorted out (Hennink, Hutter & Bailey, 2015). The use of interview guides also helped to probe deeper. Some of the questions asked include the following:

What do you understand by augmentative and assistive technology?

What computer program or apps do you have on your smartphone or computer that can aid teaching language or other subjects or skills to children with autism?

How often do you use them?

If you have used them, how effective are they for teaching children with autism?

Did you receive any special in-service training or during your study about how to integrate computer programme, apps or other related devices into teaching of L1 or L2 or other subjects to children with autism or any other disabilities?

What is your opinion about integrating augmentative and assistive technology to teach language (L1 or L2) or other subjects or learning activities to children with autism?

What is another factor that may affect integration of augmentative and assistive technology in your own case?

Succinctly, the study adopted content analysis, and findings and discussion of the findings were carried out simultaneously. After completion of the interview process, the recordings of semi-interviews were transcribed and categorized based on the participants' viewpoints. This was done by paying attention to transcribed texts to ensure that responses were reread, well-captured and well-interpreted as D. Weinberg (2020) suggested.

Similarly, meanings were condensed after categorization has been performed using participant's information or statements. The analysis of key findings was carried out in form of interpretive commentary and some direct quotations from participants were used to substantiate the results and discussions (Kvale & Brinkmann, 2009; Abed & Shackelford, 2020).

Ethical Consideration. As a part of a larger study embarked on by the first author, permission to conduct this study was obtained from all participating schools/autism centres as well as from Local Government Education Authority, where the schools belong in Lagos, and from the Department of Education KwaZulu-Natal. These approvals were presented to the school, and the participants, and their consent was secured. The study adhered to research ethical principles as contained in ethical clearance certificate obtained from the University of Zululand Research and Ethics Committee (UREC 171110-030 PGD 2019/19).

FINDINGS AND DISCUSSION

The following are results of this study, and they are discussed as follows: (1) *Absence of Special Training on Integration of Augmentative and Assistive Technology into Teaching Children with Autism*; (2) *Integration of into Language Teaching and Learning at a Low Ebb*; (3) *Uncertain Situation of Boosting Linguistic and Communicative Competence of Learners with Autism*; and (4) *Difficulty in Accessing the Devices*.

Firstly, ***Absence of Special Training on Integration of Augmentative and Assistive Technology into Teaching Children with Autism***. All educators (NGEDU [Nigerian Educator]: 1, 2, 3, 4, 5; and SAEDU [South African Educator]: 1, 2, 3, 4, 5) revealed that though they have personal knowledge on how to install and operate some computer devices and apps, but no special training on how to integrate many augmentative and assistive technology including computer programmes and apps for teaching language or other subjects to children with developmental disabilities including autism.

It was also found that only few of them have personally sought means of learning and using of those computer programmes or those on their smartphones. One of the educators (NGEDU 1) stated that:

"I attended a Federal Special School, but I was not trained or introduced to augmentative and assistive technology nor did I receive such training since I joined this school".

Another educator (SAEDU 4) reeled out the following statement:

"It is like a surprise now because all these you mentioned, I mean the augmentative and assistive technology was not focused on at my higher institution, and no way may you expect me to know them or know how to use them for teaching children with autism. I said that because my school too has not introduced me to it. No training, no training about that technology am serious".

Furthermore, EDUSA 3 quipped that:

"Nobody should expect me to be using this technology by now as I am not familiar with them at either here in my school or from the school I obtained my degree. I don't know anything about them because I was not trained or told".

It was also indicated that many educators were not familiar with the concept of augmentative and assistive technology.

Secondly, ***Integration of into Language Teaching and Learning at a Low Ebb***. The respondents (NGEDU [Nigerian Educator]: 2, 3, 4, 5; and SAEDU [South African Educator]: 1, 2, 4, 5) indicated that they were yet to initiate integration of augmentative or assistive technology means of teaching of either L1 or L2, or into their teaching of children with autism general subjects, or to make them get engaged. They reiterated

the reason for that is unconnected with lack of special training from institutions where they obtained education, and when they have resumed teaching.

As regards, integration of augmentative and assistive technology into teaching children with autism, SAEDU 1 maintained that:

“I am sure that lack of training at work and at school I attended are the results of neglect of augmentative and assistive technology for our learners with autism. So, as you asked in my opinion, I am sure many schools and many educators like us are facing this problem, therefore, we cannot integrate them in my opinion unless we get it right”.

One educator (NGEDU 2), who was a language educator, responded thus:

“I have tried to use an app for teaching my learners, but after I read about the processes and procedures in one website, (hmmm) in Autism Speaks, I told myself, you can’t do this alone, and it was like being confused to continue it. Yes, integration is good but it cannot be done alone and unprepared. You mentioned something about training, so no training, no integration in my view”.

A fewer number of the participants also maintained that the little knowledge they have about the use of audio-visual like TV, and other related teaching materials was based on self-mentorship.

Thirdly, ***Uncertain Situation of Boosting Linguistic and Communicative Competence of Learners with Autism.*** Majority of the participants (NGEDU [Nigerian Educator]: 1, 2, 3, 4, 5; and SAEDU [South African Educator]: 1, 3, 4, 5) affirmed that all their learners are from bi/multilingual family background, but boosting the linguistic and communicative competence of these children through augmentative and assistive technology is in dicey situation as it may take a long process before it is attained. They mentioned that many schools and learning centres where these children are being trained must first embrace the idea, then freshly introduce it to parents of children with autism, and if accepted, then, they may be talking about the strategic training especially (in-service) for the educators, and teaming up with the other professionals to ensure correct selection and suitable strategies for effective adoption.

Responses categorised for questions that sought types of computer program or apps that the participants smartphone or computer have but which can aid teaching language or other subjects or skills to children with autism, and how often they use them indicated uncertain situation of boosting linguistic and communicative competence as well as other aspects of knowledge or skill enhancement of learners with autism.

Similar to what the majority of the participants stressed, SAEDU 5 explained that:

“What will become adoption and integration of augmentative and assistive technology for teaching learners with autism is not known to me because it is like we, schools and may be parents are not ready for it from the looks of things”.

Fourthly, ***Difficulty in Accessing the Devices***. The majority of the participants established that having access to secure right augmentative and assistive technological gadgets for language and communication enhancement might become another financial burden to some of them including the parents of children with autism. They identified lack of finance as another militating factor against the use of augmentative and assistive technology for enhancing the linguistic and communicative competence of children with autism who in both Nigeria and South Africa.

Views submitted for question about another factor that may affect integration of augmentative and assistive technology in the context of this study was captured thus:

“Let me summarise in my own way that there will be problem of accessing the devices due to many how the school accept the innovation, and how rich the parents who I know are not financially OK” (SAEDU [South African Educator] 2).

“Lack of money to acquire the devices is a problem. The school, we the educators, and the parents may find it difficult to know which one is good or bad, and if the price is higher, we may not be able to cope with the purchase” (NGEDU [Nigerian Educator] 4).

The findings of this study indicate that special education training institutions do not take adequate cognizance of practices, theory, and context of teaching and learning language with computer and mobile devices (Hubbard & Levy, 2016; Hubbard, 2017). The findings further suggest that while the participants may have general or specific ICT (Information and Communication Technology) training, they lack in-service training and training while they were students at their respective higher intuitions on theory, and context of integrating ICT/augmentative and assistive technology as wells as apps into their teaching.

This current study also implies that non-familiarity to modern and functional augmentative and assistive technology is one of the reasons for difficulty being witnessed by educators in setting up and in using such technology including language teaching apps that are capable of boosting language and communication (in either L1 or L2 or both) of children with autism in both Nigeria and South Africa. These findings imply that educators are yet to have required knowledge of what augmentative and assistive technology entails, its strategies, and its benefits (Nunes, 2008; Holt, 2017; Cortez, 2020). Educating bi/multilingual children with

autism using these strategies will enhance their language and communication and not complicate it.

The current research suggests that process may be considered essential as correct deployment and integration of augmentative and assistive technology are considered indispensable only when they are effectively deployed. This implies that applications of augmentative and assistive technology for language and communication, and for other subjects require special methods, which other type of ICT knowledge, years of experience, and education attainment may not provide. This finding is in consonance with some recommendations that the use of assistive and alternative technology requires professional evaluation as well as training for achieving maximum effectiveness, and because children with autism have varied language (Alm, 2017; AS, 2018; VCU, 2020).

More importantly, smart technology that serves the purpose of augmentative and alternative communication requires different levels of training, such as those that require: (1) little or simple training for the low-tech programme, such as *Duolingo*, Object/picture choice boards, Communication/language boards, Picture exchange systems like PECS or its modified versions; (2) elevated training for mid-tech programme, such as *Go Talk*, *Quick Talker*, *Communication Builder*, *Chat Box*, *Alpha Talker II*; and (3) more time and higher level of training for high-tech smart technology programme, such as *iPad/iTouch* with apps like *Go Talk Now*, *Proloquo2go*, *Sonoflex*, *iClick-iTalk* (AS, 2018; VCU, 2020). Meanwhile, for effective deployment for boosting language and communication of children with autism, the educators of children with autism need mastery of these smart technology programmes.

Additionally, it can be deduced from the findings of this current study that right and quality smart technological devices that provide practical applicability to support children with autism may be difficult to acquire for both educators and the learners. This result confirms some previous reports on financial constraints being faced by caregivers of children with autism as many of them largely depend on personal income to secure different interventions (Christon, Mackintosh & Myers, 2010; Montes & Cianca, 2014).

Furthermore, as indicated above that experts have categorized relevant and effective smart technology that can be used to assist in boosting language, communication competence, and social interactions of children with autism into low-tech, mid-tech, and high-tech (AS, 2018; VCU, 2020); therefore, in term of qualitative function, high-tech will be at the forefront. However, the cost may be exorbitant for both educators, and parents of children with autism (Christon, Mackintosh &

Myers, 2010; Montes & Cianca, 2014), due to their lower economic power as they are part of millions of people living at lower and middle income countries in which Nigeria and South Africa belong respectively (WHO, 2020).

CONCLUSION

The study has advanced knowledge on means in which language, communication and learning of children with autism spectrum disorder can be boosted. The findings have showed that integration of AAT (Augmentative and Assistive Technology) for boosting linguistic and communicative competence and other academic performance of children with developmental disabilities like autism is not rampant among schools and centres where children with autism are educated in both Nigeria and South Africa. The study explicated what may restrict educators and parents to embrace AAT.

The study showed that absence of specialized training at both higher institution of studies and at work may slow down the adoption of AAT in the two examined countries; lack of financial capability of parents to procure and secure right and relevant computer devices and programmes which can boost both linguistic and communicative practices as well as other learning activities of children with autism may tantamount to tedious, slower and ineffective adoption of AAT for children with autism.

Essentially, this study can claim that the use of augmentative and assistive technology for language and communication enhancement has double-edge benefits as it helps language educators and other to be on top of their work, and make teaching less burdensome. To the learners, augmentative and assistive technology make learning various aspects of language (L1, L2 or L3) and other subjects easier, attractive, and engaging.

Limitation of the study. This study is limited to few educators in few schools and centres where children with autism are being educated, therefore, the results may not be widely generalized. Additionally, the study did not emphasize some AAT features that certain children (with a specific phenotype) may need, and how it may differ from another child's need with different autism phenotype.

The study did not also cover some empirical strategies which educator may use to effectively adopt each selected AAT device before it can be certified as being effectively deployed for boosting linguistic and communication competence as well as other academic activities of children with autism.

Recommendations. Based on the findings, this study recommends that higher education department in Nigeria and South Africa should add practical training on augmentative and assistive technology to their

curriculum for special education trainees, and schools or centres, where individuals with autism are working should have special in-service training for educators who teach children with autism and other developmental disabilities.

Such schools or autism centre should team up with other professionals like speech language pathologists, AAC specialists, occupation therapists, clinicians, and educators. Similarly, language educators dealing with children with autism should embrace the fact that these children have cognitive capacities to use those devices, and they can develop bi/multilingualism if introduced to them earlier.

The study further recommends that relevant argumentative and alternative gadgets should be made affordable and accessible to parents, educators, and children with autism by government or other private organizations. Schools, centres, and educators of children with autism should also understand that AAC has come to stay, and they need to start embracing and deploying this technology for boosting various aspects of socio-communication, and behaviors of individuals with autism.

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