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Implementation of Dual Education

The Creators of Quantitative Evidence

Highlights

The Working Class in Burkina Faso

Bridging Gaps in Science Education

Discovering Thoughts, Inventing Future

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Assessment of Satisfaction of Students and Economic Units Regarding the Implementation of Dual Education

By Silviu Gîncu, Elena Movileanu & Radu Moldovanu

Technical University of Moldova

Abstract- As part of the research, the authors aimed to present the results of monitoring the implementation of dual education in the Republic of Moldova, based on a survey conducted among students enrolled in dual education, as well as economic units (companies) involved in delivering this form of education. The research also included an analysis of the provisions of the national regulatory framework governing dual education, as well as international experiences in implementing dual education systems. Given that, in recent times, the authorities in the Republic of Moldova have focused on increasing the number of students enrolled in dual education, it is important to assess the satisfaction of the direct beneficiaries of this system (students and economic units) in order to provide insights into the quality of its implementation and to anticipate potential implementation risks. We believe that the findings presented in this paper will be of interest both to those currently involved in dual education and to students who may choose this form of Vocational Education and Training (VET) in the future.

Keywords: dual education, education, economic entities, labor market requirements, technical professional education, quality assurance.

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Assessment of Satisfaction of Students and Economic Units Regarding the Implementation of Dual Education

Silviu Gîncu [α], Elena Movileanu [σ] & Radu Moldovanu [ρ]

Abstract- As part of the research, the authors aimed to present the results of monitoring the implementation of dual education in the Republic of Moldova, based on a survey conducted among students enrolled in dual education, as well as economic units (companies) involved in delivering this form of education. The research also included an analysis of the provisions of the national regulatory framework governing dual education, as well as international experiences in implementing dual education systems. Given that, in recent times, the authorities in the Republic of Moldova have focused on increasing the number of students enrolled in dual education, it is important to assess the satisfaction of the direct beneficiaries of this system (students and economic units) in order to provide insights into the quality of its implementation and to anticipate potential implementation risks. We believe that the findings presented in this paper will be of interest both to those currently involved in dual education and to students who may choose this form of Vocational Education and Training (VET) in the future. Considering the positive feedback received from students and economic units that participated in the research, the material presented in this publication may also serve as an additional argument for encouraging more companies to engage in dual education. Moreover, we consider that the research findings may serve as examples of good practices for the implementation of VET policies at both national and international levels.

Keywords: dual education, education, economic entities, labor market requirements, technical professional education, quality assurance.

I. Introduction

Over the past decade, dual education as a part of Vocational Education and Training system (VET) has become increasingly popular and more frequently promoted by the authorities responsible for the professional training of young specialists. This has also contributed to the growth in the number of students choosing to pursue training through dual education. In 2024, there was an increase of over 60% in the number of students enrolled in dual education compared to 2023. In this context, it is important to ensure quality in the implementation of dual education. According to national-level research in the field [1–5], it is important to mention that the Republic of Moldova has made significant progress in the process of implementing dual education.

Internationally [6–19], dual education is considered one of the most successful forms of workforce training, as it meets labour market expectations and significantly contributes to the growth of the market economy.

It should be noted that dual education, as a form of organizing VET education, is characterized by the fact that "*theoretical training is conducted at the vocational education and training institution, while practical training takes place at the economic unit*" [20, Art. 3, par. (1)].

The involvement of the economic unit in dual education occurs under the condition that it meets conformity criteria [21] and has signed a cooperation agreement [22] with the VET institution. Following the approval of the cooperation agreement, "*the parties establish full cooperation relations and provide each other with all necessary assistance to ensure the prompt and effective implementation of vocational training programs through dual education*" [22, p. 5].

To a large extent, the success of dual education relies on the modern equipment and infrastructure available at the economic units, but equally important is the role of the Master instructor within the economic unit. Thus, the Master instructor is responsible for integrating students into the economic unit and for developing their practical skills. At the same time, students in dual education are also monitored by a Master instructor from the VET institution.

Considering that, in order to implement dual education, the economic unit provides students with available equipment and ensures student guidance through an instructor from the company, we believe it is necessary to evaluate the cost-effectiveness of implementing dual education as well as the level of satisfaction of those involved.

From the student's perspective, it is evident that they are involved in practical production activities from

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the age of 16–18 and are given the opportunity to train using high-performance infrastructure and equipment. In this sense, it is important to assess students' perception of dual vocational training, their satisfaction levels, and areas for improvement in the dual vocational education process.

To ensure the quality of dual education implementation, economic units must undergo a conformity assessment procedure [20, 21] before entering a dual training partnership. Through this procedure, the stakeholders involved in dual education are assured that the economic unit has the physical capacity to organize vocational training within the unit, and that it has the necessary and qualified human resources, ensuring all the necessary conditions are in place for the proper implementation of dual education in accordance with nationally approved quality standards.

In this research, we aim to address the results of surveys conducted with students and economic units involved in dual education, highlight the strengths of dual vocational training, and present their level of satisfaction with the implementation process of dual education.

II. Materials used and Applied Methods

This research is based on the provisions of the regulatory framework in the field of VET system and is developed using the results obtained from two surveys aimed at determining the level of satisfaction among students and economic units involved in dual education.

To assess the overall satisfaction level of students in dual education, the following topics were addressed: the degree of satisfaction with their experience in dual education; the level of communication and collaboration with company Master instructors; the degree of support provided by the company for carrying out practical activities; the appreciation of the work performed within the economic unit; the level of integration into the economic unit; satisfaction with working conditions; the amount of monthly remuneration received by the student within the economic unit; and the strengths that motivate students to pursue training through dual education.

The questionnaire included 10 multiple-choice questions, was conducted online in March 2025 via Google Forms, and was completed by 1,583 respondents. It is worth mentioning that, as of October 1, approximately 2,417 students were enrolled in dual education programs [5].

To evaluate the satisfaction level regarding the impact of dual education on economic units, the following topics were addressed: the preparation level of students participating in the dual education program; the impact of dual education on the skills development of the economic unit's employees; the integration of dual education students into the company's work teams; the impact of dual education on the productivity of the economic unit; and the economic efficiency of dual education within the company.

The survey included 12 multiple-choice questions, was conducted online in March 2025 via Google Forms, and was completed by 125 economic units out of approximately 170 that are implementing dual education during the 2024–2025 academic year [5].

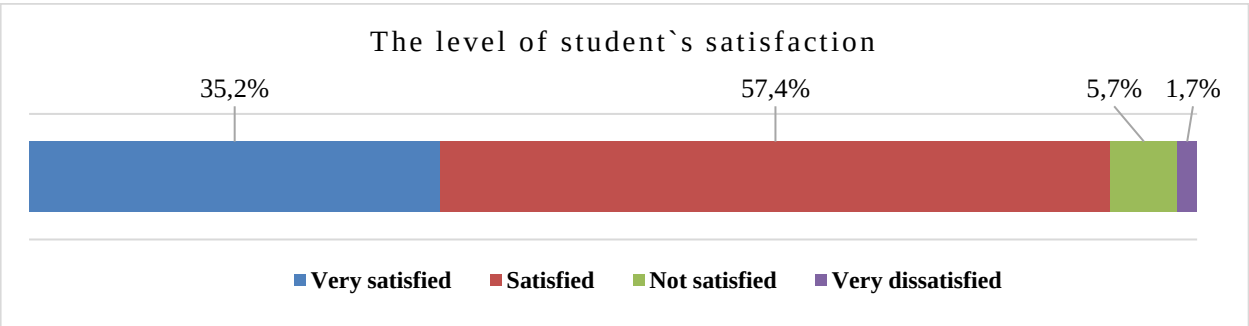
Additionally, the results of the questionnaires were discussed in May 2025 within 10 student groups. These discussions with students aimed to validate the findings from the two surveys.

III. Results

Below, we present the survey results for the two samples: students enrolled in dual education programs (1,538 respondents) and economic units implementing dual education (125 respondents).

a) Students' Perceptions in Dual Education Identified by the Survey

As a result of analysing the questionnaire responses, we found that approximately 92,6% of respondents indicated they were satisfied or very satisfied with the experience gained within economic units during their dual education studies. However, it is noted that around 7,4% of students indicated a less positive experience (Figure 1).

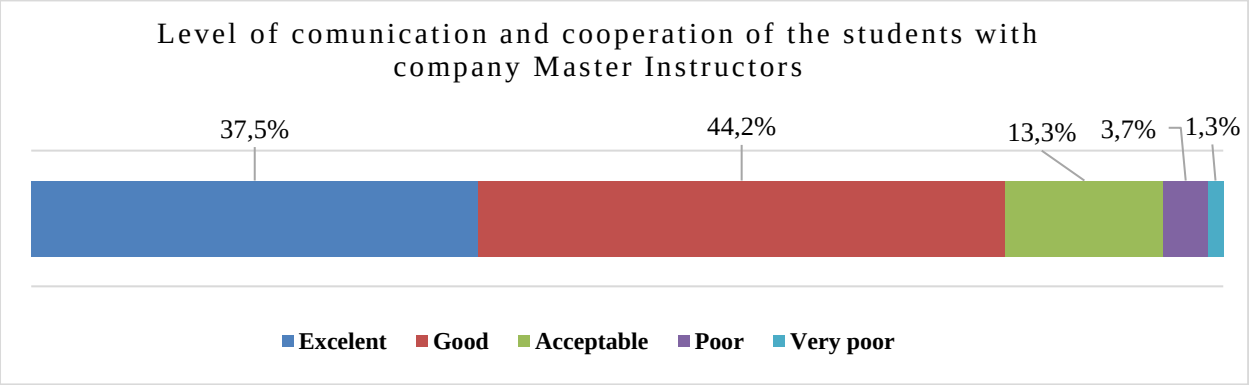


Source: Prepared by the author based on responses from students, 1,583 respondents.

Figure 1: How Satisfied are you with Your Experience in Dual Education?

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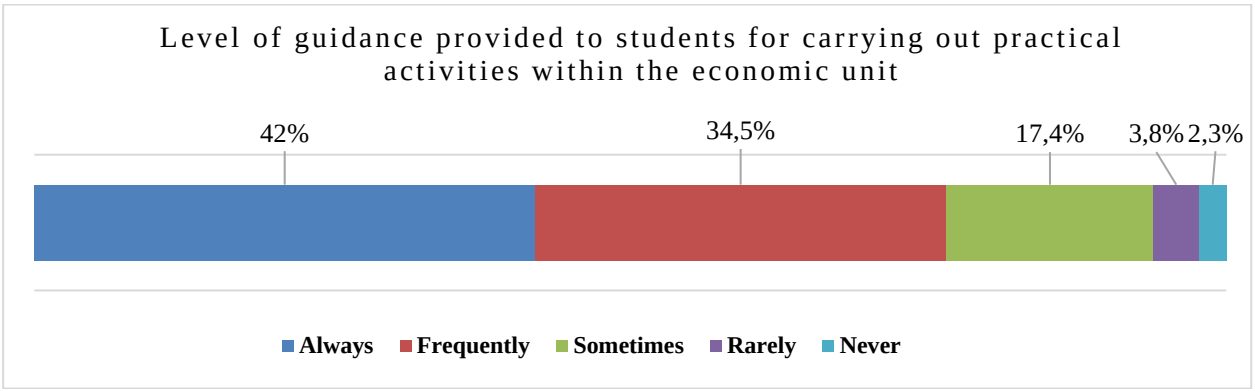
Concerning the evaluation of the level of communication and collaboration between students and company Master instructors, 44,2% of respondents reported a good level of cooperation and communication, 37,5% rated it as excellent, and 13,3% indicated an acceptable level of collaboration and communication. On the other hand, 3,7% of respondents mentioned a poor level of communication and collaboration with the company Master instructors, and 1,3% classified this process as very poor. If we generalize the data obtained, approximately 95% of respondents rated cooperation and communication with the company Master instructors positively, while 5% evaluated this process negatively (Figure 2).



Source: Prepared by the author based on responses from students, 1,583 respondents.

Figure 2: How do you Evaluate the Level of Communication and Collaboration with the Company Master Instructors?

Regarding the evaluation of the level of methodological support provided to students by representatives of the economic units to enable them to carry out practical activities, the following results were noted. About 42% of respondents stated that they always receive this support, while 34,5% mentioned they frequently receive support. At the same time, 17,4% reported that the guidance activities are sporadic. Additionally, 3,8% of respondents indicated that they are rarely guided in carrying out practical activities, and 2,3% mentioned that they are not guided at all during the practical activities within the economic unit (Figure 3).

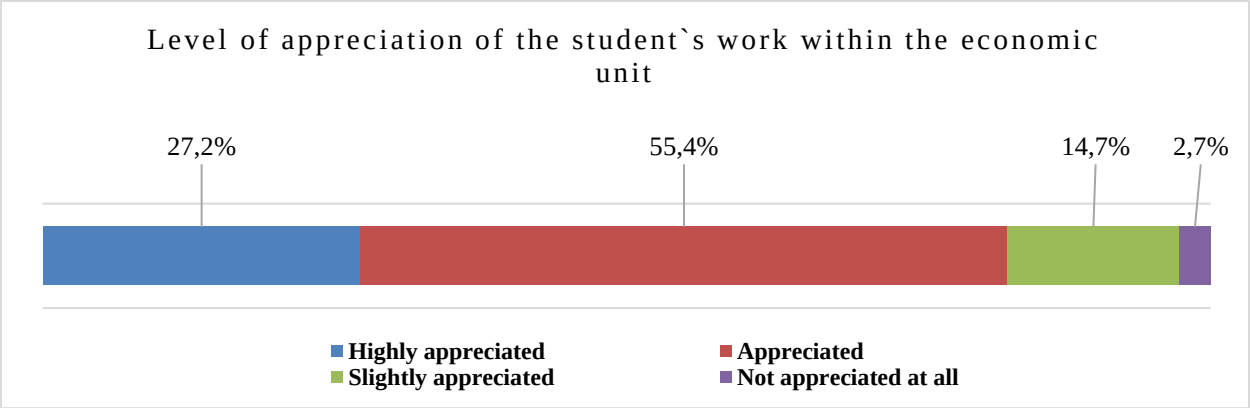


Source: Prepared by the author based on responses from students, 1,583 respondents.

Figure 3: Do you Consider that you Receive Sufficient Support (Guidance) from the Company to Carry out the Practical Activities?

Related to the students' opinions on how their work is valued within the economic unit, we found that 55,4% of respondents believe their work is appreciated, while 27,2% believe their work is highly appreciated. At the same time, 14,7% of respondents feel their work is only slightly appreciated, and 2,7% believe their work is not appreciated at all (Figure 4).

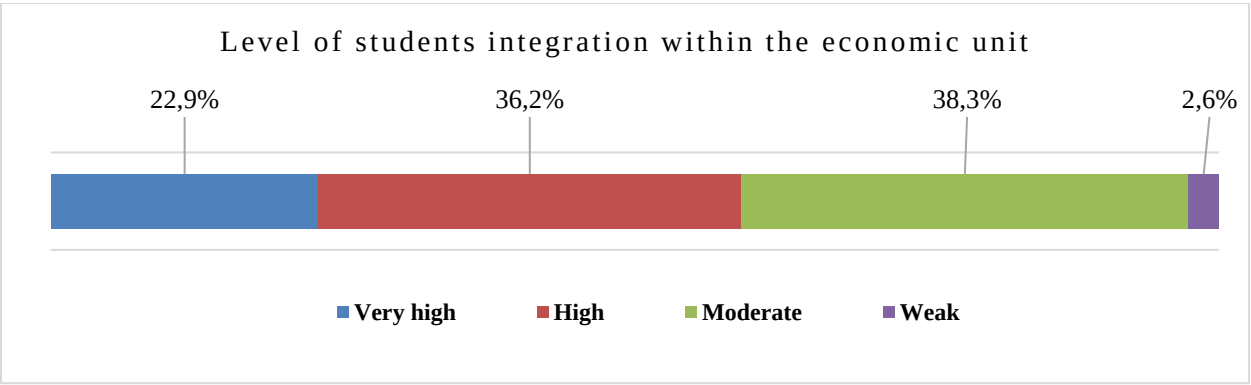
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Source: Prepared by the author based on responses from students, 1,583 respondents.

Figure 4: Do you Believe your Work is Appreciated in the Company?

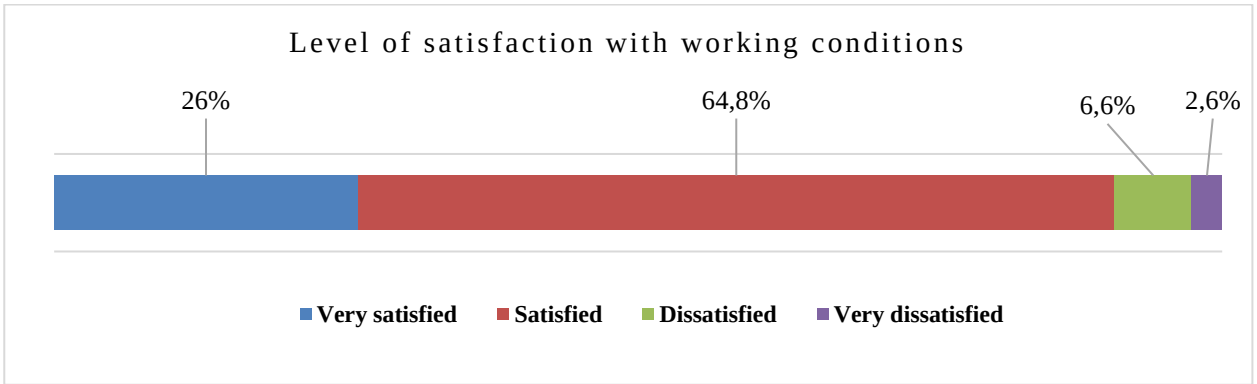
The integration of students into practical activities within the economic unit is an essential factor in the professional training process. In this regard, around 2,6% of respondents stated that their level of integration within the company was low. The remaining respondents indicated varying degrees of successful integration: 22,9% reported a very high level of integration, 36,2% rated it as high, and 38,5% considered their integration level within the economic unit to be moderate (Figure 5).



Source: Prepared by the author based on responses from students, 1,583 respondents.

Figure 5: How do you Assess your Level of Integration within the Company?

Given that working conditions are one of the strong points of dual education, the survey results regarding students' satisfaction with working conditions show that 64,8% of respondents rated them as satisfactory, while 26% considered the working conditions in the economic unit to be very satisfactory. Meanwhile, 6,6% of respondents reported being dissatisfied with the working conditions in the company, and 2,6% stated they were very dissatisfied (Figure 6).

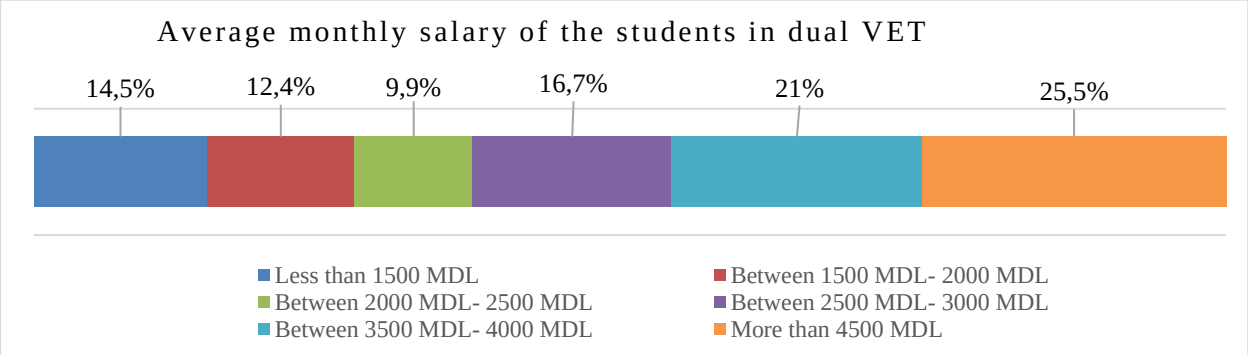


Source: Prepared by the author based on responses from students, 1,583 respondents.

Figure 6: What is your Level of Satisfaction with the Working Conditions?

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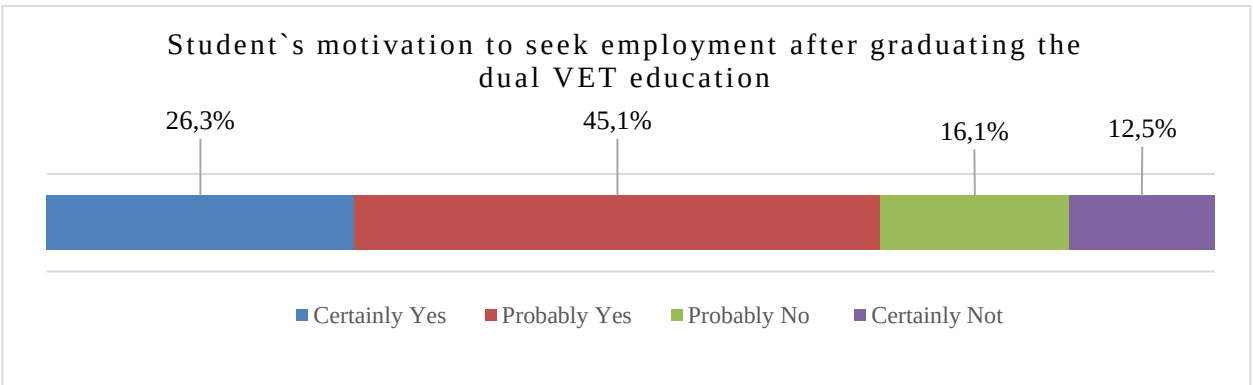
Another advantage of dual education is that students receive "*remuneration, the amount of which is negotiated by the parties and stipulated in the professional training contract under the dual education system, but it must not be lower than the guaranteed minimum wage in the real sector*" [20, Art. 12, p. (3), letter d)]. According to [23], the guaranteed minimum wage in the real sector for the year 2025 was set at 5500 lei. Given that students are remunerated by the company in proportion to the time spent at the economic unit, their responses regarding the average monthly remuneration vary. However, approximately 63,2% of respondents stated that they receive an average monthly wage higher than 2500 lei (Figure 7).



Source: Prepared by the author based on responses from students, 1,583 respondents.

Figure 7: What is the Average Monthly Remuneration you have Received from the Company?

One of the performance indicators established by the Ministry of Education and Research for VET institutions [24] is the employment rate of students after graduation. It is worth mentioning that, according to [5], "*around 60–70% of dual education graduates are employed within six months after completing their studies*." In this regard, the students' responses to the question of whether they intend to seek employment with the company where they completed their dual education program are as follows: 45,1% of respondents answered probably, 26,3% stated definitely, 16,1% indicated probably not, and 12,5% categorically stated they would not seek employment at the company. Thus, in total, 71,4% of respondents are inclined to seek employment with the companies where they completed their dual education, while 28,6% do not intend to do so. These results confirm the dual education employment rate of approximately 60–70% (Figure 8).

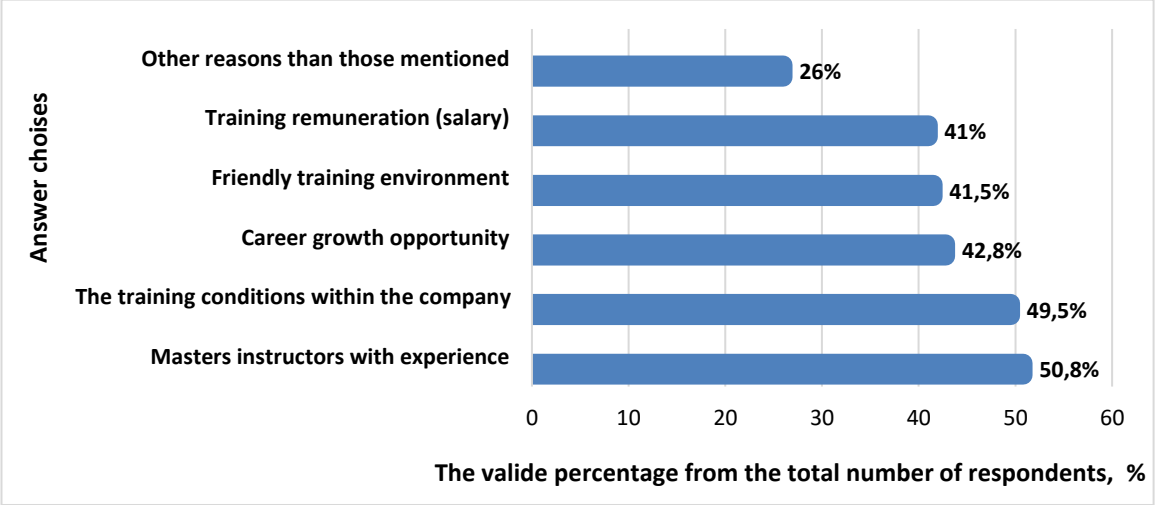


Source: Prepared by the author based on responses from students, 1,583 respondents.

Figure 8: After Completing your Study Program, will you Choose to Work for the Company where you are doing your Dual Education?

To determine the motivating factors for students in dual education, a predefined list was presented to the students, and they were asked to select the top three priorities (Figure 9).

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Source: Prepared by the author based on responses from students, 1,583 respondents.

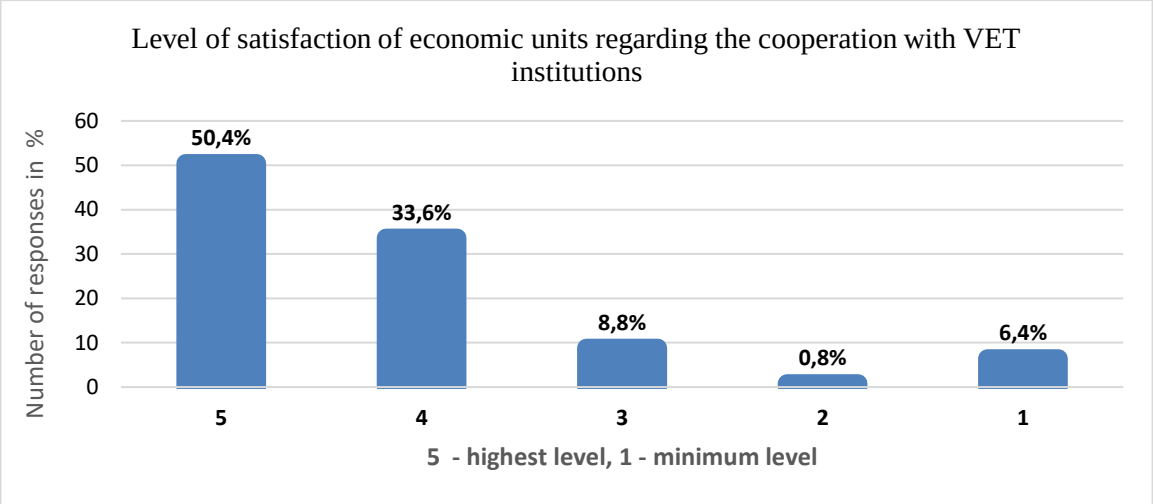
Figure 9: What Motivates you to Pursue your Studies through Dual Education?

In this regard, it was found that the two most decisive factors motivating students to pursue dual education are (1) experienced Master-instructors and (2) the training conditions within the economic unit. At the same time, it is worth noting that professional training remuneration is not mentioned as one of the determining factors, which suggests that the remuneration amount established for students in dual education is generally sufficient and largely meets their expectations.

b) *Assessments of the Economic Units Implementing Dual Education Identified in the Survey*

Given that dual education takes place mostly within economic units, it is important to evaluate the level of satisfaction of the economic units implementing dual education. In this regard, the economic units indicated that cooperation with VET institutions is successful.

Thus, among the total respondents, 50,4% gave the highest rating of 5, 33,6% rated it as level 4, and 8,8% rated it as level 3 (Figure 10).



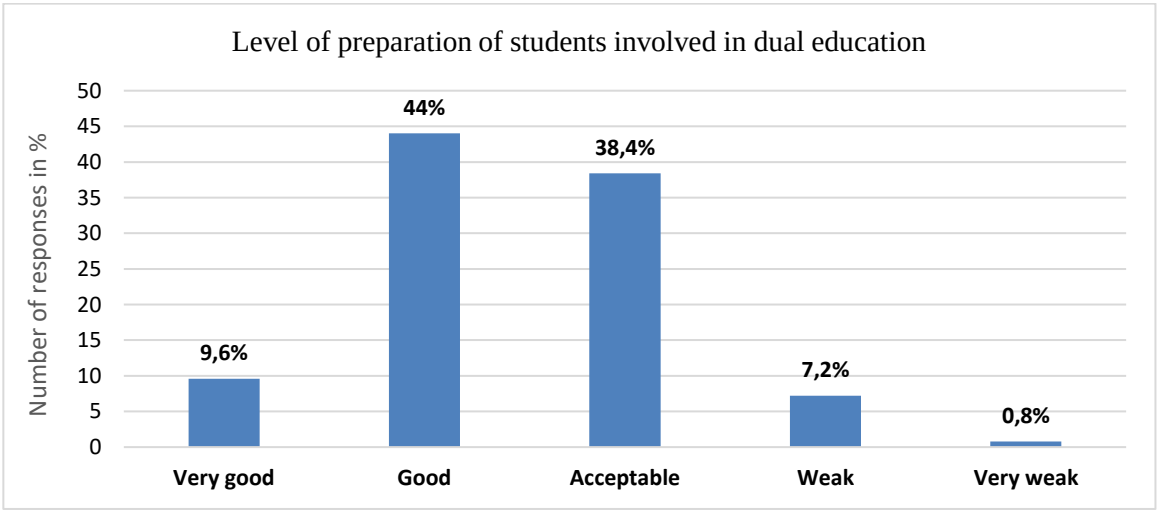
Source: Prepared by the author based on responses from economic units, 125 respondents.

Figure 10: On a Scale from 1 (Minimum) to 5 (Maximum), what is your Company's Level of Satisfaction Regarding Collaboration with VET Institutions?

At the initial pilot stage of dual education, students aged at least 18 were enrolled in the economic units. This allowed the companies to employ young people with full labour rights. Over time, it was found

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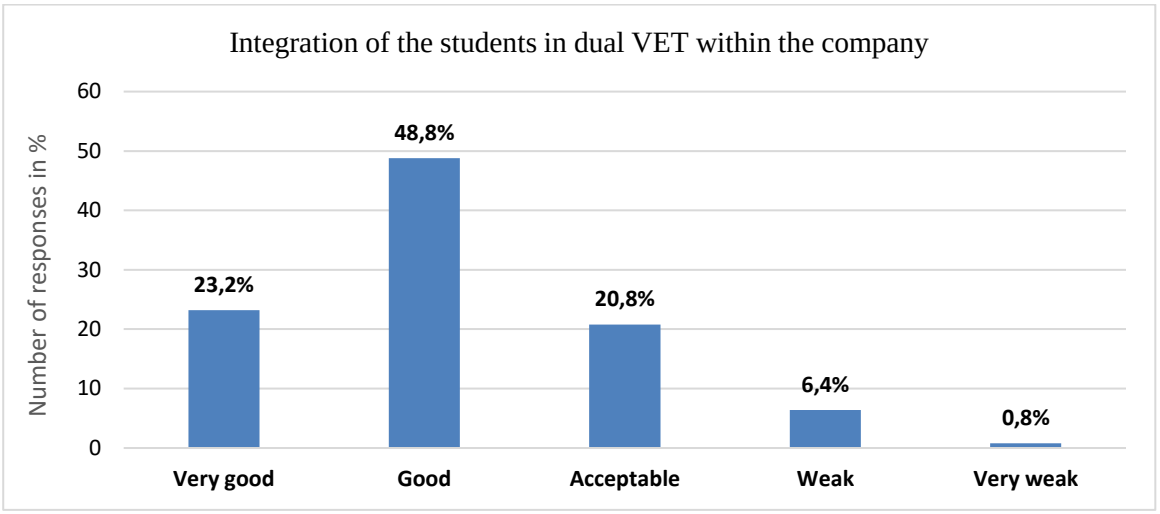
that 18-year-olds were not interested in participating in the dual education system. Taking into account the practices of VET systems in European Union countries, the minimum age for students to enrol in the dual system was lowered to 16 years. One of the risks of enrolling 16-year-old students is their level of preparation to participate in dual education. From this perspective, we note that approximately 92% of economic units assessed the level of preparation of students participating in the dual education program as at least acceptable (Figure 11).



Source: Prepared by the author based on responses from economic units, 125 respondents.

Figure 11: How do you Assess the Level of Preparation of the Students Participating in the Dual Education Program?

In a similar manner, representatives of the economic units mentioned that approximately 92.8% of students have an acceptable, good, or even very good level of integration within the company (Figure 12).

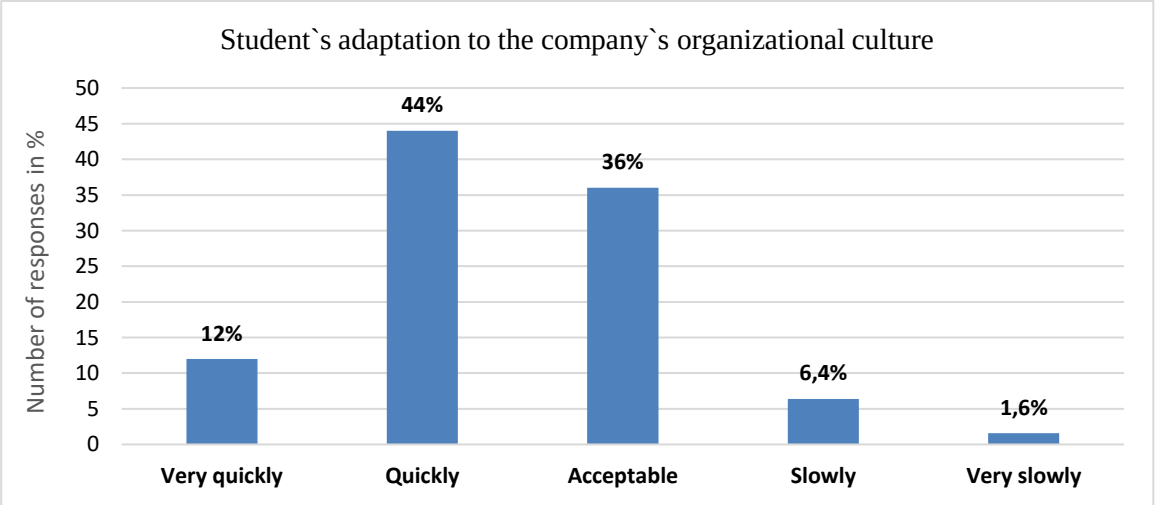


Source: Prepared by the author based on responses from economic units, 125 respondents.

Figure 12: How do you Assess the Integration of Dual Education Students within the Company?

In line with the previous responses (Figures 11–12), representatives of the economic units mentioned that approximately 92% of students manage to adapt to the company's organizational culture, while only 8% of students show a slow or very slow level of integration (Figure 13).

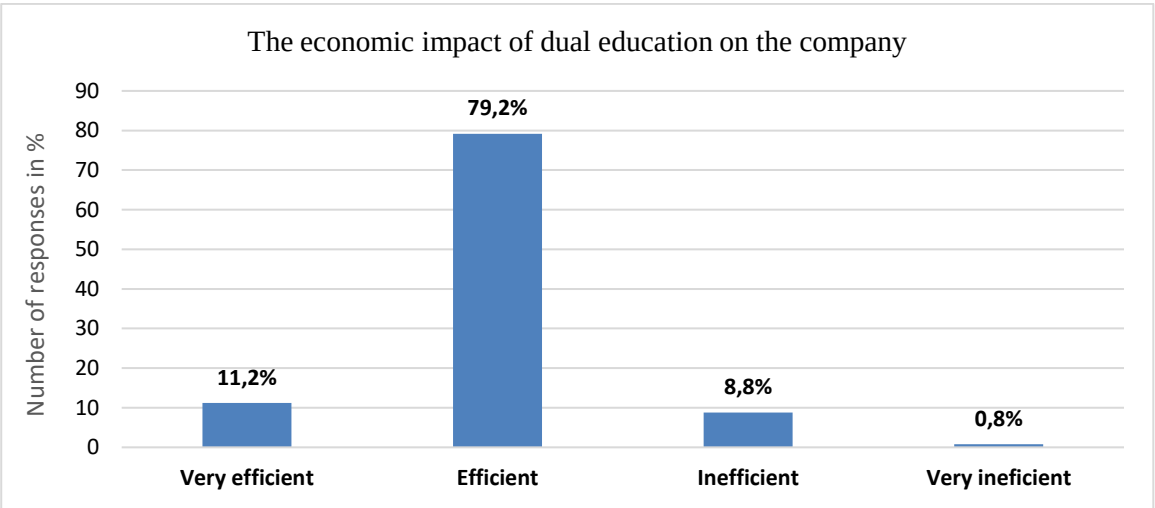
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Source: Prepared by the author based on responses from economic units, 125 respondents.

Figure 13: How Quickly do Students Manage to Adapt to your Company's Organizational Culture?

An important element identified during the survey of economic units is the efficiency of dual education within the unit from an economic perspective. In this regard, approximately 79,2% of respondents mentioned that, in their view, the implementation of dual education within the economic unit is efficient, while 11,2% of respondents considered it to be very efficient. At the same time, around 8,8% of respondents stated that the implementation of dual education within the unit is not efficient, and 0,8% of respondents consider the implementation of dual education to be very inefficient (Figure 14).

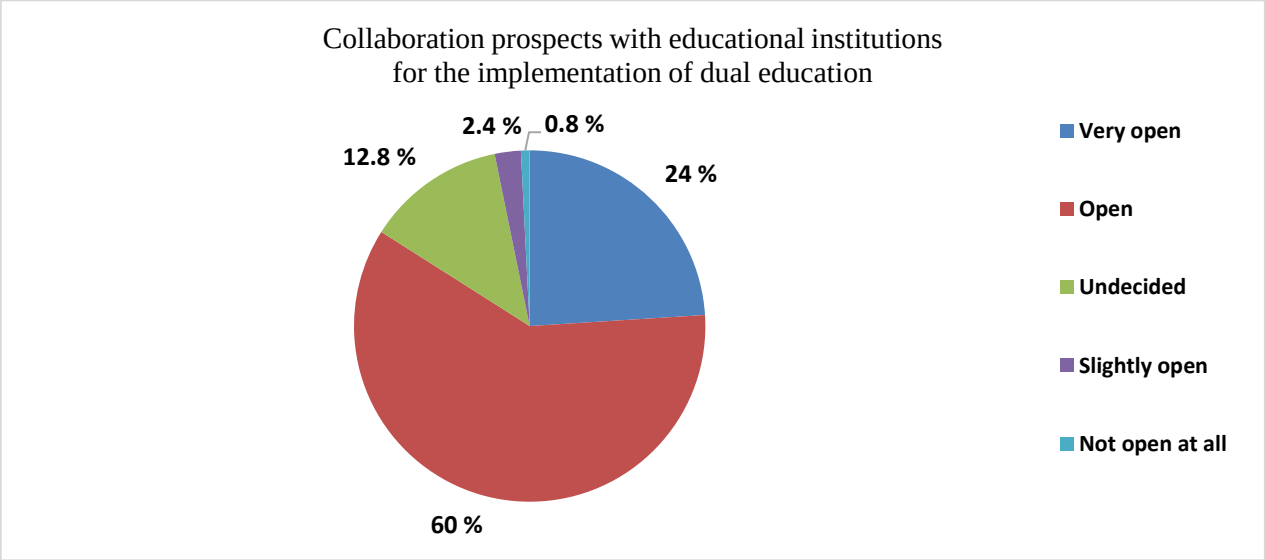


Source: Prepared by the author based on responses from economic units, 125 respondents.

Figure 14: To what Extent do you Consider the Dual Education Program is Economically Efficient for your Company?

Regarding the extent to which companies would be open to continuing collaboration with VET institutions in the future, approximately 60% of respondents mentioned that they would be open to continuing the collaboration, 24% specified that they would be very open to cooperation, while 12,8% of companies indicated that they are undecided about their future involvement in the implementation of dual education, and 0,8% of companies would not be interested in continuing dual education (Figure 15).

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Source: Prepared by the author based on responses from economic units, 125 respondents.

Figure 15: How open would your Company be to Continuing its Collaboration with Technical Vocational Education Institutions in the Future?

IV. Discussions

Based on the results gathered from the survey conducted among students enrolled in dual education, the following observations can be made:

- Approximately 92.6% of students stated that they are satisfied or very satisfied with the experience gained within economic units during their dual education studies;
- Around 95% of students reported a satisfactory level of communication and collaboration with the company's Master instructors;
- About 93.9% of students mentioned that during their studies, they received support from the Master instructors to carry out practical activities within the company;
- Approximately 97.3% of students stated that their work within the economic unit is appreciated;
- Around 97.4% of students mentioned that they managed to integrate into the professional training activities within the companies where they are enrolled in dual education;
- To a large extent, students are satisfied with the working conditions in the economic units. In this regard, about 92.8% of students reported being satisfied with the working conditions;
- Students in dual education are remunerated, and the amount corresponds to the volume of work they perform within the economic units;
- About 71.4% of students are inclined to seek employment within the companies where they undergo dual education after graduation;
- Experienced Master instructors and the training conditions in the economic unit are the top two factors that motivate students to pursue dual education.

The students' responses to the questionnaires highlight the relevance of dual education and the students' interest in this model, as well as the crucial role of the Master instructor within the economic unit. The Master instructor is the key person who ensures the student's integration into the company and guides them throughout their practical activities during their time at the company.

Undoubtedly, the economic unit plays a key role in the implementation of dual education, as "*it is organized within a unified framework, at the initiative of the interested unit acting as a potential employer, the Chamber of Commerce and Industry of the Republic of Moldova, or the VET institution*" [20, art. 4 letter a)]. Based on the responses of the economic units that participated in the questionnaire, we highlight the most relevant results:

- Cooperation with educational institutions in the implementation of dual education is a key factor that ensures a high quality of students' professional training. In this regard, about 84% of the units rated the partnership with educational institutions as effective;
- Although most students in dual education are enrolled at the age of 16, around 92% of companies assessed the preparation level of students participating in dual education as acceptable, good, or even very good;
- Over 94% of students manage to integrate successfully into the practical activities within the economic unit;

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- A significant proportion (90.4%) of economic units expressed their intention to continue collaborating with educational institutions for the implementation of dual education;
- 90.4% of economic units consider the dual education program to be economically efficient for the company.

V. Conclusions

The results presented in the research reconfirm the relevance of dual education for economic units, as ensuring a qualified workforce for the labor market remains a key factor in increasing the competitiveness of the market economy.

From the students' perspective, dual education is attractive. The survey results showed that students are satisfied with the remuneration they receive from economic units for their practical training activities and highlighted the role of the Master instructor within the unit in the professional training process through dual education.

The Master instructor within the unit is the main person responsible for the implementation of dual education. In this regard, it is important that the Master instructor from the economic unit, in addition to having professional experience and competencies, also possesses psycho-pedagogical skills that facilitate the training process for students in dual education.

Given the economic and social impact of dual education, the competent authorities should monitor and implement motivational policies for economic units in order to encourage the involvement of as many economic actors as possible in the workforce training process, including through dual education.

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Public Space in the Age of Social Media: Towards the Emergence and Conquest of Debate by the Working Class in Burkina Faso

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Résumé- Les espaces publics africains connaissent de profondes mutations. Marqués par une grande ouverture, voire sa transformation ils soulèvent de nouveaux enjeux. Il a autorisé la prise de parole de nouveaux acteurs à travers les médias numériques, notamment les médias sociaux qui incarnent la brèche permettant la modification et l'installant d'une nouvelle ère. Au Burkina Faso, la révolution numérique, à travers les portails numériques individuels (page Facebook, compte Instagram, WhatsApp, twitter, Tik-Tok…), en plein essor, a favorisé une poussée de la classe populaire dans l'espace public longtemps contrôlé par l'élite. L'arrivée de ces nouveaux acteurs n'a pas fait que perturbé profondément les équilibres d'antan, elle est parvenue à inverser la configuration au sein des espaces publics. Passablement en phase avec les procédés de construction des identités numériques, les intellectuels ont de la peine de se créer une existence sur les réseaux sociaux, moyen de contrôle de l'espace public contemporain. Par conséquent, « l'homme de la rue » va asseoir son autorité dans le nouvel espace public.

Motsclés: médias numériques, espace public, classe populaire, élite (intellectuel), réseaux sociaux.

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Public Space in the Age of Social Media: Towards the Emergence and Conquest of Debate by the Working Class in Burkina Faso

L'espace Public À L'ère des Médias Sociaux: Vers une Émergence et une Confiscation du Débat par la Classe Populaire au Burkina Faso

Dr. Régis Dimitri Balima [α] & Jérémie Nion [σ]

Résumé- Les espaces publics africains connaissent de profondes mutations. Marqués par une grande ouverture, voire sa transformation ils soulèvent de nouveaux enjeux. Il a autorisé la prise de parole de nouveaux acteurs à travers les médias numériques, notamment les médias sociaux qui incarnent la brèche permettant la modification et l'installant d'une nouvelle ère. Au Burkina Faso, la révolution numérique, à travers les portails numériques individuels (page Facebook, compte Instagram, WhatsApp, twitter, Tik-Tok…), en plein essor, a favorisé une poussée de la classe populaire dans l'espace public longtemps contrôlé par l'élite. L'arrivée de ces nouveaux acteurs n'a pas fait que perturbé profondément les équilibres d'antan, elle est parvenue à inverser la configuration au sein des espaces publics. Passablement en phase avec les procédés de construction des identités numériques, les intellectuels ont de la peine de se créer une existence sur les réseaux sociaux, moyen de contrôle de l'espace public contemporain. Par conséquent, « l'homme de la rue » va asseoir son autorité dans le nouvel espace public. Si l'on peut saluer, dans l'esprit, cautionner cet effet de la révolution numérique qui, en favorisant l'émergence de la classe populaire instaure l'équité dans la prise de parole dans un état, les inquiétudes sont légitimes quand on observe la tendance à l'enraiement voire l'extinction de la voix de l'élite.

Le nouvel espace public burkinabè où prospèrent l'horizontalité, l'absence de hiérarchies où chaque utilisateur est maître de la méthodologie de son succès et où tous les chemins, y compris les plus méprisables, mènent à la notoriété pose le débat de la qualité. La révolution numérique irréversible, si elle ne parvient pas à apporter une plus-value au débat dans l'espace public burkinabè, elle ne doit pas le tirer vers le bas. L'intellectuel burkinabè doit en être le garant et doit parvenir à opposer à cette forme de diktat du numérique et à ses usages, une tropicalisation sur mesure qui va intégrer à la révolution toute son utilité publique.

Comment l'élite burkinabè peut-elle se réapproprier l'espace public face à l'intrusion tonitruante de la classe populaire (souvent analphabète ou peu instruite) grâce aux réseaux sociaux ? La théorie structuro-fonctionnaliste développée par Merton (1976) pour analyser les effets d'instabilité, de sensibilité aux problèmes sociaux et leur lot de déviance, d'anomie et de désorganisation des médias numériques sur la société burkinabè. La méthode quantitative a permis de mesurer efficacement l'analyse des données chiffrés issus de l'enquête de terrain pour ainsi infirmer ou confirmer l'hypothèse.

Motsclés: médias numériques, espace public, classe populaire, élite (intellectuel), réseaux sociaux.

I. Introduction

Les espaces publics africains connaissent de profondes mutations. Jadis réservés à l'intelligentsia, ce « *petit bataillon de grandes âmes vouées à une noble cause* » (Rouzic 2011), l'espace public contemporain se caractérise par sa grande ouverture, voire sa transformation au point que Cissé parle « *d'espace public défiguré* » (Cissé 2013). La prise de parole de nouveaux acteurs dans le cercle réservé de la prise de parole, à la faveur de l'arrivée des médias numériques, notamment les médias sociaux, constitue la brèche qui a occasionné une perturbation de l'espace public ouvrant une nouvelle ère. En effet, devenir acteur de cet espace public n'est plus sélectif. Au contraire, les médias numériques, à travers les réseaux sociaux, favorisent l'émergence d'une forme d'espace public, en tant que lieu d'échanges et de discussions entre individus, sans qu'il soit absolument question d'aboutir à l'idéal du consensus évoqué par Habermas (Habermas 1992b).

Les médias classiques qui étaient autrefois les artisans et les garants d'un espace public codifié qui réservent prioritairement leur préférence à l'élite semble aujourd'hui avoir perdu ce privilège. Les nouveaux médias, eux, favorisent l'envahissement de l'espace public par tout le monde et surtout « *les sans-noms* ». Les nouvelles technologies sont donc au cœur de bouleversements qui affectent la société burkinabè. C'est le cas depuis l'apparition des blogs et plus

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largement des applications du web 2.0 qui permettent à l'internaute de s'exprimer encore plus facilement que précédemment. Internet, contrairement à la radio ou à la télévision, met en situation d'égalité l'émetteur et le récepteur au point où nombre d'auteurs le perçoivent comme l'outil idéal pour une démocratie participative qui permet à tout citoyen d'intervenir très régulièrement dans le débat public (Adamic, Glance 2005; Lampe 2005; Paracharissi 2004; Price, Cappella 2002; Wall 2007; Wright, Street 2007). En apparence, les médias numériques facilitent l'expression démocratique sincère et directe renvoyant à l'origine de la terminologie et à sa tradition de débats publics dans les agoras de la Grecque antique (Amouretti, Ruzé, et Jockey 2018). Si la société se compose de personnes libres, la parole de tous mérite bien d'être prise en compte car la vérité semble se trouver dans le grand nombre: « *Vox populi, vox dei* » (Euvé 2016). Ce caractère d'équité qu'on croyait trouver à travers les réseaux sociaux ne semble pas si impartial qu'il ne le promet. Au Burkina Faso, il a créé une injustice pour en réparer une autre. On observe, de plus en plus, un mutisme, une perte du réflexe de la prise de parole des intellectuels poussant à questionner la qualité du débat public et le fonctionnement des médias numériques que génère l'espace public.

II. Problématique

Les portails numériques individuels (page *Facebook*, *Instagram*, WhatsApp, *twitter*, *Tik-Tok*…), en plein essor, constituent, de nos jours, ce cadre d'expression de la classe populaire. Les médias numériques ont libéré la parole. Chaque citoyen peut librement afficher ses opinions. Elle est frappée de caducité l'époque où les clés de l'espace public étaient détenues par les médias traditionnels qui en organisaient l'accès selon des règles bien édictées. Le nouvel espace public numérique est la négation du contrôle. Les réseaux sociaux se perçoivent comme « *une tribune libre où l'on vient s'épancher, prendre position, ferrailler avec les autres sur des sujets divers. Il contribue à l'émergence de modes nouveaux de prise de parole publique, favorise l'émancipation et la valorisation des singularités de manière plus ouverte, plus directe, plus participative* » (Atenga 2017:19).

Bien que ces nouveaux médias, à l'opposé des médias classiques, soient inclusifs par essence, c'est-à-dire, relevant d'un domaine accessible et ouvert à tous les citoyens, on y observe une diminution voire l'effacement de l'activité des intellectuels burkinabè. *Les réseaux sociaux, à travers l'horizontalité qui les caractérise, renversent indirectement le présupposé de* « la compétence politique » (Bourdieu 1991) *dans ce sens où ils laissent place à « ces nouvelles formes de débat public qui reposent sur un modèle de société plus démocratique où l'on considère que chaque individu possède des compétences effectives qui lui permettent de prendre place dans la discussion* » (Flichy 2010:626). *On assiste donc à une remise en cause de* compétence politique qui était loin de faire l'unanimité eu égard à sa *« définition à la fois arbitraire et légitime, c'est-à-dire dominante et dissimulée comme telle, de la politique. Cette compétence politique n'est pas universellement répandue. Elle varie grosso modo comme le niveau d'instruction* » (Bourdieu 1991). On observe donc une chute de privilège. Dans la reconfiguration de l'espace public qui en résulte, une correction de l'animation de la vie sociale s'opère. Ainsi, « *ces nouvelles formes du débat public reposent sur un modèle de société plus démocratique où l'on considère que chaque individu possède des compétences effectives qui lui permettent de prendre place dans la discussion. Cette démocratie qu'on pourrait appeler « démocratie 2.0 » n'est pas seulement associée à un nouveau dispositif technologique* » (Flichy 2010:626). On est tenté d'affirmer qu'avec l'arrivée des médias numériques, l'ère de l'abus de savoir (De Certeau et Wittgenstein 1978) où « *la volonté de vouloir convertir la compétence en autorité* » (Flichy 2010:626) touche à sa fin.

Aujourd'hui, il n'est pas superflu d'interroger la place des médias classiques burkinabè jusque-là considérés comme le quatrième pouvoir en complément de l'échelle des forces sociales démocratiques définie par Montesquieu face à la poussée des médias numériques. Le numérique semble se positionner comme un contre-pouvoir du quatrième pouvoir. En effet, « *les révolutions arabes ont montré de façon spectaculaire ce que l'on pressentait depuis quelques années : l'irruption des réseaux sociaux dans l'univers de l'information. (…).Tout se passe comme si aujourd'hui, dans la propagation de l'information, la presse et les médias en général se trouvaient dépassés par la capacité de tout un chacun de produire de l'information* » (Kessier 2012). L'hégémonie de la presse classique perd son lustre d'autant. Dans leur poussée, les médias numériques ont secrété un environnement dans lequel où « *on remet l'homme dans les conditions de l'oralité où chacun peut communiquer directement en devenant son propre média et être en quelque sorte un journaliste citoyen, alors qu'avant, cette activité était associée aux maîtres de l'écriture (calligraphes) et aux maîtres imprimeurs. Une élite qui avait le droit de porter l'épée comme tout bon aristocrate de la classe ouvrière. On semble ainsi revenir aux sources de la diffusion traditionnelle de transfert de l'information dans le champ de la communication directe grâce à la parole, par l'intermédiaire de chaque individu ordinaire* » (Orwell 1949), l'oralité au cœur de la conversation (Tarde 1993). Dans leur prise de pouvoir les nouveaux médias deviennent l'instrument direct de gestion de l'espace public.

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Au Burkina Faso, les réseaux sociaux sont devenus un mode de gouvernance. Le Ministre de la culture de la communication et des relations avec le parlement, porte-parole du gouvernement, Rémy Djandjinou déclarait, de façon imagée et ce, face à la montée en puissance d'activistes présumés instrumentalisés qui formataient une opinion hostile au gouvernement en place: « *si on vous boxe en dessous de la ceinture, vous n'allez pas boxer en dessous de la ceinture; vous allez chercher d'autres personnes pour boxer en dessous de la ceinture pour vous. C'est comme ça que ça fonctionne !* »[1]. Les médias numériques sont un instrument majeur dans la construction des espaces publics. La présence des réseaux sociaux et la force dissuasive qu'ils peuvent incarner dans la gestion de la cité poussent à repenser la notion de l'espace public, notamment, en interrogeant les nouvelles forces qui la configurent, sa valeur intrinsèque, mais également son mode de construction. La question au cœur de la présente recherche découle de ce constat. Elle s'élabore comme suit: en quoi les techniques de construction des identités des médias sociaux empêchent-elles les élites de se doter d'une identité numérique afin d'atténuer ou contester la tendance à la confiscation de débat public par la classe populaire?

Notre problématique, non seulement, questionne les rapports de forces qui s'expriment dans l'espace public mais surtout tente d'élaborer la qualité du débat dans ledit espace. On peut même se demander s'il n'y a pas un rapport étroit entre le niveau d'expérimentation de la démocratie dans un Etat et la manière d'utiliser les réseaux sociaux ? L'inconfort de l'élite face au mode d'emploi des médias n'est-elle pas source de dévoiement du débat public ? L'instauration de « l'horizontalité et l'absence de hiérarchies » (Manrique 2011) dans le nouvel espace public questionne la qualité du débat public. Umberto croit trancher le débat en déclarant que: « *les réseaux sociaux ont donné le droit de parole à des légions d'imbéciles qui, avant, ne parlaient qu'au bar, après un verre de vin et ne causaient aucun tort à la collectivité. On les faisait taire tout de suite alors qu'aujourd'hui ils ont le même droit de parole qu'un prix Nobel. C'est l'invasion des imbéciles* » (Umberto 2015), (op cit Pottier, 2020 p17). Mais le modèle d'espace public sous les ordres des médias classiques pouvait-il perdurer avec ses limites ? Ainsi, la poussée de la classe populaire afin de prendre une part active dans la construction de l'espace public est si forte et si irrésistible qu'il fallait repenser ledit espace. Il s'agit pour nous, de cerner le mal-être de l'élite contemporaine Burkinabè dans le processus de reconfiguration de l'espace public sous les ordres des nouveaux médias et d'en tirer les conséquences. Nous soutenons l'hypothèse qui affirme que la construction d'une identité dans la nouvelle espace numérique, du fait de ses contraintes, conditions et pratiques spécifiques enthousiasme passablement l'élite qui assiste ainsi à une confiscation du débat public par la classe populaire.

III. Cadre Théorique

Nous inscrivons cette étude dans la théorie structuro-fonctionnaliste développée par Merton (1976). Dans son approche, Merton a exploré plusieurs champs d'intérêt que nous pouvons organiser en axes suivants:

- l'attention portée aux éléments structurels, qui facilitent ou rendent difficile l'initiative de l'acteur;
- la sensibilité aux « *problèmes sociaux* », à la déviance, à l'anomie, à la désorganisation;
- l'intérêt passionné pour les thèmes de la connaissance, c'est-à-dire pour les rapports entre science et société.

Nous exploitons, pour structurer la présente, les deux premiers points centraux du structuro-fonctionnalisme par lesquels l'auteur (Merton 1957) porte un regard analytique sur la liaison entre le système social et la science dans une relation dialectique qui nous livre une clé pour questionner les valeurs de la communauté scientifique en interaction avec les valeurs dominantes du système social. Il en découle des résultats souvent imprévisibles. En outre, et c'est la quintessence de la pensée mertonienne (1957), l'institution scientifique comme toute autre organisme génère, en lui-même, systématiquement et simultanément, des valeurs incompatibles.

A la faveur de l'évolution technologique, les TICs, principalement les réseaux sociaux, simplement constituent un facteur d'apparition ou d'amplification des situations d'imprévisibilité. Les élites burkinabè notamment les membres de la communauté scientifique, attendues à la pointe de l'appropriation et de maîtrise des médias numériques afin de servir de guide à leurs contemporains semblent plutôt réduite dans un rôle de victime résignée. La part d'imprévisibilité revêt une dimension perverse. En effet, l'inconfort des élites contraste avec l'aisance de la classe populaire face aux outils technologiques et précisément les médias sociaux. Attendue à la pointe des nouveaux médias, l'intelligentsia burkinabè apparaît recalée et devancée par les couches populaires.

Aussi, le leadership de l'élite dans la promotion des médias numériques au Burkina Faso est également entamé du fait de l'effet de ce que Merton (Merton et Barber 2004) nomme la sérendipité qui désigne l'apparition d'une donnée inattendue et anormale. La sérendipité qui comporte une part imprévue peut se présenter comme une conséquence des conditions

[1] Rémi Djaunguinou déclaration faite lors de l'émission de télévision, Le tribunal de l'actualité de la chaine de télévision privée burkinabè, 3TV, le 19/09/2019.

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sociales, la réceptivité et la sagacité affichée au bout de l'échelle. Le degré d'usage des médias numériques révèle une anomalie, une difformité, une remise en cause. La faible présence de l'élite dans les médias numérique, reflet de leur degré de sensibilité aux dits médias, ouvre la porte à la déviance, à l'anomie pour finalement provoquer une remise en cause de l'organisation la société en place. Ainsi l'ascendance de la classe populaire grâce aux nouveaux médias nous permet de d'apprécier la place des intellectuels dans le débat public. Elle vient en contradiction de la théorie d'espace public de Habermas (1992) favorisant ainsi l'émergence d'un nouvel acteur (l'homme de la rue) sonnant le glas de la théorie du « *two flow stepp* » (Katz et Lazarsfeld 1955). Ce qui stimule la curiosité, ouvre les portes de la recherche et oblige à formuler de nouvelles pistes de réflexion.

IV. Démarche Méthodologique

La méthodologie de travail choisit prend appui sur l'étude quantitative. En vue de récolter des données chiffrées pour l'analyse, un questionnaire a été élaboré et administré dans les quatre principales villes du Burkina Faso (Ouagadougou, Bobo-Dioulasso, Banfora, Ouahigouya) du 15 avril au 10 mai 2023.

A cet effet, nous avons formé un échantillon sur la base de la technique d'échantillonnage probabiliste (Dépelteau 2000). Ce sont 105 individus dont 64 hommes et 41 femmes qui ont été choisis aléatoirement pour constituer l'échantillon. Notre sujet portant l'analyse de l'appropriation des intellectuels vis-à-vis des réseaux sociaux, notre population est circonscrite aux individus totalisant au moins quatre années d'études après le baccalauréat. Pour définir l'échantillon, nous avons choisi fortuitement 25 enseignants d'université qui constituent le plus gros contingent des sondés. L'université étant l'antre du savoir, nous y avons réservé la majorité de l'échantillon persuadé minimiser ainsi les marges d'erreur. Nous avons questionné quinze (15) avocats ou magistrats, quinze (15) officiers supérieurs des forces armées nationale au regard de la spécificité de ces corps, quinze (15) médecins car ils entretiennent, à travers les réseaux sociaux une relation avec leurs patients. Vingt (20) journalistes ont été sondés car leur corps de métier est directement menacé par les réseaux sociaux et quinze (15) cadres de l'administration publique afin de garantir à l'échantillon une diversité certaine.

Le questionnaire administré l'a été soit par contact direct soit par voix d'internet. Les données ainsi collectées ont été dépouillées et traitées manuellement au regard de la taille assez faible de l'échantillon. Il a été élaboré sur la base des variables suivants:

- Expositions aux réseaux sociaux qui prend en compte le temps-mis, les fréquences de publications, le niveau d'interactions qui permettent de juger de l'impact d'une présence sur les réseaux sociaux.
- Les fortunes diverses de l'élite sur les réseaux sociaux qui résument les mécanismes de construction des personnalités sur les réseaux sociaux, les épreuves rencontrées et les niveau de performance de l'élite en la matière.

V. Profil bas des Intellectuels Dans L'espace Numérique Burkinabè

Les résultats de l'enquête dressent un tableau qui confirme un fait : le monde des intellectuels affiche une présence attestée dans l'espace public numérique. A preuve, l'ensemble des enquêtées (105 sur 105) déclarent posséder une identité numérique. Sur cette base, on peut en déduire que le milieu des intellectuels n'oppose pas une hostilité face à la montée en puissance des supports de communication numériques. Notamment, la classe des intellectuels n'est pas abonnée absente sur les réseaux sociaux. Notre enquête révèle que l'ensemble des individus de l'échantillon possèdent au moins un compte privé à défaut d'en avoir plusieurs. Ainsi, sur les 105 sondés, 99 ont créé leur fenêtre sur la plateforme numérique *facebook*. Sur *Messenger*, on retrouve 93 sur les 105 enquêtées tandis que tous possèdent un compte *Whatsapp* (105 sur 105); 42 sur 105 des sondés disposent d'un compte *Tik-tok*, 30 sur 105, un compte Instagram, 12 sur 105, un compte *Youtube*, 8 sur 105, un compte *Hashtag* et 3 sur 105 autre compte.

Mais cet enthousiasme apparent mérite d'être tempéré quand l'on considère la variable « *temps d'exposition aux réseaux-sociaux* » de l'enquête. En effet, le temps mis est un signe de l'activisme du titulaire d'un compte. A ce propos, force est de constater que 64% de l'échantillon consacre 1 heure par jour en moyenne dans l'espace public numérique. 19% évaluent leur usage journalier des réseaux sociaux à 2 heures contre 11% pour 3 heures et 6% pour 4 heures et plus. Le temps est un facteur d'appropriation des réseaux sociaux mais la construction d'une forte identité combine nécessairement le temps mis à l'aptitude de l'usager à interagir.

En analysant les centres d'intérêt des intellectuels que l'enquête révèle, à travers l'étude, on peut consolider l'argumentaire qui tend à soutenir que l'intellectuel burkinabè occupe un strapontin dans le nouvel espace public. A la question de savoir quel sujet suscite une interaction de la communauté intellectuelle sur les réseaux sociaux, il ressort que les thèmes portant sur la politique ne recueillent qu'un faible avis (17 voix sur 105). 23 sur 105 avouent interagir sur les sujets d'ordre professionnel, 38 sur 105, les sujets sportifs, 37 sur 105, les sujets d'ordre social (mariage, décoration, anniversaire et deuil), 5 sur 105, la musique et 3 sur 105 pour autres sujets. On observe globalement

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que sur l'espace public numérique, la communauté des intellectuels esquive les sujets d'une sensibilité avérée au profit des thèmes qui n'appellent pas la polémique. La variable « *facteur redouté* » lors de l'utilisation des réseaux sociaux confirme cette tendance où les enquêtés semblent perdent toute sérénité quant à l'utilisation des réseaux sociaux. La hantise des intellectuels de l'espace public numérique est nourrie par le sentiment de climat austère qui s'y prospère.

L'enquête démontre que 67% de l'échantillon a déjà été victime bizutage a été malmené sur les réseaux sociaux soit en réaction à une intervention sur la plateforme numérique, soit à la suite d'une prise de parole sur les médias traditionnels qui a fait l'objet d'une reprise sur les nouveaux médias. Ainsi, l'étude révèle que 31 sur 105 personnes a été victime d'injures et des propos haineux, 45 sur 105 personnes interrogées ont subi des propos déplacés, 4 sur 105 personnes ont fait face à des moqueries. On peut donc aisément comprendre que les réseaux sociaux, singulièrement, et l'espace des médias numériques burkinabè, dans l'ensemble, se présente comme une jungle particulièrement hostile à la classe des intellectuels qui s'accommode mal « *des débats de chiffonnier* » où tous les coups sont permis. D'ailleurs, très peu, selon les résultats de l'enquête y possède de grandes audiences. 94% des sondés évalue leur audience à moins de 5000 followers contre 6% qui compte entre 5000 et 10 000 followers. L'écrasante majorité ne peut donc pas être considérée comme des influenceurs de renom (Virfollet 2018). En effet, l'auteur distingue les macro-influenceurs qui sont ceux totalisant un minimum d'abonnés dépassant 100 000 tandis que les micro-influenceurs sont ceux qui totalisent un nombre d'abonnés oscillant entre 10 000 et 100 000. Les méga-influenceurs comptent plus de 1 million d'abonnés alors que les nano-influenceurs sont ceux qui ont moins de 100 000 followers. La grande majorité de l'élite burkinabè qui totalise moins de 5000 abonnés ne peuvent, tout au plus, que faire partie du groupe des nano-influenceurs.

En effet, cette notoriété se construit. Et dans un espace public comparable à un « *no man's land* » les esprits cartésiens peu enclins à recourir à « *la théorie de la fin justifie les moyens* » (Martinez 2012) reste, logiquement, à la traîne. Ainsi, l'enquête atteste que les milieux des intellectuels sont hostiles « *au buzz* ». 100% des personnes sondées disent réfuter une telle pratique et ne sont pas aptes à s'exposer afin de construire une popularité sur les réseaux sociaux. Rejetant les moyens efficaces utilisés par les usagers des espaces numériques pour acquérir de meilleures audiences, les intellectuels se privent de tous moyens d'avoir une place au soleil dans l'espace public numérique. C'est donc logiquement justifié que 71% des enquêtées avouent n'avoir pas d'autorité sur les réseaux-sociaux confirmant ainsi notre hypothèse.

VI. Les Médias Numériques Autrement

Dans la tracée de « *la nouvelle frontière de notre espace public* » (Guiton 2019), le numérique a rebattu les cartes. L'enquête permet de conclure une incompatibilité, ou du moins, un mal appropriation de l'élite burkinabè dans l'animation de l'espace numérique. En conséquent, on peut penser que l'intelligentsia a quasiment perdu la main sur le débat public. Ainsi, le monopole du débat n'est plus l'apanage prioritaire d'une classe d'érudits et d'éclaireurs. Car le numérique a ouvert l'ère de la désacralisation de l'espace public en promouvant « *l'horizontalité et l'absence de hiérarchie* » (Manrique 2011).

La possibilité offerte à chacun de s'exprimer en ligne a produit un « *pluralisme démocratique radicale* » (Badouard 2018). Les réseaux sociaux et les médias numériques en général, ont réussi un reformatage de l'espace public au Burkina Faso qui est devenu un lieu de confrontation qu'aplanissaient, auparavant, les « *gatekeepers* » (Guiton 2019). Les dépositaires de la parole public d'antan installés dans un confort méthodique et protégés par des codes et une éthique semblent aujourd'hui dépassés, largués face au « *business model idiot* » (Abiteboul et Cattan 2020:37) que Abiteboul et Cattan associent aux supports numériques. En effet, longtemps considérés comme la chasse gardée de l'élite, les réseaux sociaux ont réussi à se transformer en un outil de spoliation ou de dépouillement des anciens dignitaires de leur droit exclusif à la parole, à l'élaboration de la pensée et du savoir au Burkina Faso. Pour parvenir à inverser la tendance, l'espace public numérique a été le théâtre de la discrimination positive en faveur des masses populaires qui vont faire mieux que refaire leur retard.

Dans la « *nouvelle agora* » (Flichy 2008) burkinabè, il va émerger une nouvelle force d'influence et de proposition que constitue le groupe de population surnommé les « *Millenneials* » (Frau-Meigs 2017). Théoriquement, l'accession à ce groupe n'est pas sélective. A preuve, l'élite burkinabè comme le démontre l'enquête est bel et bien présente sur les réseaux sociaux, et théoriquement, elle peut se considérer comme membre du groupe. La question essentielle porte sur le poids a elle accordé. En effet, il est établi que la moyenne critique pour acquérir une notoriété sur les réseaux sociaux se situe à partir de 3 heures d'usage quotidien (Asselin 2017). C'est un engagement proche de l'addiction[2]. Les intellectuels burkinabè, pour une large majorité, conformément à l'enquête, n'entendent pas consacrer plus d'une (01) heure par

[2] Sur le temps passé sur les réseaux sociaux, le site Statista.com fait état d'une moyenne mondiale passée de 90mn en 2012 à 130mn en 2016 selon une étude sur la question en 2016.

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jour aux réseaux sociaux. En refusant de prendre le risque d'être « *accro* » à l'usage du numérique, l'élite fragilise son impact et sa voix porte faiblement. La faiblesse de l'assiduité des intellectuels sur les réseaux sociaux dans l'espace numérique couplée, comme l'attestent les résultats de l'enquête, à leur passivité achève d'indiquer que cet outil les échappe. En effet, « *il est important de partager régulièrement du contenu sur internet ainsi que d'interagir avec leurs réseaux et partager leurs avis et ressentis sur leur quotidien* » (Asselin 2017) afin de réussir la création d'une identité de référence dans le milieu.

L'identité et la notoriété dans l'espace public requièrent un apport individuel et soutenu. La construction de la personnalité numérique pousse à l'usage de méthodes qu'on peut qualifier de peu orthodoxes situées à la lisière de la « *para-légalité* » (Dumont et El Berhoumi 2020). Ainsi, des formats courts, des slogans, des phares choc, des images sont la règle. Et comme souvent cela ne suffit pas, au nom d'une quête effrénée de « *followers* », on invente des histoires, des ragots, des bobards, à faire émerger des complots. « *Le modèle d'affaire des réseaux sociaux est essentiellement fondé sur la publicité. Que cela soit justifié ou non, un tel modèle incite à une exploitation forte de nos données personnelles et un profilage toujours plus important* » (Abiteboul et Cattan 2020:37). Les publics en réseau étant essentiel au processus « *d'audienciation* », *(c'est-à-dire à leur propre construction en tant qu'audience » (Blondeau et Allard 2007)*, il faut plaire, séduire. La complicité du public est l'unique condition pour se hisser la visibilité à un haut lieu. Ces méthodes d'action dont l'efficacité est proportionnelle à leur propension à défier les normes sociales, à provoquer (Bergami et Barbosa 2017) ne sont pas séduisantes pour les esprits cartésiens.

Les facteurs temps et les risques d'abus amènent l'élite « *à freiner des quatre fers* » préférant préserver sa lucidité et rejeter les risques d'addiction. Elle cède ainsi le terrain dans l'espace numérique face à des « *Millenneials* » (Frau-Meigs 2017) qui, eux, ne reculent devant rien. Ni l'exigence de temps, ni le niveau et la qualité des contenus ne semble les ébranler. Ils affirment ainsi leur autorité sur l'espace numérique et contrôlent désormais l'espace public. Laisser donc entre des mains peu habiles, les réseaux sociaux ont transformé l'espace numérique et l'espace public en un véritable dépotoir. Toutes ces applications révolutionnaires qui ont vite fait de conquérir le cœur de milliards d'utilisateurs, à travers le monde, se révèlent de fausses promesses. En effet, à leur naissance, ces réseaux sociaux, au premier regard, inoffensifs, se sont transformés en de véritables menaces pour la démocratie et deviennent désormais le lieu de mélange explosif de « *fake news* », de propagandes conspirationnistes, de haines de violence, de manipulations politiques et d'amplification de l'ignorance.

L'objectif n'est pas de blâmer ou balayer du revers de la main les médias numériques au nom du principe sacro-saint de la préservation d'un espace public authentique. D'ailleurs, au Burkina Faso, sous l'impulsion des médias sociaux, une dynamique sociétale s'observe. Ces espaces publics dressent et lèvent des foules autour des causes nobles et justes. Grâce aux nouveaux moyens de communications, « *les sans noms* » d'hier nourrissent une opinion et réussissent des victoires dans des luttes que l'espace public, alors sous contrôle de l'élite, ne permettait pas d'enregistrer, certainement pas de la même manière. Les réseaux sociaux, au Burkina Faso, peuvent se percevoir comme la forme la plus aboutie de la liberté d'expression que tous les démocrates appellent de leurs vœux. Le numérique ayant réussi la prouesse d'offrir, à tous et à toutes, le droit d'être entendu et de sortir une majorité jadis silencieuse de l'anonymat, ce serait leur faire un mauvais procès que de les vouer aux gémonies. *« Il est cocasse de penser que l'espace politique d'avant n'était pas polarisé, que les publics ne s'exposaient pas à des médias qui correspondaient à leurs préférences idéologiques ou de croire que ce sont les réseaux qui ont créé des bulles informationnelles* »[3].

Cependant c'est un euphémisme que de dire que les réseaux sociaux ne sont pas tous voués au bien de l'humanité (Abiteboul et Cattan 2020). Laisser les réseaux sociaux déployer librement leur autorité suppose de faire la place également à leur côté obscur et, en conséquence, courir le risque de payer le lourd tribut pour n'avoir pas su maîtriser « *l'expression débridée de nos désirs; de nos pulsions, en abandonnant la sphère publique à un business model faisant de l'humain une machine* » (Abiteboul et Cattan 2020:36). Il appartient à l'élite de questionner les réseaux sociaux mais surtout d'interroger son positionnement actuel vis-à-vis de cette pointe technologique qu'est le numérique afin de la bonifier, de la perfectionner voire l'orienter au service de l'intérêt général. Face à l'impossibilité d'arrêter le pouvoir du numérique dans notre monde, il incombe aux intellectuels, face à « *la bête* » de sortir de leur torpeur pour ainsi contribuer à la dompter et lui donner un visage plus humain.

Il serait donc incongru pour nous de souscrire à une ligne de défense, si celle-ci existe, en faveur d'une communauté de privilégiés au motif qu'elle en était le dépositaire exclusif d'une science infuse et diffuse. Il ne s'agit pas non plus « *de regretter le passé et les farouches caudines des gatekeepers d'hier* » (Guiton

[3] Dominique Cardon: Ce ne sont pas les réseaux sociaux qui ont créé des bulles informationnelles. In Lemonde.fr du 21/10/2018

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2019:29). Mais il revient à l'élite de dégager les mécanismes pour contribuer à freiner les abus et déviances associés à l'usage des réseaux sociaux. Au regard du caractère irréversible de la révolution numérique, il faut minimiser ses effets pervers et accroitre ses biens faits. Pour éviter de clouer au pilori les réseaux sociaux, il nous faut monter qu'il est possible de faire autrement.

La problématique telle qu'elle que soulevé par les médias numériques est l'apanage des Etats de démocratie naissante. Les démocraties avancées semblent connaître d'autres types de réalités liés en la matière. En Europe par exemple, « *il n'est ainsi pas rare de lire que des sites tels que Twitter ou Facebook permettraient aux hommes et femmes de l'élite politique* » (Roginsky 2015) de renforcer leur présence dans l'espace numérique aux fins de « *communiquer directement, continuellement et sans restriction avec le public* » (Roginsky 2015) dans l'optique de se soustraire des contraintes liées aux « *processus de sélection, cadrage et interprétation par les journalistes ou du financement du parti et de ses activités* » (Graham et al. 2013). Toutefois, si l'élite européenne mieux suivie ne boude pas les réseaux sociaux à l'image de ce qui semble s'annoncer pour les intellectuels africains, sa forme d'exploiter des réseaux sociaux n'est pas pour autant la mieux élaborée. L'utilisation qui en résulte est inappropriée (Di Fraia et Missaglia 2014) autrement dit ils les exploitent plus comme un média de masse que comme un média social étant donnée qu'ils éprouvent un malaise devant le « *style Web 2.0 de la communication* » (Jackson et Lilleker 2009) en refusant de soutenir les situations d'interaction en ligne avec les citoyens (Small 2010).

L'Europe a rendu son espace public sous l'ère du numérique équitable d'accès grâce à une légifération. Au Burkina Faso, les réseaux sociaux ont longtemps évolué dans un champ sauvage échappant à tout système. Il a fallu attendre 2023 pour observer un timide intérêt du législateur pour l'espace numérique à la faveur de la révision de loi organique portant attribution, composition, organisation et fonctionnement du Conseil supérieur de la communication qui stipule à son article 2 que l'autorité du Conseil supérieur de la communication s'étend sur les contenus des sites de blogueur, d'activistes ou d'influenceur disposant d'au moins 5 000 abonnés en ligne. Les publications qui en découlent sont soumis aux mêmes lois que celles appliquées aux contenus des médias. Ce dispositif juridique semble assez léger pour assainir un secteur aux enjeux si énormes. Le législateur en voulant réguler les médias numériques comme les médias classiques est loin d'assurer la meilleure couverture, au regard de la spécificité des deux secteurs.

Une règlementation spécifique, traduite par une loi consacrée au champ du médias numérique, s'avère une nécessité impérieuse pour sécuriser tous les usagers. Les réseaux sociaux sont si présents, si envahissant pour notre société au point où il est difficile de comprendre qu'ils ne trouvent pas encore un intérêt du juge. A l'image des démocraties avancée, le Burkina Faso peut pacifier son espace publicitaire numérique par l'adoption de loi qui définira les droits et les devoirs, les prérogatives et les limites de chaque burkinabè pour ainsi minimiser les abus.

Mais le cadre juridique seul ne suffit pas pour corriger les intempérances qui caractérisent l'espace publicitaire du fait de la mauvaise appropriation des médias numériques. Il est primordial que les intellectuels burkinabè sortent du bois et prennent la responsabilité qui sont la leurs. On observe, dans certains milieux de l'élite des tentatives de répliques. Des groupes fermés dont l'entrée très sélectif permettent de créer des micro-espaces publics où les membres peuvent s'exprimer à l'abri des réactions inappropriées. Mais, en « *prêchant les convaincus* », on réalise combien cette forme de résistance développé par les intellectuels présente des limites. Le rôle de l'élite est de contribuer à ce que dans ce siècle présent les lumières ne laissent pas de place à l'ombre (Galand 2005), c'est dans l'espace public ouvert qu'elle est le plus attendu. Les réseaux sociaux sont semblables à un champ de jeu dont il faut maîtriser les règles pour un meilleure utilisation. En matière d'interaction par exemple, si on ne peut pas éviter les avis à tendance péjorative, il est possible, en jouant bien le jeu, « de noyer » le négatif dans le positif. Du reste, la vassalité est caractéristique des pratiques en matière de réaction. Plusieurs usagers sont influencés par ce qu'ils lisent et leur réaction s'alignent sur la tendance globale. Les messages négatifs appellent donc d'autres messages négatifs, idem les messages positifs. En vertu de « *la loi des grands nombres* » (Godin 2022), il suffit donc aux intellectuels de faire dominer, dans les réactions, les messages positifs pour imposer l'orientation souhaitée. Ainsi, au lieu de fuir les réseaux sociaux, l'élite doit faire preuve d'une solidarité agissante dans la réflexion positive afin de parvenir à assainir l'espace public en réduisant, à sa plus simple expression la portion congrue de la nullité sur les réseaux sociaux. A l'état, en dehors du système, il semble moins possible de l'impacter.

VII. Conclusion

Le numérique a grandement impacté l'espace public burkinabè. Bousculée, heurtée et vilipendée, l'élite locale redoute de plus en plus l'usage des médias numériques dans l'animation du débat public. Refusant d'utiliser le langage à succès sur les réseaux sociaux, les intellectuels burkinabè y ont perdu la main en observant une attitude passive. Face à un pouvoir, de jour en jour grandissant des médias numériques dans la gouvernance de nos sociétés contemporaines, l'élite, jadis considérée comme le phare dans les

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communautés est désormais reléguée en seconde zone. La qualité du débat a été fortement dégradée exposant la société ce qui n'est pas sans constituer des sources de menaces pour la société entière.

Le législateur qui jusque-là est resté indifférent aux dérives du monde du numérique est plus que jamais interpellé. Sans arsenal juridique approprié, il sera difficile d'organiser, d'assainir et de pacifier le débat public à l'ère du numérique. Mais l'élite qui fait montre d'une passivité coupable est tout aussi responsable de la dérive associée au numérique. Le laisser faire amplifie, de jour en jour, la médiocrité du débat public. Pour redorer le blason des intellectuels déteint sous l'effet de la pression de la nouvelle vague de penseurs Millennials et espérer ainsi rééquilibrer les débats dans l'espace public contemporain, l'intellectuel burkinabè doit connaître les règles du jeu afin de parvenir à dompter les réseaux sociaux et reprendre sa place. Ce qui n'est ni plus moins que le rôle qui l'échoit dans la société.

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Um, Vírgula: Um Pedido aos Criadores de Evidências Quantitativas em Políticas Educacionais

By Dr. Valdoir Pedro Wathier
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Resumo- O objetivo deste ensaio é discutir alguns riscos e potencialidades associados à onda atual da chamada ciência de dados, que prolifera inferências e prescrições nos mais diversos campos, reverberando, inclusive, nas políticas educacionais e contribuindo para o descaso com nossas desigualdades mais evidentes. Metodologicamente, trabalhou-se comparativamente com as técnicas de cálculo numérico, com sua aritmética de Ponto Flutuante, que expressa e decide sobre erros na transposição de um número (matemático) para um registro de computador (digital). A partir disso, a análise é argumentativa e exemplificativa. Por fim, propõe-se que a redução ao dado, ou à unidade, seja explicitada, caso contrário, lança-se dúvida sobre a confiabilidade dos estudos. Por outro lado, a explicitação permite ao leitor uma interpretação consciente e apropriada das evidências, que serão sempre limitadas e parciais.

Palavras-chave: *ciência de dados, evidências, políticas educacionais, inteseccionalidade.*

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Um, Vírgula: Um Pedido aos Criadores de Evidências Quantitativas em Políticas Educacionais

One, with an Asterisk: A Request to the Creators of Quantitative Evidence in Educational Policies

Dr. Valdoir Pedro Wathier

Resumo- **O objetivo deste ensaio é discutir alguns riscos e potencialidades associados à onda atual da chamada ciência de dados, que prolifera inferências e prescrições nos mais diversos campos, reverberando, inclusive, nas políticas educacionais e contribuindo para o descaso com nossas desigualdades mais evidentes. Metodologicamente, trabalhou-se comparativamente com as técnicas de cálculo numérico, com sua aritmética de Ponto Flutuante, que expressa e decide sobre erros na transposição de um número (matemático) para um registro de computador (digital). A partir disso, a análise é argumentativa e exemplificativa. Por fim, propõe-se que a redução ao dado, ou à unidade, seja explicitada, caso contrário, lança-se dúvida sobre a confiabilidade dos estudos. Por outro lado, a explicitação permite ao leitor uma interpretação consciente e apropriada das evidências, que serão sempre limitadas e parciais.**

Palavras-chave: ciência de dados, evidências, políticas educacionais, inteseccionalidade.

I. Introdução

Este trabalho trata de evidências derivadas da ciência de dados para políticas educacionais na realidade brasileira. O problema abordado é de que a geração de múltiplas evidências, tratando das mais diversas questões, pode gerar dispersão de questões essenciais, que perduram como fatores crônicos de desigualdade na garantia do Direito à Educação. Tal discussão é especialmente oportuna em razão da massificação do uso da Inteligência Artificial (IA) para gerar evidências relativas a políticas públicas. A relevância é configurada pela proposição de mecanismo para garantir que os fatores predominantes nas questões sociais do Brasil não sejam deixados de lado sem que isso repercuta na confiabilidade do estudo ou proposta de evidência.

Foram Definidos os Seguintes Objetivos: i) discutir técnicas que a matemática utiliza para tratar as perdas de informação e dimensionar erros quando ocorre a transição da matemática (abstrata) para o dado (digital); ii) argumentar que, na construção de evidências para políticas educacionais, é necessário explicitar os erros decorrentes da perda de informação quando se transpõe a realidade para o dado; iii) analisar a potencialização do uso de evidências em razão da massificação da inteligência artificial; iv) propor mecanismo de análise da razoabilidade de evidências, quando tratam de questões educacionais na realidade brasileira.

O Brasil possui história particular e dela decorre a persistente desigualdade estrutural do país. Quando nos afastamos deste conhecimento, são frustrados muitos esforços para reduzi-la, a qual segue amparada por nosso modelo social e mental. Como alerta Morin (2014), pensar reformas exige que primeiro se reforme o pensamento. Sem uma nova perspectiva cognitiva, as propostas de interpretação ou de mudança social serão pensadas a partir dos mesmos modelos que construíram a desigualdade. Isso apenas fará com que ela perdure como problema público (Oliveria; Silva, 2019; Silveira; Palomo, 2023).

O papel das políticas públicas é tratar de problemas públicos e, para isso, é preciso analisar as grandes questões e modelos hegemônicos ou emergentes, sendo que, para essas identificações "nitidez não é uma opção" (BALL, 2014, p. 44). Sem a compreensão das bases de problemas públicos, os esforços tendem a tratar de aspectos decorrentes do problema, não dele propriamente.

Em razão do dissenso de opiniões e perspectivas para a configuração de políticas educacionais, há forte movimento para que sejam utilizadas evidências produzidas em estudos específicos, ou em precedentes da experiência internacional, a despeito de especialistas alertarem para o equívoco de transposições simplificadoras no campo da Educação Comparada (Bray et. al., 2015; Wathier, 2016). Evidências correspondem a constatações objetivas, em regra, baseadas em vasta gama de dados. Tais assertivas são caracterizadas pela "curiosa e ao mesmo tempo reveladora mescla de descrição e prescrição" (Ball, 2011, p. 103).

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Consideremos a política pública como um "fluxo de decisões públicas, orientado a manter o equilíbrio social ou a introduzir desequilíbrios destinados a modificar essa realidade" (Saravia, 2006, p. 28). Em seguida, reconheçamos que o Brasil equilibra (sustentado e sustentando) a desigualdade crônica. Portanto, é essencial praticar políticas que gerem desequilíbrios, a fim de viabilizar efetivas reorganizações. Para isso, análises elementares e conhecimento mínimo da história brasileira trazem robustas evidências de bases que combinam racismo, machismo e desigualdade socioeconômica (Matias; Barros, 2022), na qual é essencial incluir renda e patrimônio. Apesar das fortes narrativas em relação à importância de adotar políticas baseadas em evidências, muitas vezes a seleção das evidências que serão consideradas parece negligenciar a relevância desses aspectos.

A proposta deste artigo requer questionar se, nesses casos, o que se está apresentando são evidências para aprimorar a política pública, para justificar crenças precedentes, ou para camuflar a manutenção do *status quo*. Há conhecimento suficiente dos problemas estruturais crônicos, o que torna inadmissível desconsiderar os fatores (múltiplos e conjuntos) de nossa desigualdade. Buscar outros conhecimentos é saudável, desde que o deleite de aplicar técnicas requintadas e linguajar rebuscado não seja utilizado como subterfúgio para desconsiderar questões essenciais de nossa sociedade.

A partir dessa problemática, nossa contribuição, aqui, é desenvolver uma análise que coloque em diálogo a perspectiva social e os mecanismos da matemática, apresentando técnicas que ela própria adota para gerir as perdas de informação e, por consequência, os erros causados pela transposição do número abstrato para o dado. Em seguida, problematizaremos o movimento da realidade para o dado, analisando o quanto a inteligência artificial pode potencializar erros de análise. Por fim, propomos uma estratégia para gerir os erros de evidências quando não se consideram fatores essenciais, ao menos quando aplicadas à realidade brasileira.

a) *De Onde Partimos*

Para este ensaio, dois termos são essenciais: o de evidência e o de interseccionalidade, ambos especialmente quando associados a políticas educacionais. Tais termos estão em voga no debate nacional e internacional, sendo que sua intersecção é um terreno de tensões e disputas, explicitando a complexa governança das políticas educacionais (Saura; Adrião, 2024; Bortot; Da Silva Scaff, 2023; Sakata, 2023).

Levantamento do estado da arte mostra que há diversas análises acerca da relevância e da criticidade do tema de políticas baseadas em evidências, sobretudo quanto aos critérios de construção e interpretação. A temática é abordada por diversas perspectivas no cenário global (Souza et al., 2021; Howlett et al., 2022; Camargo; Yonekura, 2023; Oliveira; Pereira, 2024; Lichand; Christen, 2020).

Estudos situados no Brasil abordam desde a necessidade de definição conceitual (Pinheiro, 2020), passando pelos desafios metodológicos (Fernandes; Senhoras, 2022), até efeitos de questões específicas como exclusão digital (Sorj; Guedes, 2005), trajetórias educacionais (Soares; Alves; Fonseca, 2021), o Ensino Médio (Silva; Carvalho, 2024), informática na educação (Bittencourt; Isotani, 2018), recursos educacionais para estudantes do espectro autista (Andrade et al, 2024), relação entre financiamento e desempenho (Panassol, 2020), fechamento de escolas do campo (Dos Santos, 2025), educação socioemocional no ambiente escolar (Da Silva et al, 2025). De mapeamentos (De Souza; Dos Santos Silva; Nunes, 2020) a análises críticas (De Faria, 2022), percebe-se um tema em pauta e um consenso distante. Além das essenciais discussões sobre o fato de que ao tempo que não se pode colocar resultados quantitativos em pedestais, também não se pode avançar em políticas com pensamento baseado em negacionismo científico, como alerta Da Costa (2024), em razão de correntes conservadoras no Brasil e no mundo.

No contexto internacional, distintos agentes, das mais diversas perspectivas, têm investigado a interseccionalidade (Clacso, 2022; Corrigan et al., 2023; OECD, 2023; Prior et al., 2022), fato que demonstra a força do conceito. No Brasil, a discussão também é presente, ao se tratar de políticas públicas, incluindo as educacionais. Abordagens construídas por diferentes perspectivas trazem em comum o reconhecimento da interseccionalidade (Dias, 2022; Faria, 2022; Farranha; Silva, 2021; Fonseca, 2024; Henriques, 2015; Oliveira; Valentim, 2023; Santos et al., 2023; Silveira; Nardi, 2017).

Com isso, parece-nos que os autores têm assimilado a perspectiva interseccional como um fator de credibilidade, no entendimento de que ignorá-la é fragilizar seus estudos. Tem-se, assim, o reconhecimento de Crenshaw (2002) ao apresentar a interseccionalidade como uma ferramenta analítica que ajuda a compreender como diferentes formas de discriminação se sobrepõem e se reforçam mutuamente.

A premência destes dois conceitos, oriundos de diferentes correntes, leva à necessidade de análise crítica quanto à interação, de modo que técnicas de ciência de dados reconheçam a relevância da interseccionalidade, ao invés de ofertarem múltiplas outras variáveis potencialmente explicativas, essencialmente por serem as que estão presentes nos dados de curtas séries históricas. O'Neil (2016) mostra como modelos matemáticos imprecisos podem se

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tornar armas de destruição algorítmica, ao codificar e perpetuar desigualdades estruturais.

Como já defendemos antes, trata-se de ferramentas, cujas finalidades assumidas são outras, mas que podem se converter em armas a depender do uso que fazemos delas. Tal tipo de ferramenta é também chamado de arma branca. A ciência de dados pode facilmente converter-se em uma arma branca (Wathier et al, 2023), ainda que em outra acepção, pois, como enfatizam Garcia e Silva (2023), a omissão desses fatores nas análises computacionais pode constituir um racismo algorítmico silencioso. Noble (2018) explicita que os algoritmos operam sobre bases de dados enviesadas, o que frequentemente resulta em reforço de estereótipos sociais.

Apontamentos feitos especialmente por pesquisadoras indicam a relevância de aspectos que, em geral, não estão comportados nos dados. Como exemplo, podemos citar que a ausência de uma metaética feminina na IA pode agravar lacunas de responsabilidade ética (Siapka, 2023), ou que múltiplas opressões interseccionais refletem na solidão da mulher negra, as quais são negligenciadas pelas análises objetivas (Mizael, Barrozo e Hunziker, 2023). Como expressa Mitchell (2024, p. 271), as tecnologias que aprendem com dados "se limitan a captar el sexismo y otros sesgos de nuestro lenguage, y nuestro lenguage refleja los prejuicios de nuestra sociedad".

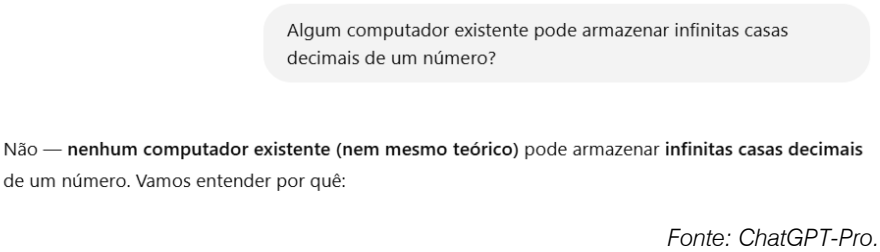
As justificativas muitas vezes baseiam-se nos limites dos dados disponíveis, mas nem por isso deixa-se de, com esses dados, fazer prescrições. Mais sério: sem indicar expressamente essas limitações, que podem levar a erros de inferência e, se as conclusões forem utilizadas como evidências, os equívocos nas políticas públicas educacionais podem ser catastróficos.

b) Um Olhar Pela Lente Matemática: Gerenciar Erros

Um exemplo elementar de como a realidade não cabe no número pode ser percebido na relação entre o comprimento da circunferência e seu diâmetro. Há muitos séculos sabe-se que existe uma relação direta e proporcional entre o comprimento de uma circunferência e o seu diâmetro. Convencionou-se chamar este resultado de pi, representado pela letra grega (π). Ocorre que, embora representada internacionalmente por este símbolo comum, até hoje não se conhece o resultado numérico preciso desta relação. Alguns cálculos já especificaram dezenas de trilhões de casas decimais. Pelos nossos padrões numéricos atuais, perduraremos sem conhecer este número de forma precisa (Barros; De Sá, 2022).

Portanto, embora conheçamos círculos, comprimentos de circunferências e diâmetros, eles não podem ser medidos com precisão nem representados numericamente com exatidão. Embora muitos de nós saibamos disso, temos dificuldade em reconhecer e agir a partir das verdades decorrentes (ou corolários). Essa negligência revela-se na recorrente tentativa de falar de números como se refletissem a realidade, a verdade sobre os fatos, ou uma suposta exatidão.

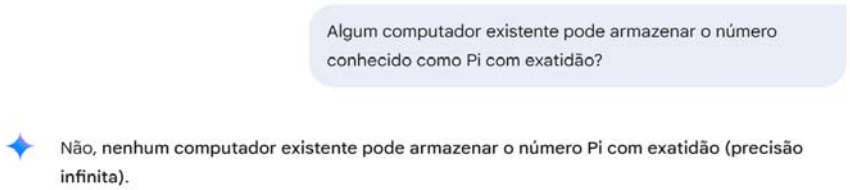
O pi é um único número, mas não há computador capaz de armazená-lo com precisão. Prevendo que essa afirmação possa causar estranheza e desconfiança, cabe consultar uma fonte de informação que usualmente argumenta em favor do potencial das tecnologias digitais, o ChatGPT. A Figura 1a a seguir apresenta uma pergunta feita ao ChatGPT e a resposta dada por esse mecanismo de Inteligência Artificial:



Fonte: ChatGPT-Pro.

Figura 1a: Exemplificação de questão apresentada ao ChatGPT

Para ratificar, foi apresentada uma variação da pergunta ao Gemini, que respondeu conforme Figura 1b a seguir:



Fonte: Gemini

Figura 1b: Exemplificação de questão apresentada ao Gemini

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Não se trata de argumento especulativo, mas de uma questão fática que é reconhecida tanto pela matemática quanto pela computação. Números que não podem ser representados como razão de dois números inteiros, chamados de irracionais na matemática, não podem ser utilizados para a realização de cálculos numéricos, apenas algébricos (quando a precisão numérica é abstraída e simbolizada por uma letra). Além disso, é reconhecido na matemática que existem mais números irracionais do que números racionais. Portanto, no conjunto dos números que são chamados de Reais, a maioria não pode ser trabalhada com precisão, não pode ser armazenada em nossos potentes computadores digitais, apenas na abstração.

É em razão disso que a matemática assume que a transposição de um número abstrato para o dado gera erro (Ferreira, 2024). Na imagem a seguir, apresentamos as 200 primeiras casas decimais de Pi, destacando as primeiras 50. Supondo que utilizemos estas primeiras para realizar cálculos, todas as casas seguintes gerarão aquilo que chamamos de erro (valor que, conhecida sua existência, é descartado):

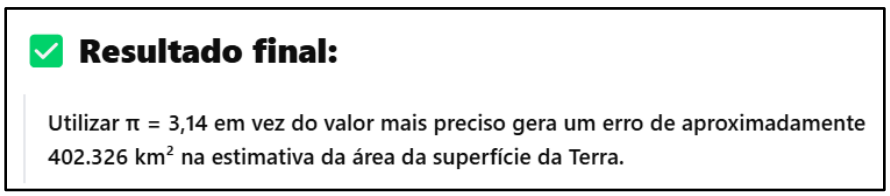
*3,14159265358979323846264338327950288419716939937510*58209749445923078164062862089986280348253421170679821480865132823066470938446095505822317253594081284811174502841027019385211055596446229489549303819 6 (primeiras 200 casas decimais de pi)

É importante destacar a que se refere este tipo de erro: parcela do número cuja existência é reconhecida, mas que é descartada por limitações técnicas. Neste tipo de erro, há um atenuante, pois quanto mais à direita da unidade o dígito está, menor é seu valor. Especificamente, cada dígito representa apenas 10% do seu antecessor, à esquerda. Mesmo assim, sempre que houver truncamento ou arredondamento, reduzindo-se o número de casas decimais do número, haverá um erro. Portanto, embora saibamos que Pi = Pi, a matemática reconhece que Pi não é igual a 3,14..., não importa quantas casas decimais tentemos escrever.

Trazendo a questão para o campo social, é preciso considerar um axioma elementar da matemática: o da identidade formal. Por esse axioma, qualquer sentença é igual a si mesma, ou para qualquer valor de x, teremos que x = x. Portanto, para qualquer unidade, teremos 1 = 1; 2 = 2;.... É vital perceber que isso não é uma verdade absoluta: é um axioma, ou seja, uma afirmação que convencionou-se aceitar como verdadeira para que todas as demais relações matemáticas sejam válidas. Se não aceitamos que 1 = 1, nada na matemática elementar funcionará.

Na realidade social, assumir de antemão que 1 = 1, quando a unidade é o ser humano ou qualquer tipo de relação social, é decidir pela anulação de todas as desigualdades e diferenças, por mais evidentes que sejam. Tem-se, portanto, um relevante dilema entre o axioma matemático de que 1 = 1 e a realidade social em que 1 ≠ 1. Há quem argumente que se pode combinar parâmetros, também numéricos, para contemplar as diferenças: será mesmo razoável supor que podemos calibrar a realidade para que caiba em um dado, que não é sequer capaz de comportar a maioria dos números reais?

Ainda, na matemática reconhecemos e estudamos problemas de transposição do número para o registro numérico computacional. No Cálculo Numérico (Arenales; Darenzo Filho, 2015; Jarletti, 2023), os erros decorrentes de truncamento e arredondamentos são reconhecidos, dimensionados e analisados, para que se avalie se comprometem os resultados ou não. Assim, sabemos, por exemplo, que se a medida de pi for armazenada em um byte (correspondente a 8 bits), teremos um erro de 1,32%. Se calcularmos o comprimento de uma circunferência adotando 3,14 como valor de pi, teremos na medida do seu comprimento um erro de aproximadamente 0,005%. Parece pouco, mas se isso for utilizado, por exemplo, para calcular a circunferência da Terra, este erro seria de 13,5 km. Se avançarmos para o cálculo da superfície do nosso Planeta, admitindo duas casas decimais de pi, teremos o seguinte resultado:



Fonte: ChatGPT - Pro

Figura 2: Resultado de cálculo obtido no ChatGPT

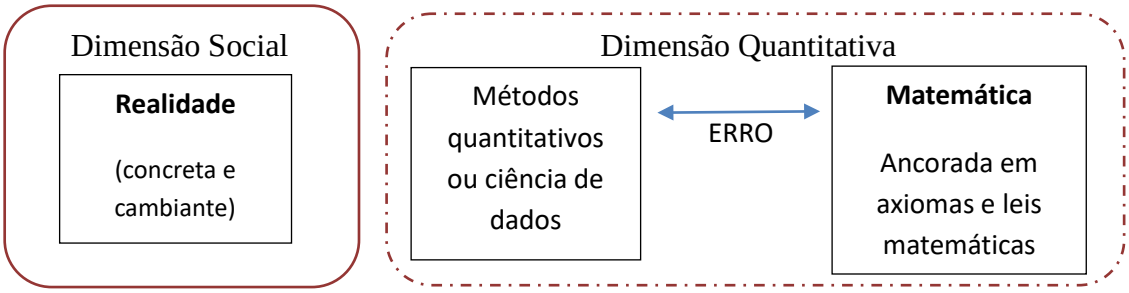
Quando avançamos para a superfície da Terra, temos uma sequência de cálculos que utiliza um número impreciso para realizar operações com outros números imprecisos. Com isso, o erro se agrava. Percentualmente, ele chega a 0,079%, o que também parece pouco, mas representa uma área superior à da Alemanha. E, então, precisamos nos perguntar: tratar de dimensões da superfície terrestre, admitindo um erro do tamanho da área da Alemanha, é aceitável ou não?

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O Cálculo Numérico, também a aritmética de ponto flutuante utilizada em computação, tem o cuidado de não violar a matemática ao transpor o número abstrato para o dado digital. Como vimos, o erro é admitido, calculado em sua expressão absoluta, relativa ou percentual. Em seguida, é avaliado para saber se compromete os resultados ou não, o que sempre dependerá da situação concreta em que se quer utilizar os resultados.

A prudência matemática reconhece e propõe estratégia para gerir a perda de informação na transposição de um número para o dado. Então, qual a razão para que, na transposição da realidade para o dado, a perda de informação não seja reconhecida? Se há preocupação com a integridade matemática, não seria fundamental que também fosse cobrada a preocupação com a inteireza humana?

Pode-se visualizar tal processo na intercomunicação entre três dimensões, ilustradas na Figura 3a:



Fonte: elaboração própria.

Figura 3a: Esquematização das Dimensões de Análise

Quando dizemos que os números não mentem ou que a matemática pode oferecer infinitas respostas, estamos nos referindo estritamente à dimensão quantitativa, à direita na Figura 3a. E há diferença entre dizermos que matemática não mente e que ela dirá sempre a verdade. O conhecimento matemático ensinou a não dizer sobre aquilo que escapa ao domínio da matemática. Este talvez seja o principal ponto a ser aprendido na ciência de dados: não extrapolar suas conclusões para a dimensão social sem reconhecer o erro assumido.

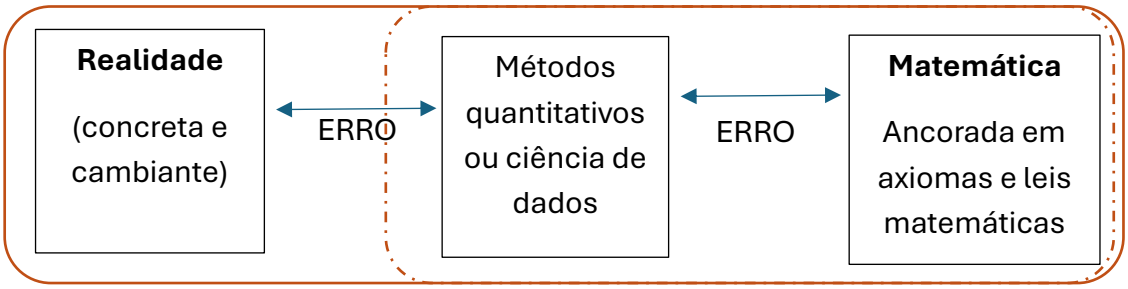
Ao fazer a captação de dados da realidade para a dimensão quantitativa, quando são desconsiderados aspectos relativos a raça/cor, gênero, nível socioeconômico, região, características familiares, entre diversos outros fatores que caracterizam um indivíduo e seu contexto, estamos também incorrendo em erro. Se consideramos cada pessoa como uma unidade matemática, estamos lhe negando o valor e a influência dos múltiplos fatores que caracterizam uma pessoa em sua inteireza.

O erro causado, por assumir a premissa de que 1 = 1, é replicado em todas as unidades transformadas em dados. Se cada uma das variáveis humanas e sociais que são transformadas em dados possui erro, ao desenvolvermos análises, ocorrerá a propagação do erro, movimento no qual ele tende a ser substancialmente modificado, incluindo possível ampliação elevada.

Um primeiro movimento necessário é que a representação numérica da realidade também seja reconhecida como parte do domínio social. Mais do que isso, os métodos quantitativos são definidos, operados e utilizados de forma não neutra, pois são construções humanas, aplicadas em contextos sociais. Por isso, propomos o reconhecimento das dimensões quantitativas como parte do domínio social, negando as tentativas de associá-lo a alguma verdade suprema. Aqui, nos limitamos ao primeiro passo: reconhecer o erro, considerando a informação perdida ao recolher a complexidade do real ao objetivismo do número com dígitos limitados.

O segundo passo é aquele ao qual convidamos a ciência de dados: assumir e dimensionar o erro e sua propagação, reconhecendo e comunicando do início ao final dos tratamentos e análises de dados. Com isso, a ciência de dados é convidada a aproximar-se mais da realidade e ter com a dimensão social a mesma responsabilidade que demonstra com a Matemática (Figura 3b):

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Fonte: elaboração própria.

Figura 3b: Esquematização ampliada das Dimensões de Análise

Ao adotarem axiomas matemáticos, muitos analistas deixam de explicitar que não estão considerando múltiplas diferenças: de gênero, de nível socioeconômico, de idade, de cor da pele, de localidade de residência. Na matemática, fala-se em erro admitido, o que é definido arbitrariamente. Nas evidências de políticas, propomos que seja explicitado que os resultados são verdades se considerado, por exemplo: todo estudante é igual a outro estudante; ou cada estudante pardo de qualquer município do Brasil é igual a qualquer outro estudante pardo, de qualquer outro município; quanto às escolas rurais, um estudante da região amazônica é igual a um estudante da Serra Gaúcha. Os resultados apresentados são verdadeiros exclusivamente se não considerarmos que esses marcadores são relevantes. Seja por ingenuidade, seja por perspicácia de não gerar dúvida sobre o estudo, é usual que essas limitações não sejam admitidas expressamente.

Além disso, a aplicação dos resultados como evidência para elaboração de políticas educacionais somente caberá se considerarmos que os fenômenos vindouros terão essencialmente as mesmas características dos fenômenos passados. E, neste ponto, concluímos que evidências baseadas em ciências de dados essencialmente terão a capacidade de produzir alterações incrementais e tímidas na mudança social, que poderão servir mais para dar sustentabilidade ao *status quo* do que para embasar transformações sociais.

Para findar este tópico, propomos que, quando não assumidas expressamente as premissas adotadas e as diferenças que estão sendo ignoradas ou consideradas como iguais, cabe reconhecer tais estudos como não legítimos. A legitimidade só pode ser conferida às pesquisas que reconheçam suas limitações e parcialidades, pois conquanto o pesquisador possa e deva estar ciente, a ocultação dessa informação gera grande risco de compreensão equivocada pelo leitor.

II. Inteligência Artificial

A inteligência artificial (IA) potencializa a lógica aqui descrita, trazendo uma nova possibilidade, que é a de incluir grande número de variáveis. Por usar de técnicas pouco compreendidas, podemos questionar se é geração de evidências ou alquimia, como desafia Filgueiras (2024). Mais especialmente, Klein e D'Ignazio (2024) alertam sobre as forças desiguais e excludentes presentes na pesquisa e desenvolvimento da inteligência artificial.

Ao mesmo tempo que a ampliação dos dados pode permitir análises mais complexas, ela traz consigo o risco de propagar o erro de forma indiscriminada (e discriminatória), especialmente pelo fato de que este erro não é assumido. O erro matemático pode ser tratado pela IA, mas o erro gerado na transposição da realidade para o dado não será – exceto se adotadas as proposições aqui apresentadas, ou outras que tenham essa mesma finalidade.

Como evidenciado por Noble (2018), os algoritmos operam sobre bases de dados enviesadas, o que frequentemente resulta em reforço de estereótipos sociais. Não sendo viável aqui aprofundar a discussão teórica, o caráter aplicado deste trabalho requer a ilustração de casos concretos.

Por exemplo, se uma das finalidades da educação é a inserção dos estudantes no mercado de trabalho, vamos propor uma atividade de pesquisa: analisar duas escolas comparativamente, verificando a situação de trabalho e renda dos estudantes após 10 anos da conclusão da educação básica. Supondo que identifiquemos que os egressos de uma das escolas têm renda média de 10 vezes a renda média dos egressos da outra escola, isso tende a levar à conclusão de que uma escola é muito mais efetiva do que a outra. Mas essa afirmação ou seu questionamento apenas fará sentido se levarmos em conta algumas das infinitas características adicionais: da escola, dos estudantes, da formação e do patrimônio dos familiares, dos seus contextos de trabalho e renda. De fato, pode-se estar diante de uma

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escola transformadora, ou de um sistema reprodutor. A diferenciação não é trivial e o risco de erro ao se igualar desigualdades é de extrema relevância.

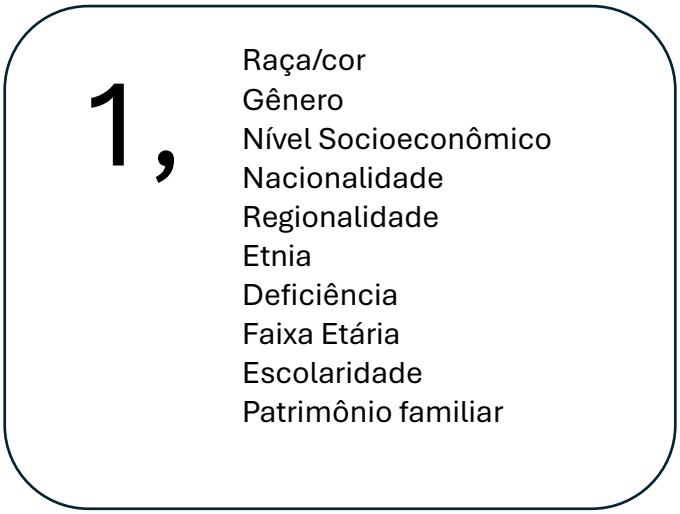
Ademais, a IA opera em termos probabilísticos. A probabilidade mais elementar é baseada no princípio da aleatoriedade (Mlodinow, 2009). Porém, em questões sociais, sabemos que há muitos condicionantes (e alguns determinantes), sendo a aleatoriedade uma exceção e não a regra. Mas, na IA, os algoritmos vão muito além da probabilidade elementar. Quando se avança, há diversos mecanismos probabilísticos, muitas vezes altamente contraintuitivos, que nos trazem respostas muito reveladoras em relação àquilo que não percebemos facilmente, mas cujas conclusões encontram total amparo nos dados analisados. Ao trazer constatações contraintuitivas e sem que seja factível rastrear todos os caminhos até as conclusões, a IA pode indicar alternativas que supostamente nos levariam a soluções, mas que de fato podem estar nos distanciando dos problemas estruturais e reproduzindo as desigualdades sociais, precisamente por ignorá-las.

Técnicas adotadas em IA permitem que as análises considerem múltiplas variáveis, mas não são capazes de considerar nada que não esteja presente nos dados disponíveis. E há poucos dados disponibilizados aos algoritmos sobre as heranças recebidas (materiais e imateriais), sobre a qualidade da água a que se teve acesso, sobre o quão alinhado com os valores econômicos atuais eram os valores cultivados em sua comunidade de origem, sobre quem era preferido para ser pego no colo nas creches, olhado com afeto, elogiado, menos ameaçado pela violência, com melhor acesso à saúde. Há inúmeros outros fatores que influenciam sobremaneira no desenvolvimento humano e social e, portanto, na educação. Fatores de desigualdades tão vastos que, se não podem ser equiparados a números irracionais, também dificulta trata-los como racionais.

III. Uma Proposição

Se nos preocupamos quando ocorre a mutilação do número, pela incapacidade de ele ser representado em sua inteireza por mecanismos computacionais, não seria razoável que, no mínimo, tenhamos este cuidado também ao tratar de pessoas e questões sociais?

Então, propomos que essa perda de informação seja reconhecida e, em analogia ao que se aborda em cálculo numérico, passemos a colocar uma vírgula após a unidade genérica, para qualificarmos essa unidade:



Fonte: elaboração própria.

Figura 4: Proposta de expressão para evidências em políticas educacionais

Como já tratado, na transposição da matemática para o dado, quanto mais à direita da unidade o dígito estiver, menor será seu valor. Na transposição da realidade para o dado, isso se modifica: quanto mais distantes da unidade padrão estiver uma característica humana ou social, mais ela tende a gerar erro caso seja desconsiderada. Por isso, aqui, não podemos utilizar características sucessivas, como se houvesse hierarquia entre as múltiplas dimensões do ser. Todavia, ao menos para estudos que compreendam a realidade brasileira, há elementos estruturantes que precisam ser colocados em evidência.

Assim, propomos que o "1, vírgula" seja seguido das características que tenham mais relevância no foco do estudo. No caso da educação aplicada à realidade brasileira, propõe-se que os elementos mínimos sejam: raça/cor, gênero, nível socio-econômico, região. Estudos que busquem construir evidências para fundamentar as políticas educacionais,

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mas que não considerem ao menos esses aspectos, tanto separadamente quanto de modo interseccional, não podem ser adotados como referência qualificada para orientar políticas educacionais que visem à qualidade com equidade.

Portanto, do mesmo modo que a divulgação de pesquisas de intenção de voto inclui informação sobre suas margens de erro, propomos que estudos que envolvam a transposição da realidade para o dado explicitem se adotam ou não os principais fatores interseccionais. Caso contrário, propõe-se que passe a ser explicitada essa ausência, com a indicação de que a validade do estudo está restrita à consideração de que 1 = 1.

IV. Considerações Finais

Pelas discussões aqui apresentadas, esperamos ter elucidado suficientemente a necessidade de que a perda de informação da transposição da realidade para o dado seja reconhecida como aspecto metodológico na ciência de dados, quando aplicada às ciências sociais e, mais especificamente, à educação. Como tal, que a pressuposição de que as unidades são todas iguais seja explicitada, indicando que, caso se considere que características individuais ou contextuais conferem a cada "1" condições diferentes, então as evidências devem ser consideradas como de menor confiabilidade.

Quando ocultamos as medidas do erro, ou não utilizamos, na ciência de dados, esse aprendizado para o diálogo com a outra dimensão (a realidade), assumimos o risco de estarmos mentido pela matemática e por nós mesmos. Podemos, também, estar engendrando técnicas apuradas, linguagem rebuscada e assertivas contundentes para construir um esconderijo para nossos próprios preconceitos, que não queremos que sejam vistos, mas não nos dispomos a abandonar.

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Bridging Gaps in Science Education- A Case Study of Chemistry Education in Bo City, Sierra Leone

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Abstract- The degree to which students understand the subjects taught in schools largely depends on the educational environment. In resource-poor regions, particularly in resource-poor developing countries, this environment is often inadequate; severely hindering learning outcomes. Here, the mixed-methods approach was used to assess the degree to which students understand chemical formulas and equations taught in Senior Secondary Schools (SSS) in Sierra Leone. A total of 158 SSS II and SSS III students across 6 schools in Bo City were randomly selected. Bo City is the regional headquarter of the Southern Region of Sierra Leone. Diagnostic pre-test results showed an alarming deficiency among students regarding the level of knowledge of foundational chemistry. Only 3.6% of the students correctly formulated Lithium Trioxosulphate (IV) and only another 7.3% accurately balanced the sodium-chlorine reaction equation. Qualitative analysis further showed a widespread misconception of the IUPAC nomenclature (63.29%) and polyatomic ion valencies (88.3%). Additionally, 77% of the students failed to correctly identify NaCl compound and some 53.7% properly balanced the related chemical equations.

Keywords: learning outcomes, senior secondary school, resource-constrained environment, science education, chemical equations, chemistry misconceptions, symbolic representation, STEM education, teacher training, curriculum reform.

GJHSS-G Classification: LCC: LA1501–LC1808



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Bridging Gaps in Science Education- A Case Study of Chemistry Education in Bo City, Sierra Leone

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Abstract- The degree to which students understand the subjects taught in schools largely depends on the educational environment. In resource-poor regions, particularly in resource-poor developing countries, this environment is often inadequate; severely hindering learning outcomes. Here, the mixed-methods approach was used to assess the degree to which students understand chemical formulas and equations taught in Senior Secondary Schools (SSS) in Sierra Leone. A total of 158 SSS II and SSS III students across 6 schools in Bo City were randomly selected. Bo City is the regional headquarter of the Southern Region of Sierra Leone. Diagnostic pre-test results showed an alarming deficiency among students regarding the level of knowledge of foundational chemistry. Only 3.6% of the students correctly formulated Lithium Trioxosulphate (IV) and only another 7.3% accurately balanced the sodium-chlorine reaction equation. Qualitative analysis further showed a widespread misconception of the IUPAC nomenclature (63.29%) and polyatomic ion valencies (88.3%). Additionally, 77% of the students failed to correctly identify NaCl compound and some 53.7% properly balanced the related chemical equations. The learning gaps were due to systemic challenges in the educational environment, including overcrowded classroom space, scarce instructional materials, and limited laboratory access. The findings showed that abstract symbolic representations and resource-poor teaching strategies hinder the effectiveness of science education. It was recommended that targeted interventions (such as remedial drills, mnemonics, and interactive visualization tools) be implemented to reinforce core concepts. There was also the need for reforms, including training teachers, prioritizing foundational subjects, and increasing resource allocation. These measures could bridge the gap between resource-rich and resource-poor educational environments, thereby aligning STEM education with global efforts to strengthen science learning.

Keywords: learning outcomes, senior secondary school, resource-constrained environment, science education, chemical equations, chemistry misconceptions, symbolic representation, STEM education, teacher training, curriculum reform.

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I. Introduction

As the engine of technological innovation, science education is a critical tool for national development *(Orukotan, 2007)*. Chemistry is a key discipline of central science *(Adams & Sewry, 2010),* bridging physics, biology, medicine, and engineering. A fundamental aspect of secondary school chemistry education is the study of chemical formulas and equations, which encode the compositions and interactions of substances. Mastery of these concepts underpins critical chemical principles, including stoichiometry, reaction mechanisms, and material properties *(Johnstone, 1991),* but also the prediction of the behavior of chemicals *(Ben-Zvi et al., 1987).*

Despite being so important, chemical formulas and equations pose significant learning obstacles, particularly in resource-constrained settings *(Calik & Ayas, 2005; Taber, 2020).* Students struggle most with symbolic and submicroscopic notations, which demand abstract reasoning *(Johnstone, 1991).* These difficulties are exacerbated by inadequate teaching resources, overcrowded classroom spaces, and reliance on rote learning. *WAEC (2018)* documented systemic failure in balancing basic reaction equations such as $Cl_2 + H_2O$, reflecting a widespread inability to connect abstract notation to tangible phenomena. *Calik & Ayas (2005)* attributed this disconnect to curricula that neglect real-world applications, a recurring issue in underfunded education systems.

Khurshid et al. (20171) noted that persistent struggles with chemical notations result in mass failures in high-stake examinations, discouraging students to pursue STEM pathways. The declining proficiency in chemistry is increasing the scarcity of qualified chemistry instructors, resulting in a cycle of poor science education *(OECD, 2023).* Treating equation balancing as a mechanical exercise rather than a reflection of mass conservation *(Nakhleh, 1992)* only increases the tendency to confuse molecular (e.g., H_2O_2) with empirical (e.g., HO) *(Taber, 2002)* formulas. This also results in misapplication of valency rules, especially for polyatomic ions *(Barke et al., 2021).*

Johnstone (1991) noted that the three levels of chemical notation (macroscopic, submicroscopic, and symbolic) are seldom taught cohesively in under-resourced institutions. Limited access to models or digital simulations *(Gilbert & Treagust, 2022)* forces students to rely on abstract learning, deepening the

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misunderstanding. In Sierra Leone, these challenges are compounded by dilapidated laboratories, undertrained instructors, and post-conflict recovery constraints *(MoE-SL, 2022)*. Similar trends in Nigeria *(Orukotan, 2007)* and Pakistan *(Khurshid et al., 2017)* highlight a global equity gap in chemistry education.

Studies show that scalable solutions can be used to bridge the gaps in science education. One such solution is scaffolded learning, where step-by-step templates are used in balancing equations *(Johnson & Lee, 2022)*. Another is peer collaboration, where students work in groups to solve science problems and by doing build confidence *(Zoller, 2021)*. Multimodal tools such as PhET simulations for visualizing reactions *(Smith et al., 2023)* and molecular kits for tactile learning *(Adu-Gyamfi, 2019)* have also been proven useful. One other approach is the use of remedial drills with focus on valency can improve the ability of students to balance chemical equations *(Nakleh, 2023)*. Curriculum redesign in Rwanda reduced errors in balancing stoichiometry equations by 30% *(MoE-R, 2021)*. The use of hands-on modeling kits in Ghana demonstrated the impact of systemic investment in teacher training on science education *(OECD, 2023)*.

While misconceptions in chemical formulas and equations are well-documented in resource-sufficient regions, little is so done for resource-constrained environment. The aim of this study was to investigate misconceptions in interpretations of chemical formula and test intervention strategies among secondary school students in Sierra Leone. This was investigated by adapting global insights to local realities. By diagnosing recurring errors and piloting context-appropriate interventions, the basis for equitable chemistry education in resource-constrained settings were developed, using Sierra Leone as a case study.

II. Materials and Methods

a) Study Area

Sierra Leone is on the west coast of Africa, between latitudes 6.91–10.08° N and longitudes 10.21–13.32° W and has a total area of 71,740 km^2. The country is divided into sections, amalgamated into chiefdoms, in turn amalgamated into districts, and eventually amalgamated into regions, and then the Western Area.

Bo District, which lies in the Southern Region, has an area of 1,400 km^2 and population of 463,668 persons *(SSL, 2014; UNDP, 2018)*. The district comprises 15 chiefdoms, with Bo Township located in Kakua Chiefdom. Bo township is also the district headquarter and the second largest city in Sierra Leone *(Mokuwa & Maat, 2020)*.

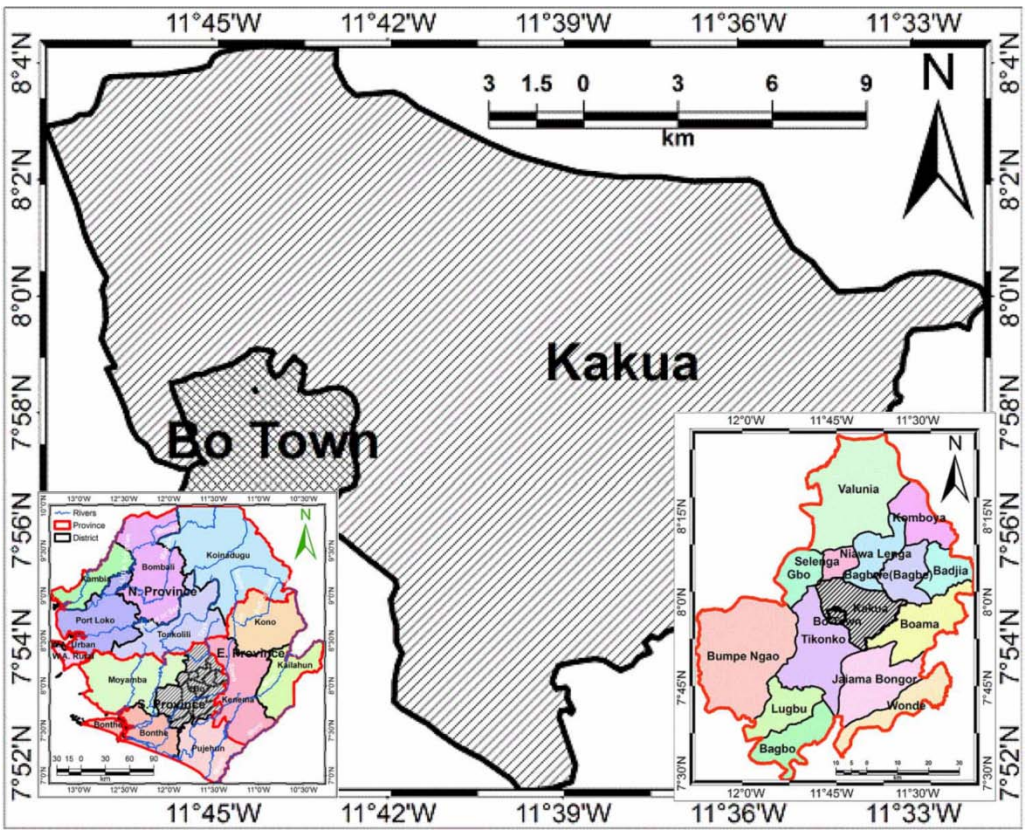


Fig. 1: A map of Sierra Leone (inset on left) depicting Bo District (in stripes), a map of of the district (inset on right) depicting Kakua Chiefdom (in strips), and then the main map depicting Kakua Chiefdom and Bo township (the study area).

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b) Study Population and Sample

There are some 1025 schools in Bo District, of which 747 (72.88%) are in Bo City. Only 47 (4.59%) of the 1025 schools in the district are SSS; of which 18 (38.30%) are in Bo township *(Table 1).* Of the 18 SSS in the township, 6 (33.33%) were randomly selected for this study. Also, as chemical formulas and equations are generally taught in Grades 11 (SSS II) and 12 (SSS III), only science students in these grades were targeted. Based on 2023–2024 data *(MoE-SL, 2022; WAEC, 2023),* there are some 5000 SSS students in Bo township, with 3200 in SSS II & III. Of this number, 158 (4.94%) students participated in the study. A total of 22 students (13.92%) were in SSS II and 136 (86.08%) in SSS III. The number of students and then the male-female ratio of participants per school varied.

Table 1: A list of the categories and number of schools in Bo District, Bo town and the percent ratio

Category of Schools	Bo District (BD)	Bo City (BC)	BC/BD (%)
Pre-primary School	158	69	43.67
Primary School	688	620	90.12
Junior Secondary School	132	40	30.30
Senior Secondary School	47	18	38.30
Total	1025	747	72.88

c) Data Collection

The mixed-methods approach that was a combination of purposive random sampling, diagnostic pre-test, and questionnaire was used to collect both quantitative and qualitative data. According to *Johnstone (1993),* this data collection approach is effective for both qualitative and quantitative data collection *(Taber, 2020).*

For the diagnostic pre-test, a total of 12 carefully selected variables were used to evaluate fundamental competency of chemistry students. Of this, 7 were used to assess basic chemical notation proficiency, 3 for testing equation formulation, and 2 for balancing equation. Supplementary questions were used to examine the core principles of chemical formulas and equations. Also, questionnaires were used to evaluate the levels of comprehension of students and confidence in writing chemical symbols and equations.

The pre-test was conducted on different days under timed classroom setting and the responses scored for analysis. The questionnaire was administered several days after the pre-test to the same set of students in the 6 schools. The responses were then used to evaluate the learning outcomes.

For validity and reliability, the data collection instruments (pre-test and questionnaire) were piloted on 20 students in the Bo Government Secondary School. The feedback was used to identify and fix the gaps in the data collection instruments and to also ensure consistency.

d) Data Analysis

Descriptive statistics was used to measure frequencies and percentages of the pre-test performance *(Tables 2–5).* The focus here was on correct and incorrect response rates for formulas, equations, and basic concepts. The questionnaire data were analyzed for recurring patterns. The analysis was done in Microsoft Excel environment.

III. Results and Discussions

a) Pre-test Result Discussion

In Sierra Leone and much of Africa, the 6-3-3-4 education system is such that secondary school chemistry for SSS II (Grade 11) and SSS III (Grade 12) students focuses more intensively on formulas and equations *(Taylor, 2021; MBSSE, 2022).* The pre-test assessment revealed a generally low level of competency among SSS students in basic chemical notations, including chemical formulas and equations. As shown in *Table 2,* students performed best in writing chemical formula for Sodium Chloride (73.18% correct responses), with the lowest scores recorded for Lithium Trioxosulphate (IV) and Beryllium Nitride (3.64% each). Apart from Sodium Chloride, the next highest score was for Zinc Oxide (38.64%), indicating a widespread deficiency in correctly writing basic chemical formulas among SSS students *(Brown et al., 2019; MBSSE, 2022).* This knowledge gap may be attributed to constrained education environment, including the availability of teachers who are sufficiently competent and committed.

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Table 2: Performance of SSS students in writing chemical formulas under timed classroom setting

Compound	Correct		Incorrect		No Response		Total
	Count	%	Count	%	Count	%	
Sodium Chloride	116	73.18	41	25.91	1	0.91	158
Lithium trioxosulphate (IV)	6	3.64	148	93.64	4	2.73	158
Calcium Tetraoxophosphate (V)	10	6.36	142	90.00	6	3.64	158
Calcium Tetraoxosulphate (VI)	34	21.82	119	75.45	4	2.73	158
Sodium Oxide	20	12.73	135	85.45	3	1.82	158
Beryllium Nitride	6	3.64	139	88.18	13	8.18	158
Zinc Oxide	61	38.64	80	50.45	17	10.91	158

The study also revealed widespread misconceptions among students regarding the fundamental principles of writing and balancing chemical equations. This was particularly evident for nomenclatures of complex chemicals and valencies of oxoanions and polyatomic ions *(Smith & Johnson, 2020).* As illustrated in *Table 3,* students struggled significantly; with the highest accuracy rate of 7.27% for formulating basic equations and the lowest of 1.82% (for more complex reactions). The findings aligned with prior studies, suggesting that secondary school students across Sub-Saharan Africa often face difficulties in balancing chemical equations due to knowledge gaps on stoichiometry and valency rules *(Adesoji & Babatunde, 2018; Ezeudu, 2019).*

The analysis further suggested that the challenges stemmed from inadequate understanding of the concept of oxidation states and ion charges, particularly for transition metals and oxoanions such as sulfates and nitrates *(Taber, 2020).* Limited application of the crisscross method in formula derivation was another challenge *(WAEC, 2021).* Over-reliance on rote learning rather than grasping periodic trends and bonding principles was another challenge *(Niaz & Robinson, 2021).* These deficits highlighted the need for targeted pedagogical interventions (such as inquiry-based learning and digital simulations) to reinforce stoichiometric reasoning *(Gabel & Bunce, 2023).*

Table 3: Performance of Students in Writing and Balancing Equations of Chemical Reaction under timed Classroom Setting

Reaction	Correct		Incorrect		No Response		Total
	Count	%	Count	%	Count	%	
$Na + Cl_2$	11	7.27	141	89.09	6	3.64	158
$Ca + H_2PO_4$	3	1.82	147	92.73	9	5.45	158
$Zn(OH)_2 + H_2SO_4$	11	7.27	135	85.45	11	7.27	158

Table 4 further shows chemical equations, of which only 28.2% of the students balanced one and 34.5% balanced the other correctly, a concern for those straightforward chemical equations. *Johnson & Lee (2022)* noted that students more easily grasp chemical reactions involving straightforward stoichiometry. *Smith et al. (2023)* also concluded that secondary school students are generally challenged with correctly balancing simple chemical reactions. *Gilbert & Treagust (2022)* observed that the difficulty students face with reaction dynamics point to gaps in linking theoretical concepts to practical applications. Consistent with those studies, *Brown et al. (2021)* found that students generally struggle with acid-base reactions.

Table 4: Performance of Students in Balancing Chemical Equations under timed Classroom Setting

Reaction	Correct		Incorrect		No Response		Total
	Count	%	Count	%	Count	%	
$CH_4 + O_2 \rightarrow CO_2 + H_2O$	45	28.18	101	63.64	13	8.18	158
$HCl + CaCO_3 \rightarrow CaCl_2 + H_2O + CO_2$	55	34.55	88	55.45	16	10.00	158

For the variables in *Table 5,* the highest score — indicating student knowledge on basic principles and concepts of chemical formulas and equations — was 75.45% and the lowest 1.82%. The average score among participating students was 28.08%, which was critically low for a public examination-level class. The findings suggested a widespread deficiency in foundational knowledge on chemical principles. Similarly, *Smith et al. (2021)* reported a low average performance (<30%) in balancing chemical equations

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among secondary school students. In terms of conceptual gap, *Johnson & Lee (2022)* noted that weak foundational knowledge hinders mastery of complex topics. Scores below 40% in formative assessments affect examination readiness, resulting in poor performance in standardized chemistry examinations *(Ogunleye & Adeyemo, 2023).*

These challenges were linked to systemic issues within the educational environment. In Sierra Leone, schools are severely resource-constrained, lacking even basic teaching aids and adequate infrastructure *(MBSSE, 2022).* Many schools lack sufficient furniture, leaving students without proper seating for effective learning *(UNICEF, 2021).* Additionally, there is a shortage of adequately trained teachers, particularly in specialized subjects like chemistry *(World Bank, 2020).* Even the available teachers often receive inadequate salaries, reducing their motivation and commitment to the profession *(Education International, 2019).* These systemic deficiencies contribute to the poor performance of students in basic sciences, including *chemistry (African Development Bank, 2022).*

Table 5: Knowledge of students on basic principles and concepts of chemical formulas and equations

Question	Correct		Incorrect		No Response		Total
	Count	%	Count	%	Count	%	
Name the elements in NaCl	37	23.18	105	66.36	17	10.45	158
How many oxygen atoms are in $C_6H_{12}O_6$	119	75.45	31	19.55	8	5.00	158
Why are chemical equations balanced	70	44.55	75	47.27	13	8.18	158
The number in front of a balanced chemical equation denotes …….	62	39.09	82	51.82	14	9.09	158
What are the valencies of X_2 and Y_3	29	18.64	57	36.36	71	45.00	158
In balancing chemical equations, the total number of …… on the reactant side must equal that on the product side	75	47.27	55	35.00	28	17.73	158
+ on the right-hand side	3	1.82	112	70.91	43	27.27	158
+ on the left of the equation	3	1.82	115	72.73	40	25.45	158
In the chemical formula for Aluminium Tetraoxosulhpate (VI), represented as $Al_2(SO_4)$	32	20.00	81	51.36	45	28.64	158
Chemical formula	24	15.45	80	50.45	54	34.09	158
Chemical symbol	57	35.91	46	29.09	55	35.00	158
Chemical equation	3	1.82	80	50.91	75	47.27	158
Total	43	27.08	77	48.48	39	24.43	158

b) Questionnaire Result Discussion

Table 6 shows the key areas of the questionnaire and the recorded response in count and percent. In line with the SSS Grades, most of the students (>60%) were above 16 yr old. The age range (16-19 yr) matched well with this system of education. Even in the self-assessment, a very low fraction of the students (6.33%) had an excellent knowledge of chemistry. Only 15.82% rated themselves as confident in balancing chemical equations. A good number of the students (63.29%) had challenges with the IUPAC naming system. This underscored the complexity of the IUPAC nomenclature in chemistry education *(Barke et al., 2021).*

Table 6 further shows that because the tutors had multiple challenges in teaching chemistry, the teaching method was virtually ineffective. This resulted in the high misconception of chemistry taught in schools, including chemical symbols, valencies, formulas, and equations. *Zoller (2021)* noted that closing this gap required targeted teaching with needy students given special tutorials.

The questionnaire-based self-rating further suggested that students generally had a fair knowledge of basic chemistry concepts but struggled with applications. This was consistent with the difficulty of transitioning from memorizing to understanding chemistry concepts *(Taber, 2020).*

Systemic barriers such time constraints confirmed global reports on the challenges of STEM education *(OECD, 2023).* This suggested a significant gap in conceptual knowledge, confirming literature indicating that learners are often challenged with grasping chemical notations *(Johnstone, 1993).* The high proportion of struggling students underscored the spread of these misconceptions, including difficulties in balancing chemical equations and interpreting notation *(Taber, 2002).*

Students showed significant difficulties in correctly writing chemical formulas, particularly for compounds involving valency exchange (e.g., Beryllium Nitride). Many could not recall the correct symbol for nitride, indicating foundational knowledge gap (*Smith et al., 2021; MBSSE, 2023).* The recurring mistakes

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suggested that students struggled with remembering valencies of complex ions and elements. Misconceptions regarding atomic valencies generally hinder the correct balancing of chemical equations *(Nakleh, 2023).*

Table 6: The attributes of the variables covered in the questionnaire used for self-assessment of students

No.	Variable	Detail	Count	Percent (%)
1.	SSS grade	SSS II	22	13.92
		SSS III	136	86.08
2.	Age of student	14_16	48	30.38
		17_19	99	62.66
		>19	11	6.96
3.	Understanding chemistry	Excellent	10	6.33
		Good	73	46.20
		Fair	59	37.34
		Poor	16	10.13
4.	Confidence in balancing chemical equations	Very low	30	18.99
		Low	17	10.76
		Average	56	35.44
		High	30	18.99
		Very high	25	15.82
5.	Challenge in knowing chemical formulas	Cramming valency	52	32.91
		IUPAC naming system	100	63.29
		Both	6	3.80
6.	Writing chemical equations	Balancing equation	45	28.48
		Knowing reactants & products	14	8.86
		Knowing coefficients & subscripts	22	13.92
		Knowing reaction change	78	49.37
7.	Misconception of formulas & equations	Yes	138	87.34
		No	20	12.66
8.	Nature of misconception	Polyatomic ion valency	76	48.10
		Element symbol & valency	46	29.11
		Balancing equation	36	22.78
9.	Challenges teachers face	Resource availability	39	24.58
		Crowded class	29	18.44
		Finishing syllabus	55	34.64
		Student knowledge gap	34	21.23
		Teaching method	2	1.12
10.	Effective teaching method	Very high	33	20.89
		High	60	37.97
		Average	40	25.32
		Low	18	11.39
		Very low	7	4.43

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IV. Conclusions and Recommendations

a) Conclusions

In this study, two core objectives were investigated. Firstly, the knowledge base of SSS students in the fundamentals of chemistry was assessed, including formulas, equations and the governing concepts. Secondly, the prevalence of misconceptions of basic chemistry principles and the related learning obstacles study was measured. The results showed significant gaps in knowledge base of students in chemistry science. There were also resource gaps at the institutional level, contributing to challenges students and teachers/tutors faced in schools. These gaps were situated in both global pedagogical discourse and current educational constraints in Sierra Leone.

Students demonstrated significant challenges in writing chemical formulas, particularly for compounds involving polyatomic ions such as lithium trioxosulfate (IV). Balancing chemical equations was also a key difficulty among SSS science students, even for simple sodium and chlorine reaction. Foundational knowledge gaps were evident, including misinterpretations of chemical notations and valencies. The abstract nature of chemical symbols and reaction dynamics further hindered students' understanding of stoichiometry and how chemical formulas change during reactions.

These challenges were linked to systemic issues within the educational environment. In Sierra Leone, schools are highly resource-constrained, lacking even basic teaching aids and adequate infrastructure. Many schools lack sufficient furniture, leaving students without proper seating for effective learning. Additionally, there is a shortage of adequately trained teachers, particularly in specialized subjects like chemistry. Even the available teachers receive inadequate salaries, reducing motivation and commitment to the profession. These systemic deficiencies contribute to the poor performance of students in basic sciences, including chemistry.

While similar challenges exist throughout Sub-Saharan Africa, Sierra Leone's unique combination of infrastructural deficiencies and pedagogical limitations creates a formidable barrier to chemistry education. These findings corroborate with international research on the inherent challenges of chemical symbolism, while importantly deepening the understanding of resource-limited educational environments.

This research not only filled the gap in the literature on chemistry education in Sierra Leone but also offered a blueprint for similar contexts. Future studies could explore longitudinal impacts of the proposed interventions or expand into excluded areas such as redox reactions. Ultimately, there is the need for targeted remediation to address immediate knowledge gaps and systemic investment in infrastructure and teacher capacity to sustain long-term improvement. By equipping students with symbolic literacy and critical thinking skills, this work will contribute to global efforts to democratize STEM education, ensuring that learners in resource-constrained settings are empowered to engage meaningfully with science in the 21st century.

b) Recommendations

Based on the findings in this study (highlighting such challenges as inadequate infrastructure, lack of teaching aids, teacher shortages, and poor student performance in chemistry), relevant recommendations were put forward to improve learning outcomes in resource-constrained schools in Sierra Leone and beyond.

i. *Providing Infrastructure and Learning Materials*

a. The Sierra Leone's MBSSE in partnership with NGOs and international donors, should prioritize funding for school infrastructure, including classrooms, laboratories, and basic furniture.
b. Schools should be equipped with essential chemistry teaching aids, such as molecular models, periodic tables, and chemical reaction kits, to enhance practical understanding (Smith & Johnson, 2020).

ii. *Teacher Training and Retention*

a. The government should invest in continuous professional development programs for science teachers, focusing on effective pedagogy for abstract science concepts.
b. Competitive salaries and timely payments should be ensured to retain qualified teachers and reduce recruitment turnover.

iii. *Curriculum and Pedagogical Reforms*

a. Chemistry curriculum and much so all other science curricula should be adapted to include more real-life applications and step-by-step knowledge building for complex topics including chemical formulas and stoichiometry.
b. Schools should establish peer tutoring programs and after-school remedial sessions to address foundational gaps.

iv. *Community and Stakeholder Engagement*

a. Awareness campaigns are needed to encourage community support for education, including local fundraising for school supplies.
b. Collaborations are needed with private sector stakeholders to provide funding for science labs and digital learning tools.

v. *Monitoring and Policy Implementation*

a. The Sierra Leone MBSSE should enforce strict monitoring to ensure compliance with infrastructure and teaching standards.

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b. Policymakers should use empirical studies like this to guide evidence-based reforms in science education.

The above recommendations suggest that addressing these challenges in education system in Sierra Leone requires a multi-path approach that combines infrastructure development, teacher support, curriculum improvement, and community engagement. Implementing these recommendations could enhance science education and overall learning outcomes in Bo other parts of Sierra Leone and beyond.

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Water Survival Skills and Swimming Performance of BSMT Students: A Sequential Explanatory Study

By Krystel Joyce V. Repalda

Abstract- Poor swimming performance is dangerous. The aim of this study was to determine the significance of water survival skills as a factor of swimming performance, and to explore experiences on water survival among BSMT students. Using sequential explanatory design, I surveyed 267 randomly selected samples and interviewed 5 purposively selected students. Water survival skills were found to be a significant factor, accounting for a 56.1% degree of influence. Survival skills experiences under technique developed, independent in water, and building confidence, respectively, are swimming stroke adjustment, breathing control, and overall skill enhancement; reliance on personal skills, utilization of training adaptation, and internal lessons of growth; and overcoming fear, self-reliance, and future preparedness. Mixed-method studies and enhanced training with structured water survival drills are recommended.

Keywords: *water survival skills, swimming performance, BSMT students, sequential explanatory study.*

GJHSS-G Classification: *LCC GV838.5*



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Water Survival Skills and Swimming Performance of BSMT Students: A Sequential Explanatory Study

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Abstract- **Poor swimming performance is dangerous. The aim of this study was to determine the significance of water survival skills as a factor of swimming performance, and to explore experiences on water survival among BSMT students. Using sequential explanatory design, I surveyed 267 randomly selected samples and interviewed 5 purposively selected students. Water survival skills were found to be a significant factor, accounting for a 56.1% degree of influence. Survival skills experiences under technique developed, independent in water, and building confidence, respectively, are swimming stroke adjustment, breathing control, and overall skill enhancement; reliance on personal skills, utilization of training adaptation, and internal lessons of growth; and overcoming fear, self-reliance, and future preparedness. Mixed-method studies and enhanced training with structured water survival drills are recommended.**

Keywords: water survival skills, swimming performance, BSMT students, sequential explanatory study.

I. Introduction

Maritime students are struggling with poor swimming performance, which is compromising their ability to respond effectively in aquatic emergencies (Mitishev & Sozonov, 2024). This subpar performance is resulting in diminished overall effectiveness and raising concerns about safety in real-life scenarios. Ultimately, the students' inadequate swimming abilities are hindering their ability to succeed in their maritime education and future careers (Duijn et al., 2022).

Despite being a highly competitive sport, swimming has faced challenges in sustaining its global prominence. Hunter et al. (2023) observed a decline in the United States swimming performance, with nations like Japan and Russia narrowing the gap. He attributed this decline to insufficient investment in grassroots programs and a failure to adapt to evolving trends in the sport. Tawanda and Tsara (2022) examined Africa's swimming performance and highlighted challenges in maintaining long-term success, citing a shallow talent pool and limited coaching and training resources. Similarly, Petrenko and Taran (2021) explored the difficulties Russian swimmers face in international competitions. He pointed out that inadequate investment in infrastructure and training facilities, along with limited competitive opportunities, has hindered the country's swimming development.

In the Philippine context, it has faced challenges in developing world-class swimmers, with its swimming performance trailing behind neighboring Southeast Asian countries. Rosario (2024) identified a lack of investment in swimming infrastructure and programs as a major barrier, leading to a shortage of trained coaches, inadequate training facilities, and limited competition opportunities. Celso (2025) noted that Filipino swimmers struggle to meet international standards due to limited exposure to high-level competition and insufficient support systems. Blanco (2022) emphasized the need for a more structured and systematic approach to swimming development, highlighting the lack of clear vision and coordination among key stakeholders, including coaches, athletes, and government agencies.

Despite the critical importance of swimming skills in maritime schools and industries, there is a significant gap in existing literature and training programs that address the specific challenges faced by maritime students and professionals. While studies and training programs on general swimming skills exist, there is a lack of research and initiatives tailored to the unique demands of the maritime industry. Addressing this gap is crucial, as inadequate swimming skills among maritime students and professionals can lead to serious consequences, including accidents and loss of life. With increasing regulatory requirements and safety standards in the maritime industry, urgent training programs are needed to ensure safety and compliance.

This research highlights the significance of water survival skills in enhancing swimming performance among Physical Education BSMT students, emphasizing its critical role in maritime training. Understanding this relationship is essential, as water survival mastery boosts confidence, stamina, and emergency readiness—key attributes for safety and performance in maritime environments. The findings aim to improve training strategies and curricula to better prepare students for the physical demands and challenges of maritime careers. Beneficiaries include CHED officials, who can use the insights to enhance curriculum standards; school administrators, who can refine maritime programs; PE teachers, who can tailor instruction to student needs; maritime students, who

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gain improved training; and future researchers, who can build on this comprehensive analysis for further innovations.

This study aimed to determine the significance of water survival skills as a factor of swimming performance; and to explore experiences on water survival among study participants. Specifically, it seeks to determine whether water survival skills significantly influence swimming performance and to identify which specific survival skills explain variations in overall performance, describe the level of Water Survival Skills and Swimming Performance among the BSMT students, and determine the significant relationship between water survival skills and swimming performance among BSMT students. Further, this study sought to answer the following question: What are the water survival experiences of the study participants that contribute to their swimming performance?

The following hypothesis was tested at a 0.05 level of significance: Water survival skills and swimming performance are not significantly correlated. Meanwhile, the assumption of this study is that the experiences of BSMT students on reflexive movements would lead to their fundamental movements.

This study is anchored in Harrow's (1972) Psychomotor Learning Theory. The theory posits that this taxonomy is organized according to the degree of coordination, including involuntary responses and learned capabilities: reflex movements - automatic reactions, basic fundamental movement - simple movements that can build to more complex sets of movements, perceptual - environmental cues that allow one to adjust movements, physical activities - things requiring endurance, strength, vigor, and agility, skilled movements - activities where a level of efficiency is achieved, non-discursive communication - body language.

In this study, the automatic reactions variable is indicated by flexion, extension, stretch, and postural adjustment. (Harlow, 1972) aligns with reflexive movements and exhibits foundational psychomotor abilities such as floating, treading water, breath control, and coordinated reflexive actions crucial for survival in aquatic environments, as discussed in the theory. The physical activities indicated by strenuous effort for long periods, muscular exertion, a quick, wide range of motion at the hip joints, and quick, precise movements (Harrow, 1972) are aligned with basic fundamental movements that encompass skills such as strength, endurance, agility, and coordination that support more complex and purposeful physical tasks as included in the theory. Other elements explained in the theory, such as fundamental movement, perceptual, skilled movements, and non-discursive communication, are excluded.

II. Method

This study employed sequential explanatory mixed-methods design (Creswell & Creswell, 2017), prioritizing quantitative data followed by qualitative analysis to enhance ecological validity.

The study was conducted at a private maritime institution in Davao City's Población District, focusing on Maritime Department students in transportation and engineering programs.

For the Quantitative Phase, using Yamane's formula (1967, cited in Hasan & Kumar, 2024), 267 BSMT students were randomly selected from 800 second-years. For the Qualitative Phase, five highest-scoring BSMT students were purposively selected based on researcher judgment for useful information provision.

For the Quantitative Phase, a 40-item adapted questionnaire assessed water survival skills (Moran et al., 2011; Stallman et al., 2017) and swimming performance (Pyne et al., 2004; Langendorfer, 2015). For the Qualitative Phase, open-ended interviews explored BSMT students' experiences comprehensively (Creswell & Poth, 2016; Patton, 2014), requiring careful design and piloting (Lim, 2025).

Both quantitative surveys and qualitative interviews were conducted after securing ethical clearance, ensuring comprehensive data collection through systematic monitoring and transcription processes.

The quantitative data was analyzed using Mean calculations and linear regression analysis to determine the water survival skills' influence on swimming performance using established correlation interpretation schemes. Meanwhile, the qualitative data was analyzed using Thematic analysis to identify patterns and insights from interview responses using systematic coding approaches (Braun & Clarke, 2006; Lochmiller, 2021).

Credibility through prolonged engagement (Adler, 2022), confirmability via audit trails (Amin et al., 2020), dependability through coding systems (Haq et al., 2023), authenticity ensuring genuine representation (Ahmed, 2024), and transferability through detailed descriptions (Riazi et al., 2023) established trustworthy-ness (Creswell & Creswell, 2017).

The researcher ensured the protection of participants' confidentiality (Pring, 2024), voluntary participation principles (Mumford et al., 2021), and harm minimization strategies (Picketts et al., 2021) with institutional approval.

III. Results and Discussion

The results of the analysis and interpretation of the gathered data are presented. Specifically included are the descriptive analysis, correlation analysis, modified paradigm, emerging themes and subthemes, and the summary of findings.

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a) Descriptive Analysis

Table 1 is the descriptive table. It contains the variables involved in the study, namely, water survival and swimming performance, and their respective indicators. It also contains the number of samples, standard deviation, the mean, and the corresponding descriptive interpretations

Table 1: Descriptive Table

Variable	n	SD	Mean	Descriptive Level
Water Survival Skills	267	1.00	3.25	Moderate
Technique		0.99	3.26	Moderate
Adaptability		0.99	3.35	Moderate
Endurance		0.99	3.23	Moderate
Self-reliance		1.02	3.14	Moderate
Swimming Performance	267	0.87	4.18	High
Efficiency		0.92	4.10	High
Strength		0.88	4.17	High
Speed		0.86	4.23	Very High
Accuracy		0.84	4.20	Very High

Specifically, Table 1 shows that the water survival skills variable obtained an overall mean score of 3.25, described as a moderate level. This indicates that the water survival skills of second-year BSMT students are good, affirming Ekanayaka et al. (2021) and Kim et al. (2022) findings on training effectiveness.

Moreover, the findings reveal that the overall swimming performance obtained a mean score of 4.18, which is described as a high level. This indicates that the swimming performance of second-year BSMT students is very good, corroborating Guo et al. (2022) and Lopes et al. (2021) training structure studies.

b) Correlation Analysis

Table 2 is the correlation table. It specifically contains the predictive variable, which is water survival skills, and the criterion variable, which is the swimming performance of second-year BSMT students. Lastly, it contains the r-value, the p-value, and the decision on the hypothesis.

Table 2: Correlation Table

Independent Variable	Swimming Performance			
	r-value	p value	Decision on Ho @ 0.05	Interpretation
Water Survival Skills	0.561	0.000	Rejected	Significant

Table 2 shows that the correlation between water survival skills and swimming performance obtained a p-value of 0.000, which is less than 0.05 level of significance. Therefore, the null hypothesis was rejected, confirming a statistically significant moderate relationship between the two variables. Furthermore, such a correlation obtained an r-value of 0.561, indicating a moderately positive strength. Water survival skills and swimming performance showed moderate positive correlation, supporting Duijn et al. (2022) and Denny et al. (2021).

c) Modified Paradigm

Figure 1 shows the modified paradigm of this study. In this paradigm, three emerging themes from the data collected were generated, describing their experiences. The following are the accounts of the experiences raised by the participants. The following themes emerged: technique development, independence in water survival, and building confidence.

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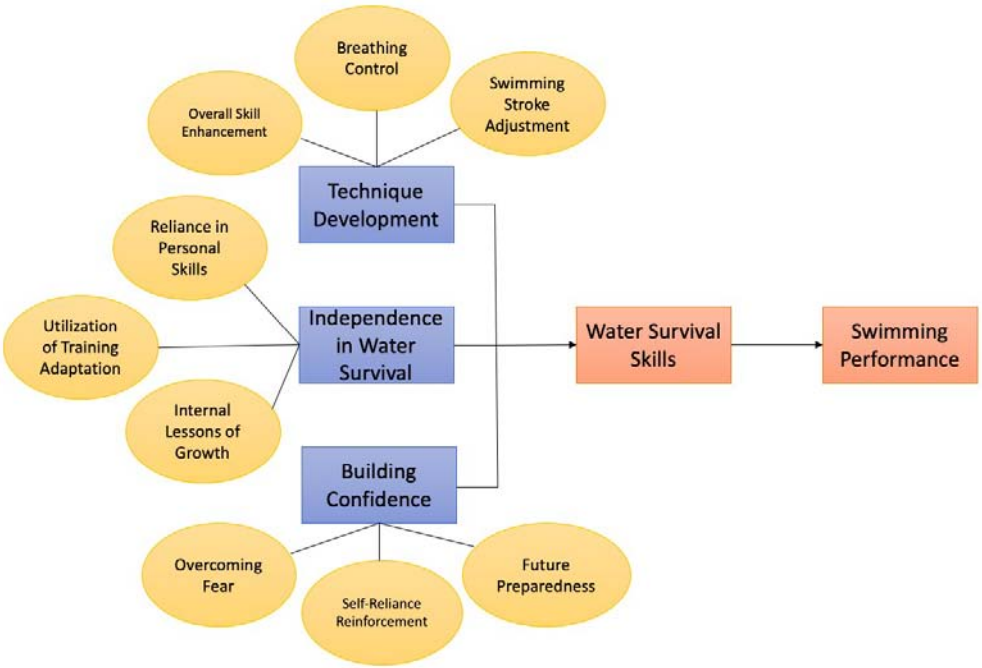


Figure 1: The Modified Paradigm of the Study

These emerging themes were supported and justified by the testimony of the participants during In-depth interviews. Table 3 shows the emerging themes on the experiences of BSMT in refining their water survival skills and improving their swimming performance.

Table 3: Emerging Themes on the Experiences of BSMT Students in Refining their Survival Skills and Improving their Swimming Performance

Discourse and Dimensions	Extracted Statements
Technique Development [a]	
Swimming Stroke Adjustment	"Even with small improvements in my swimming, like raising my elbow and smoothing my arm movements, I noticed that I do not get tired or run out of breath easily anymore. By extending my arms with each stroke and keeping my body straight, I can swim faster and more easily." (IDI-Participant 3, L48-50) "By focusing on small changes in my stroke, like staying relaxed at the start of each movement and gliding smoothly through the water, I learned how to float without struggling. Swimming faster while keeping the correct body position is a big improvement for me." (IDI-Participant 2, L73-77) "I discovered that small but regular improvements in my swimming style like using long, even strokes and keeping my head relaxed—really helped me save energy. I also used resistance training, like swimming with a buoy or fins, and short sprints, but I still kept the correct stroke position even when my speed changed." (IDI-Participant 5, L30-33)
Breathing Control	"When I learned how to control my breathing slowly, exhaling underwater and breathing at the right time to match my strokes, it helped me stay calm even when I felt nervous. Because I now breathe and stroke properly, I can float in a relaxed way and save energy through smooth movements instead of struggling while swimming." (IDI-Participant 1, L40-44)

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	"Learning to control my breathing really helped me. I practiced exhaling underwater so I could take deep breaths when I turned my head. When I swim alone, I do breathing exercises that feel like panic situations so I can learn to stay calm and keep my heart rate steady." (IDI-Participant 2, L45-50) "I try to keep my face underwater longer by taking quick but proper breaths, and this helps me swim more smoothly. I do not breathe all the time, but when I do, I take deep breaths. This helps keep my body straight and avoids too much head movement that can slow down my swim." (IDI-Participant 3, L51-55)
Overall Skill Enhancement	"I noticed that because my stroke, breathing, and technique improved, I can now swim longer without getting tired easily." (IDI-Participant 1, L27-29) "The change in my technique—from better strokes to proper breathing—really helped me stay afloat and swim farther. That experience taught me to trust myself, especially during emergencies." (IDI-Participant 3, L30-33) "Since my movements in the water are smoother now, it became the source of my confidence in swimming while still having enough energy left. Because of that experience, I realized I really need to keep practicing." (IDI-Participant 4, L34-37) "The combination of good technique, correct breathing, and practiced skills helped me trust myself in long-distance swimming." (IDI-Participant 5, L38-40)
Independence in Water Survival [b]	
Reliance on Personal Skills	"Oh my... there was a time I was swimming and did not realize I had reached a sudden drop-off, and it was already very deep...I just kept my presence of mind, so instead of asking for help, I stayed calm and slowed down my strokes. I still felt like I had enough energy, and my breathing stayed steady. Because I was careful, I was able to slowly get back to a safe place." (IDI-Participant 2, L67-71) "I had an experience I will never forget… it was when a really strong wave pulled me far from the shore, and I was all alone. It was so scary! But I stayed calm and used my presence of mind. I applied what I knew — smooth freestyle swimming and proper breathing — so I could move through the water and escape the strong waves." (IDI-Participant 3, L52-56) "Umm… because I focused and moved my hands smoothly, I was able to get through the waves without sinking, and I stayed balanced the whole time. I think it was really because of the strength and proper movement of my whole body that I did not panic and was able to keep swimming until I reached a safe place." (IDI-Participant 5, L31-34)
Utilization of Training Adaptation	"My confidence really developed because of regularly practicing emergency drills, including improving my strokes and practicing proper breathing." (IDI-Participant 1, L25-28) "Ahhh… for me, I use interval training like swimming fast then slowing down after, taking turns so I can rest a bit. It really helps build my strength and control the proper body position while swimming." (IDI-Participant 2, L78-81) "For me, because my stroke improved, I can swim faster now, so when there was a strong wave, I was able to avoid it. My controlled breathing also really helped keep my heartbeat calm and steady." (IDI-Participant 4, L82-84) "It was really good, to be honest… because it helped me maintain the correct stroke even when my swimming speed changed. In one practice, I really had to swim fast to get a life jacket that was floating away." (IDI-Participant 5, L85-88)

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Internal Lessons for Growth	"For me, staying calm and focused came from practicing how to handle stressful situations. I learned that if you already know what to do, you will not panic easily. The technique I practiced helped me trust myself during emergencies." (IDI-Participant 3, L30-33) "For me, that moment proved that all my effort to improve my stroke and trust my instinct was really worth it. Even if it was hard, I trusted the way I practiced." (IDI-Participant 2, L54-56) "The small changes in my swimming, like smoother strokes and relaxed breathing, helped me avoid getting tired quickly. It also helped me stay in control even when the waves were strong and gave me the confidence to swim farther with energy left." (IDI-Participant 5, L57-60)
Building Confidence [c]	
Overcoming Fear	"I will never forget that surprise survival exercise in open water. Even though the waves were really strong, using the right swimming technique helped me stay calm. I did not focus on the fear of sinking—I just focused on getting to safety." (IDI-Participant 1, L12-15) "During our coastal swim with strong waves, I realized I could keep swimming confidently because my arms did not get tired, and my breathing was still okay. I was able to keep the right body position in the water and escape the waves—ha-ha-ha—without panicking." (IDI-Participant 2, L39-42) "You know, I had this one experience, oh my God!… I fell off the boat I was riding, and I did not even have a life vest. So, I told myself to just stay calm while waiting for help. I used my improved stroke and breathing skills, stayed floating, and made sure I did not waste all my energy." (IDI-Participant 3, L43-47)
Self-Reliance Reinforcement	"Ahhhm… one time, I experienced being pulled by the waves away from the shore, and the worst part was—I did not have anyone with me to help. So I used my smooth freestyle stroke and controlled breathing, then swam diagonally to escape the strong pull of the waves." (IDI-Participant 3, L71-75) "During a weekend trip, I got separated from my group in the deeper part of the sea. Instead of panicking, I recalled my training—I controlled my breathing, slowed down my strokes, and chose the easiest and smoothest path back to shore. I really trusted myself while checking my direction and swam with confidence." (IDI-Participant 4, L76-80) "I practice being independent in the water by training alone sometimes. That one time, I was snorkeling when I suddenly got pulled by a strong underwater current. It was really difficult… but I pushed myself to face the challenge even without anyone to depend on. That moment truly tested my self-reliance." (IDI-Participant 5, L81-86)
Future Preparedness	"Honestly, because my freestyle has really improved, I can now swim farther without getting tired quickly. I stay more focused on my goal instead of worrying about drowning. Now, I feel more ready for long-distance swimming—I am more confident, and it feels easier for me." (IDI-Participant 1, L82-85) "Ahmm… I am happy because I have improved in my stroke, breathing, and overall skills. I can now swim longer distances without losing energy too fast. These improvements really helped me—both physically and mentally—so I can be prepared for unexpected challenges in the water." (IDI-Participant 2, L21-24) "Since I worked on improving my swimming technique, I now trust myself more and believe I can handle long-distance swimming. I now have lasting strength, and I am ready to face long swims, especially in case of water emergencies." (IDI-Participant 4, L19-22)

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d) Technique Development

Technique development represents a comprehensive process where BSMT students refine physical swimming abilities while cultivating essential professional qualities like discipline, confidence, and preparedness. This paradigm transcends mere skill acquisition, recognizing that mastered techniques could determine survival outcomes in maritime emergencies, thereby motivating deeper commitment to excellence. Rigorous training strengthened technique and endurance, confirming Ekanayaka et al. (2021) and Petrass et al. (2021) structured training benefits.

Swimming Stroke Adjustment: Swimming stroke adjustment involves modifying and refining stroke mechanics to enhance efficiency, conserve energy, and adapt to varying water conditions. Participants demonstrated that small, consistent improvements—like proper elbow positioning, smooth arm movements, and body alignment—significantly impact endurance and performance, proving that incremental progress builds substantial swimming competence. Modified stroke mechanics enhanced efficiency and energy conservation, affirming Seifert and Carmigniani (2023) and Riyanto et al. (2025).

Breathing Control: Breathing control encompasses regulating respiratory patterns to maintain composure during demanding water conditions. Participants mastered underwater exhalation, stroke-synchronized breathing, and panic-simulation exercises. This skill reduces anxiety, conserves energy, prevents fatigue, and enables swimmers to maintain proper form while developing mental focus essential for survival situations. Synchronized breathing improved swimming rhythm and stress management, supporting Ceviz (2024) and Grossman et al. (2021) research findings.

Overall Skill Enhancement: Overall skill enhancement integrates stroke technique, breathing control, endurance, and decision-making improvements. Participants experienced holistic development where refined mechanics improved efficiency, controlled breathing enhanced mental calmness, and combined skills fostered greater confidence. This comprehensive approach optimizes energy use and prepares swimmers for effective emergency responses. Integrated swimming techniques led to improved endurance and stability, confirming Riyanto et al. (2025) and Reichmuth et al. (2021).

e) Independence in Water Survival

Independence in water survival emphasizes BSMT students' ability to rely on personal skills and decision-making during challenging aquatic situations. This paradigm highlights how training and technique development build confidence, maintain composure under pressure, and manage emergencies without external assistance, reflecting professional maritime readiness standards. Immersive training cultivated student independence in water survival scenarios, affirming Downey (2021) and Petrass et al. (2021) findings.

Reliance on Personal Skills: Reliance on personal skills involves trusting abilities, training, and decision-making to handle water emergencies effectively. Participants demonstrated presence of mind during unexpected deep-water encounters and strong wave situations. Their experiences show how rigorous training enables independent navigation of high-pressure scenarios, enhancing personal safety and professional readiness. Students developed self-reliance through applying survival strategies independently, supporting Chiong (2023) and Riyanto et al. (2025) studies.

Utilization of Training Adaptation: Training adaptation refers to applying, adjusting, and refining learned techniques when facing unpredictable conditions. Participants successfully modified stroke patterns, breathing techniques, and energy management based on real-time challenges. This adaptive capability empowers critical thinking, composure maintenance, and effective decision-making during high-pressure maritime scenarios. Adapting training to real scenarios built survival autonomy, confirming Viktorelius and Selberg (2022) and Riyanto et al. (2025).

Internal Lessons for Growth: Internal lessons for growth encompass personal realizations and mindset shifts arising from overcoming water survival challenges. Participants developed self-awareness, resilience, and confidence through stressful situation management. These lessons strengthen abilities to maintain calmness, make intelligent decisions, and grow through each experience, building comprehensive survival competence. Repeated realistic challenges built resilience and mental toughness, supporting Rasyid et al. (2023) and Fazeli et al. (2024).

f) Building Confidence

Building confidence involves developing trust in abilities through consistent practice, skill refinement, and realistic scenario exposure. This confidence enables individuals to maintain composure, make quick decisions, and effectively apply survival techniques during challenging water situations, forming the foundation for maritime professional competence. Consistent water survival drills overcame fear and built self-assurance, affirming Stillwell and Khatchaturian (2020) and Stanley (2021).

Overcoming Fear: Overcoming fear involves gradually managing anxiety through supportive, guided water experiences. Participants successfully transformed fear into focused action during surprise exercises and emergency situations. By concentrating on techniques rather than potential dangers, they developed trust in abilities and maintained composure in aquatic

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environments. Students gained confidence facing water-based fears through controlled training, supporting Roche et al. (2022) and Jaskiewicz et al. (2022).

Self-Reliance Reinforcement: Self-reliance reinforcement strengthens students' ability to trust skills and judgment during challenging situations. Participants successfully handled separation from groups, strong currents, and emergency scenarios independently. These experiences demonstrate how preparation fosters calm decision-making and capability under pressure, building essential maritime professional confidence. Survival drills without assistance reinforced student self-reliance and confidence, affirming Merlin et al. (2024) and Thanvisitthpon (2025).

Future Preparedness: Future preparedness represents readiness gained through training that equips individuals for unexpected water emergencies. Participants developed physical skills, mental resilience, and strategic thinking necessary for calm, efficient responses. Improved techniques transformed both ability and mindset, fostering goal-oriented focus and positive outlook in challenging maritime endeavors. Refined techniques prepared students for maritime demands, supporting Casey et al. (2021) and Doremidov (2024) training effectiveness studies.

g) Conclusion and Qualitative Results

Based on the results of the study, it is concluded that water survival skills are a significant factor in swimming performance. This conclusion affirms psychomotor learning theory, which posits that psychomotor taxonomy is organized according to the degree of coordination, including involuntary responses and learned capabilities: reflex movements - automatic reactions, basic fundamental movement - simple movements that can build to more complex sets of movements, perceptual - environmental cues that allow one to adjust movements, physical activities - things requiring endurance, strength, vigor, and agility, skilled movements - activities where a level of efficiency is achieved, non-discursive communication - body language.

The water survival experiences of study participants are swimming stroke adjustment, breathing control, and overall skill enhancement as technique-developed experiences; reliance on personal skills, utilization of training adaptation, and internal lessons of growth as independence in water survival experiences; and overcoming fear, self-reliance, and future preparedness as building confidence experiences.

IV. Recommendations

Based on the conclusion and qualitative results, it is recommended that further sequential explanatory mixed study may be conducted using other variables to trace the 43.9% variance in the swimming performance. Furthermore, maritime training programs that integrate structured, progressive water survival drills into the curriculum may be defined to enhance the psychomotor development and swimming performance of BSMT students. These initiatives contribute to greater preparedness, confidence, and competence in handling real-life maritime emergencies.

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The Conducive Environment: J.J.R. Jolobe's Innovative Work

By Dr. Sithembele Xhegwana

Abstract- J.J.R. Jolobe, Imbongi Yomnqamlezo[1], is one of the pioneering Xhosa writers who also expressed himself through translation (both from English to isiXhosa and vice versa). He proved himself not only to be a distinct *man* of letters but also as an innovator and pioneering linguist. Steeped in the foreign culture of British imperial mission work, a hand-maiden for both colonialism and apartheid in South Africa, he played many roles. Incrementally so, ranging from the much tribalised positive socio-economic impacts of the 14th May 1835 'Mfengu' milkwood covenant to the effects of mission education, Jolobe found himself in quite a fertile ground to prosper both spiritually and intellectually. He was not only a beneficiary of colonialism but also a protector of his culture and his people. This paper seeks to look at the flip side of colonialism; that is the positive role it played in developing Xhosa intellectual giants like Jolobe.

Keywords: imbongi yomnqamlezo, translation, linguist, mission work, colonialism, milkwood covenant, fertile ground.

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Abstract- J.J.R. Jolobe, Imbongi Yomnqamlezo[1], is one of the pioneering Xhosa writers who also expressed himself through translation (both from English to isiXhosa and vice versa). He proved himself not only to be a distinct *man* of letters but also as an innovator and pioneering linguist. Steeped in the foreign culture of British imperial mission work, a hand-maiden for both colonialism and apartheid in South Africa, he played many roles. Incrementally so, ranging from the much tribalised positive socio-economic impacts of the 14th May 1835 'Mfengu' milkwood covenant to the effects of mission education, Jolobe found himself in quite a fertile ground to prosper both spiritually and intellectually. He was not only a beneficiary of colonialism but also a protector of his culture and his people. This paper seeks to look at the flip side of colonialism; that is the positive role it played in developing Xhosa intellectual giants like Jolobe.

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I. Introduction

It is a well - known fact that colonialism in the then Cape Province had devastating effects not only in the lives of the inhabitants but also in their socioeconomic welfare. Between the 1806 British imperialism's annexure of the amaXhosa territory to the extension of colonial boundaries in 1850, a quite significant move had been taken to entrench the settler movement within the amaXhosa self - sustaining agrarian economy. The nine frontier wars (1779 -1879) incrementally handed the mainly amaXhosa people and their indigenous economy into the hands of the British colonisers. The nail in the coffin was the massive slaughtering of livestock and burning of ripe crop (1856-1857) due to Nongqawuse's 'prophecy', the aftermath of which was the propelling of about 30 000 people to abandon their homes in search for employment. This was indeed the outcome of a much calculated move by Sir George Grey – the flamboyant Cape administrator- when through multi-pronged policies he sought to incapacitate the amaXhosa as far as self – sustenance was concerned. As much as the above-mentioned scenario was a defining factor, in this present paper it is my argument that British colonialism ushered in a new environment through which a certain segment of the amaXhosa people would prosper both spiritually and intellectually.

By stating this, it is not my intention to ignore Sir George Grey's convictions and thus ulterior motives when he introduced the 'civilising' policy for the natives (Ndletyana, 2008). As stated by the above - mentioned scholar, "Christianised and civilised, Grey believed, the Xhosa would cease being a British foe, and become a friend" (Ndletyana, 2008:4). However, as much as Sir George Grey and consequent administrators desired to infiltrate the colony, the missionary education and various institutions (mainly Lovedale college, missionary schools and various printing presses) left a lasting legacy in terms of education, religion and creative writing. Informing the crux of my main argument in this paper, Ndletyana (2008:4) observes,

> "Beneficiaries of the civilising mission they were, yet they refused to define themselves in the image of their colonial benefactors. Rather, they re-defined themselves, combining the best of the two worlds into what became a modern African identity and a unique contribution to South African modernity".

J.J.R. Jolobe, one of the torch bearers[2] of that era is a subject of the present paper. Through his work, he worked aggressively in innovating with form. This resulted in him bordering in new angles as not only as a creative writer but also as a theologian, historian and linguist. The moving around of his family as a result of his father serving in the Presbyterian Church of Scotland as a minister exposed him to different languages. His distinct knowledge of isiXhosa dialects (Bhaca and Hlubi) spoken at that time as well as Sotho, gave him a much needed advantage to break new grounds linguistically.

As raised by different sources, he was a unique personality as he was not only caught up with nostalgia for the amaXhosa past but also negotiated with the acceptance of the Christian present. He campaigned for the combination of traditional and Christian life which he strongly believed would lead not only to survival but prosperity in many forms. Within the isiXhosa writing canon, the theme of the conflict of tradition and the West was explored as from 1940[3] to 1972[4]. What puts

Author: e-mail: xhegwanasithembele@gmail.com

[1] Poet of the Cross.

[2] He combined all three aspects of missionary education: religious, educational and literary.

[3] A.C. Jordan's Inqqumbo Yeminyanya (later translated to The Wrath Of The Ancestors).

[4] Z.S. Qangule's Izagweba.

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Jolobe's work in the category of its own is that the theme of his literary works is not only concerned with the inherent conflicts with African traditions and the West. As much as he strongly spoke out against the oppressive colonial system of the time, he openly encouraged his people to embrace "Western civilisation".

II. From Colonialism to Apartheid: A Brief History of the AmaXhosa of the Eastern Cape Province of South Africa

Mlisa (2009) divides the history of the Eastern Cape into three major periods: the pre-colonial era (before the 17th century); the colonial era (the 17th to the 20th century) and the apartheid era (the 20th century). She further argues, "[the pre-colonial era] focus was on the Southern Nguni style of life before encountering the influence of the Eurocentric lifestyle" (Mlisa, 2009, p. 37). As Peires (1976) reveals, even prior to the arrival of missionaries, the amaXhosa cosmology was not necessarily pure. The interaction with both Khoi and San people meant hybridisation of some sort. To this effect, the influence of both Khoi and San religion prior to Christianity must be acknowledged (Peires, 1976).

Bundy (2004, p.10) has the following to say about the pre-colonial era:

> This physical divide had profound implications for the human geography and history of the region. Hunters and herders - Bushman (sic) and Khoi - had long traversed the more arid territory of the Karoo and southwestern coastal reaches; and from the fourteenth and fifteenth centuries, Xhosa clans had begun to test the westerly limits of the 500 mm annual rainfall zone, running their herds, sowing their crops, establishing larger scale polities and denser settlement. Hunters, herders and mixed farmers traded, fought, and inter-married. The extent of their interaction can be traced in linguistic borrowings and in the genetic make-up and pigmentation of some Xhosa (sic) clans.

The arrival the Dutch settlers in the Cape on the 6th of April 1652 would not only serve as a pioneering initiative for the establishment of a refreshment station for the Dutch ships *enroute* to the East but would also initiate a centuries long adventure in usurping both livestock and land of the original inhabitants of the land, both the Khoi - San and the amaXhosa. Following the frontier wars stretching between 1779 and 1880, the colonial period in the Eastern Cape Province of South Africa was entrenched by the 1820 settling of Europeans originally from England, Scotland and Ireland. Bundy (2004, p.10) summarises the progression of the colonial project in the Eastern Cape as follows:

> Subsequently, these patterns of contact were disrupted and overlaid by others: by the pressures of trekboers in the eighteenth century on Khoisan peoples and then by competition over water, grazing land and cattle between boer and Xhosa. Finally, of course, British settlers and troops unleashed forces - cultural, economic and military - that shattered Xhosa society west and immediately east of the Kei river.

The 1778 agreement between Governor Van Pletternburg and two minor amaXhosa chiefs would affect the amaXhosa people living west of the Fish River in many ways. Prior to that, there had been peaceful co-existence with the Boers, who had enslaved the Khoi people in previous encounters. The first British occupation from 1795 to 1803 and that of the Batavian Republic between 1803 and 1806 was a sign of terror. All of the above attempted to propel the Xhosa people towards the East of the Fish River.

Peires (1988, p. 161) adding to the above sentiments reveals, "in the shade of the house of Phalo, every man had a ridge for his homestead and a stream for his cattle. When his sons left home after circumcision, they never feared that they will fail to find land and water of their own". He continues, "By 1847 things were very different. The Xhosa kingdom had shrunk, and in shrinking it had lost vast tracts of its most fertile territory. The Xhosa were driven across the Fish in 1812, out of the Kat River Valley in 1829, and right past the Keiskamma in 1847" (Peires, 1988, p. 162). The indigenous economy that this community utilised as means of livelihood was negatively affected by the arrival of industrialisation and large-scale migrant labour.

The rise of two main personalities in the 19th century, Nxele (Makhanda) and Ntsikana, within the amaXhosa socio-political landscape had an effect on both Xhosa religion and way of life. As stated by Peires (1979, p. 51):

> The hundred years war (1779-1880) of the Xhosa people against the white colonists of the Cape of Good Hope produced not one but two historical traditions. One, originating with Nxele, was war-like and nationalist, embodying African beliefs and African culture. The other, originating with Ntsikana, was pacifist and Christian, enjoining salvation through obedience to the will of God.

As a result of being displaced by the English from Zuurveld (the present day Makhanda area and the surroundings) the amaXhosa experienced some kind of "national stress" (Peires, 1976). However, as argued by the above mentioned scholar, the interaction with the Boers was different. As stated by Peires (1976, p. 31), "mutual acculturation – many Boers even adopted Xhosa religious beliefs - reduced the difference between the two cultures".

As much as the amaXhosa were in awe in the presence of a European civilisation propagated by Christianity, they were not completely rendered helpless. To some extent, they did resist and thus were able to retain some of their indigenous institutions that pre-existed the late 19th century English missionaries. To this effect, Peires (1976, p. 145) observes,

> Thus it was largely in vain that the missionaries, most of whom equated Christianity with European civilisation and behaviour, attempted to persuade the Xhosa (sic) to

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abandon trusted practices which they regarded as essential to their earthly prosperity and well-being in favour of a doctrine which was abstract and explicitly devoid of material benefits.

To the Xhosa people, these cruel encounters with the British meant the invention of the word *imfazwe* (destruction of the soil as the British destroyed food, gardens and people). To a large extent, they also stole cattle. In response, the Xhosa and the Khoi formed a joint war. Peires (1979, p. 54) observes, "the expulsion created a set of problems which the chiefs were unable to solve. Thus, in the years immediately following 1812, political leadership was passed from the hands of chiefs into the hands of prophet-figures". As already alluded to, Nxele and Ntsikana, at approximately the same period of ten years served two different Xhosa chiefs in offering a spiritual dimension to the already threatened cosmology of war and daily existence.

After almost a century of wars in the Eastern frontier of the Cape Colony, "when the last frontier war – the War of Ngcayechibi – ended in 1879, the colonial forces shifted their focus to labour" (Ngcukaitobi, 2018, p. 19). As a result of the discovery of gold and diamond in the Free State and Kimberley, the Anglo-Boer war erupted. The English settlers felt they also had a stake in the minerals plundered by the Boers in these two areas. This infighting did not only claim many lives in both sides but left the economy in tatters. Thus, after the Anglo-Boer War it was mandatory to build a new country and a new economy.

As Ngcukaitobi, (2018, p. 25) keenly observes, "although Africans had been kept out of the political system, the mining bosses were actually aware that they had to be brought into the economy for the system to function". This period can be characterized by a number of events that would shape the future of the Union. These are the 1903 formation of the South African Native Affair Commission; the conversion of Africans into labour units in the colonial economy and a deliberate attempt to 'civilise' Africans. As observed by Khabela (1996) and Ngcukaitobi (2018), the civilization of Africans would be a smokescreen for ulterior motives such as creating labour reserves for the Cape Colony.

On the above sentiments Ngcukaitobi (2018, p. 27) declares, "having conquered by military means, the colonial state aimed not only to turn the black masses into a large pool of semi-skilled labourers, but also to create a docile educated class that would not question the economic and cultural hegemony of Empire". In the long run, this strategy would work against the state. Ngcukaitobi (2018, p. 28) declares, "but ten years after Britain's final military assaults of the late 1870's in Xhosaland and Zululand, a new form of resistance employing the institutions of colonialism emerged". The above-mentioned scholar continues, "not only did they use education as a basis of self-awareness and self-reliance, they saw it as a means of waging new struggles for emancipation." (Ngcukaitobi, 2018, p. 36).

The establishment of the Union in 1910 was a direct response to the imperial government to resolve the native question (Ngcukaitobi, 2018). The "Bantustan" system which was implemented after the 1948 apartheid election paved the way for new policies like separate development widely known as apartheid. The Bantu Authorities Act of 1951 offered a legal arm through which the Bantustan system could be established. In 1956, the former Transkei was the first 'homeland' to be created. This followed the 1913 and 1936 Land Acts, through which 87% of land was allocated to the white minority. As stated by Bank and Southall, this was driven by a philosophy of "a multi-national state", ironically bearing resemblance to the post-apartheid so-called rainbow nation, which was based not on 'history' but 'past conquest' (Bank & Southall, 1996, p. 412)

The apartheid era, a policy or system of segregation or discrimination on grounds of race, was defined not only by removals from ancestorial areas but urban infrastructural planning which by nature was destructive to the "kinsmen" or "tribesmen" lifestyle that the individuals were categorised as such to (Bank, 2001). The impact of social engineering policies in some of the newly established townships, both in the custody of the Republic and the apartheid homeland (areas that were preserved as reserves for most African people during the apartheid era), created "apartheid subjects" from the amaXhosa people in the Eastern Cape.

Through the Native Affairs Act of 1909 and the Native Land Act of 1913, "a system of direct rule was imposed upon the formerly autonomous chiefdoms, the legitimacy of chiefs was deliberately undermined, and subaltern authority was widely – but not uniformly – developed upon headmen" (Bank & Southall, 1996, p. 410). Furthermore, through the Native Administration Act of 1927, "systematic powers to appoint, recognize and remove chiefs" was solely vested on the Governor-General of the Cape Province (Bank & Southall, 1996, p. 411). The arrangement was designed in such a way as "to compel their services as administrative functionaries" (Bank & Southall, 1996, p. 411).

This all formed a foundation to the effect of reinventing of the former Bantustan areas rural government. The Freedom Charter, a document which culminated from the 1923 Bill of Rights of South Africa, was adopted in 1955 (Ngcukaitobi, 2018). It is Ngcukaitobi's contention that the development of the two above documents, that he terms as the African's Claim Document, was a statement against five decades of attempts of colonial administration (Ngcukaitobi, 2018).

The crafting of the constitution, a document which was a culmination of difficult negotiations spanning the periods 1990-1994, allowed for re-

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integration of the ten former 'homelands'. For both administrative and political purposes, these were further delineated into new nine new regions or provinces. The notions of liberal and consociational democracy were originally intended to be major tenants of the constitution. Also, existent legally constituted traditional authorities are 'recognized' and the indigenous laws and customs are supervised. However, "… some question whether the constitutional framework was in fact the correct response to colonialism and apartheid" (Ngcukaitobi, 2018, p. 1).

As observed by the above mentioned scholar, racial segregation can be traced back to the late-nineteenth-and early-twentieth century. As such, Victorian politicians offered a blue print. The former Transkei had already been a piloting ground for the implementation of the above within which the English colonial system had been enacted as early as 1894 (Bank & Southall, 1996; Ngcukaitobi, 2018).

Although there was more influence of Western culture in the former Transkei and Ciskei than anywhere in South Africa through mission-funded education, the ulterior motive was the transformation of the African peoples of South Africa from self-sufficient and autonomous through political subordination. Consequently, they were turned "into either communities of peasants, living on attenuated tribal lands which became increasingly dependent upon the export of migrant labour, or wage labourers who worked for firms and farms and lived in areas owned by whites" (Bank & Southall, 1996, p. 411).

The above mentioned situation was culminated in the chiefs' relative control of land through the Union 'Native policy' which allowed them to collect taxes partially for their financial gain, especially in Pondoland where colonial administration was enacted as early as the 19th century. At least, the policy of communal land tenure left the inhabitants of the late 19th century and 20th century 'homelands' better off as compared to those trapped in "the landless condition of the African population of the white areas of South Africa" (Bank & Southall, 1996, p. 412). The chiefs were not only stripped of the authority over their ancestral land but also in presiding over legal matters within their respective constituencies. Through a colonial system designed Customary Law, they were only granted powers to arbitrate only in civil cases and not criminal ones.

Through being *ex officio* members of "local governments within whose jurisdiction they fall", traditional authorities can conversely be used as state apparatus for both direct and indirect rule (Bank & Southall, 1996, p. 409). Historically, the recognition of traditional authorities in South Africa never came by default but was due "to a threatened boycott of the first democratic elections by the Zulu based Inkatha Freedom Party" (Bank & Southall, 1996, p. 409). This further emphasizes the concept of ambiguity as far as the roles of chiefs in local, provincial or national governance is concerned.

With more power progressively vested on them, the 1963 Transkei homeland first election directly translated into an outnumbering of the new 45 member legislative Assembly by 64 *ex-officio* chiefs (Bank & Southall, 1996). Presentation of the overall symbolism of post-apartheid South Africa (flags, bureaucracies and armies) by separate development architects was argued as "providing for a synthesis between tradition and modernity" (Bank & Southall, 1996, p. 413).

Not all chiefs necessarily allowed the scenario of being used as apartheid state apparatus within their respective "reserves". Some chiefs were part of the 1912 African National Congress (ANC) founding meeting. Also, Chief Poto of Western Pondoland who in 1963 opposed the imposition of separate development upon that territory in the Transkei's first election is another example (Bank & Southall, 1996). King Sabata Dalindyebo from the former Transkei took the baton and consequently was exiled in Zambia. The resistance of chiefs to both colonial and apartheid oppression was enacted in the coronation of Chief Albert Luthuli as the African National Congress (ANC) president in 1952. Lastly, Nelson Mandela, the first president of a democratic South Africa, himself was a son of a chief deposed by a colonial magistrate. With time, through the machinery of the Congress of Traditional Leaders of South Africa (CONTRALESA) traditional leadership was also coerced by the ANC to serve its political purposes just before the first democratic elections were held in April 1994.

The role of the chiefs was also very crucial in forging socio-political relations in the former "homelands" of Transkei and Ciskei just after the apartheid government installed Chief Ministers were overthrown through military coups. In the former Ciskei where Gqozo had taken over from Dr. Lennox Sebe, there were conflicts between traditional leaders and civic organizations. Contrary to Gqozo, Holomisa never removed chiefs from their positions but rather removed political enemies (Bank & Southall, 1996, p. 423).

The apartheid era is defined by not only removals but urban infrastructural planning which by nature is destructive to the lifestyle that the individuals are used to (Bank, 2001). The impact of social engineering policies in some of the newly established townships, both in the custody of the Republic and the apartheid homeland, sought to create "apartheid subjects" from the amaXhosa people in the Eastern Cape. According to Bank (2001), the amaXhosa people who were subjected to such in the East London area lost touch with some of their traditions and the essence of who they were. The housing system was further used as a tool for control, argues Bank.

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According to the above-mentioned scholar, if individuals did not qualify for housing, they were not kicked out of the system but instead were further referred for counselling (Bank, 2001). This clinical treatment of a social ailment enforced the subjectivity agenda in terms of Bantu administrators who in turn were acting for the apartheid state (Bank, 2001). This was also used to depoliticise the black masses. Creation of violence, gangsterism and unemployment was also a defining factor (Bank, 2001).

III. J.J.R. Jolobe's Missionary Background and Ouvre

As stated by Attwell (1999:268), "in what has been called the `comedic' vision of missionary education, post- Darwinian notions of progress and Christian eschatology were easily combined". As implicated, the main question "is whether the intellectuals of Dube's class, the *kholwa*, converted and merely accepted the metaphorics of the civilising mission or whether they appropriated them to serve their own interests" (ibid). The above- mentioned scholar further insinuates, "In all probability, the answer cannot be either-or: as products of the mission system they had been interpellated by its language, values and ethos, but at the receiving end of colonial racism and the limitations it imposed on their social, political and economic ambitions, they were aggrieved by the contradictions between their ideals and actual experience" (Attwell, 1999:268).

The Glasgow Mission Society's Reverand John Bennie's inscription, deliberately superimposed over "a stoic looking cow", Christian or secular, appropriated not only the amaXhosa cosmos but both their land and livestock (Peires, 1980). In essence, by declaring that "All cattle come from God", on behalf of the settlers, he was offering both justification and propaganda as a vehicle for both usurping and appropriation of the fore mentioned 'indigenous' property. By default, if the statement was indeed true, as he claimed, as agents of the British Empire and thus God they had a stake in both the Khoi-San and amaXhosa livestock. Between 1823 and 1915, focal institutions like Chuma mission station (that later changed to Lovedale) and the South African Native College (now Fort Hare) were formed. The two above mentioned institutions would play a significant role in not only reducing the South African indigenous languages to a quasi-status of written text but would help to 'civilise' a large number of African middle class.

James Ranisi Jolobe was born on the 25th of July 1902 at Indwe, roughly 67 years after the famous 14th May 1835 milkwood covenant. Led by John Ayliff from Butterworth to Peddie, the 'Mfengu'[5] tribe gathered and convened under a milkwood tree. They made a covenant to serve not only God but the Empire. They also made a solemn promise to educate their children. Jolobe was born to amaHlubi, one of the sub-groups that belong to the 'Mfengu' tribe. I am raising this now for two major reasons. Firstly, in terms of the socio-economic vantage and the aesthetic this background would assist the young Jolobe. His father (a minister in Presbyterian Church of Scottland) and mother (a primary school teacher) would instil a love for both God and education to the young Jolobe, just as promised by his ancestors. Secondly, this would haunt his career later in his life at Lovedale as there was a tribal feud then between the former and the 'Xhosas'. This feud was so immense as it would even affect giants like D.D.T. Jabavu, as he himself was classified as a 'Mfengu'.

After qualifying and practising as both a teacher and a minister, he would eventually graduate with a B.A. degree (Ethics and English) from the University of Fort Hare in 1932. Married to a professional nurse, they had three children. His classic novel, *Elundini Lothukela*, was published in 1959. At a certain point in his career he was invited to be a tutor at Lovedale by Reverand Grant. It may be around this time that the tension was heating up between 'Mfengus' and 'Xhosas' as Peirres records that at a certain point Lovedale authorities were much concerned about this rivalry as somehow "it would affect the church" (Peirres, 1980). Nkosi (1981, unpaginated) observes. "By the 1920s in South Africa the Scottish missionaries had firmly laid the groundwork for the literary activity which would culminate in that first flowering of African literature the most notable representatives of which were Mqhayi, Jolobe, Bereng, Vilakazi and H. I. E. Dhlomo. . . ." (Lewis Nkosi, 1981).

His parallel use of three languages (Bhaca, Hlubi and Sotho) initially posed a linguistic challenge as far as his literary outputs in isiXhosa were concerned. However, with the intervention of luminaries like S.E.K. Mqhayi, this would later prove to be a major development in the language. He also crossed boundaries as far as cultures and customs of these three main Xhosa sub-groups are concerned. This would later be an asset in his writing career as his major classic, *Elundini Lothukela*, owed its conception to such ethnographic inclinations. He wrote across all forms: that is journalism, novel, drama, poetry and essays. To prove this, in 1952 he was even awarded the Vilakazi

[5] 'Mfengu' is a generic term for the broken peoples who among the Xhosa in the wake of the Mfecane. They rallied around the sympathetic Wesleyan missionary John Ayliff, and during the Sixth Frontier War (1834-5) h instrumental in provoking them to desert across the Kei to the British.

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Memorial Prize for both preserving and developing Nguni languages.

As far as language is concerned, Jolobe proved himself to be a social developer. His whole oeuvre includes the following: two novels; four collections of poetry and eight translations. In total, he received five literary awards for different forms of writing. The colonial benefactors like Jolobe were not simple dormant recipients of the foreign 'civilisation' agenda brought by missionaries. As argued by Ndletyana (2008:5) "[they] re-defined themselves, combining the best of the two worlds into what became a modern African identity and a unique contribution to South African modernity".

As much as his primary language of writing is isiXhosa, he adopted bilingualism through translating both from isiXhosa to English and vice versa. Most of the work that he translated from English to isiXhosa were missionary documents and pamphlets published by Lovedale. To the same extent, he translated educational material aimed for schools. He also translated works of significance like Rider Haggards's 1885 *King Solomon's Mines* to *Imigodi ka Kumkani uSolomoni, Up from Slavery* by B.T. Washington as *Ukuphuma ukusuka ebukhobokeni* (1951). In 1972 he translated the Preface of John Knox Bokwe's Biography written by S.E.K. Mqhayi. In his own work, he translated his classic epic poem, "uThuthula" from isiXhosa to English. There is also a slim collection of his work originally translated by Z.S. Qangule and Robert Mshengu Kavanagh in 1971, *The Making Of A Servant And Other Poems*.

In seeking larger audiences, Jolobe translated some of his work, especially the award winning epic poem, *uThuthula*. *Thuthula* is still a subject interest judging from the 2003 Chris "Zithulele" Mann's adaptation of the epic into a play *Thuthula: Heart Of The Labyrinth* and its reception by the amaXhosa royal house. Xhegwana (2022) has also revisited the debate through publishing *A Letter To Thuthula* in the Institute for the Study of English in Africa published poetry journal, the *New Coin*. As a decolonising tool, Jolobe also translated a large corpus of work by other authors from English to isiXhosa. To this effect, Kwetana observes,

In his writings, Jolobe always tried to make readers aware of the statements and sentiments made by Europeans about Nguni African people [that] were derogatory in nature. Attitudes of Europeans towards African people were well captured in King Solomon's Mines (para 1.4.3, v). His translations thus ensured that those who were reading said work were aware of how Europeans were viewing them and how they regarded their status in society. At this time, he was engaging in the political awakening of African people (Kwetana 2000).

IV. Conclusion

The first generation of Xhosa intellectuals were a rare breed. With such a skill they negotiated the binary nature of their existence; old and new, traditional and modern, African and European. In being benefactors of the British missionary education, they were not passive recipients but somehow displayed a certain kind of resistance which was not easily detectable to the Empire. In doing so, they left a blue-print through which generations to come would develop. Although very much younger than these pioneers[6], Jolobe was put in the same category as the likes of Mqhayi, Jabavu and Bhokhwe. As already inclined to in the above argument, he adopted an aesthetic that had already defined itself in terms of mission education and the 'civilising' mission of the colonisers. This can be attributed both to the vintage point that both his lineage, the so-called Mfengus, and his very immediate family offered him. Indeed, his was a conducive environment that, with a lot of hard work of course from his side, allowed both his spiritual and academic pursuits flourish.

[6] Perhaps one could rightly point him out a belonging more to the second generation.

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We typeset manuscripts using advanced typesetting tools like Adobe In Design, CorelDraw, TeXnicCenter, and TeXStudio. We usually recommend authors submit their research using any standard format they are comfortable with, and let Global Journals do the rest.

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Acknowledgments

Contributors to the research other than authors credited should be mentioned in Acknowledgments. The source of funding for the research can be included. Suppliers of resources may be mentioned along with their addresses.

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Authors can submit papers and articles in an acceptable file format: MS Word (doc, docx), LaTeX (.tex, .zip or .rar including all of your files), Adobe PDF (.pdf), rich text format (.rtf), simple text document (.txt), Open Document Text (.odt), and Apple Pages (.pages). Our professional layout editors will format the entire paper according to our official guidelines. This is one of the highlights of publishing with Global Journals—authors should not be concerned about the formatting of their paper. Global Journals accepts articles and manuscripts in every major language, be it Spanish, Chinese, Japanese, Portuguese, Russian, French, German, Dutch, Italian, Greek, or any other national language, but the title, subtitle, and abstract should be in English. This will facilitate indexing and the pre-peer review process.

The following is the official style and template developed for publication of a research paper. Authors are not required to follow this style during the submission of the paper. It is just for reference purposes.

Manuscript Style Instruction (Optional)

- Microsoft Word Document Setting Instructions.
- Font type of all text should be Swis721 Lt BT.
- Page size: 8.27" x 11'", left margin: 0.65, right margin: 0.65, bottom margin: 0.75.
- Paper title should be in one column of font size 24.
- Author name in font size of 11 in one column.
- Abstract: font size 9 with the word "Abstract" in bold italics.
- Main text: font size 10 with two justified columns.
- Two columns with equal column width of 3.38 and spacing of 0.2.
- First character must be three lines drop-capped.
- The paragraph before spacing of 1 pt and after of 0 pt.
- Line spacing of 1 pt.
- Large images must be in one column.
- The names of first main headings (Heading 1) must be in Roman font, capital letters, and font size of 10.
- The names of second main headings (Heading 2) must not include numbers and must be in italics with a font size of 10.

Structure and Format of Manuscript

The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

a) A title which should be relevant to the theme of the paper.
b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
d) An introduction, giving fundamental background objectives.
e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
f) Results which should be presented concisely by well-designed tables and figures.
g) Suitable statistical data should also be given.
h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
j) There should be brief acknowledgments.
k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.

Format Structure

It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

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The title page must carry an informative title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) where the work was carried out.

Author details

The full postal address of any related author(s) must be specified.

Abstract

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

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A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy: planning of a list of possible keywords and phrases to try.

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning searching. Think about the most important concepts related to research work. Ask, “What words would a source have to include to be truly valuable in a research paper?” Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

Numerical Methods

Numerical methods used should be transparent and, where appropriate, supported by references.

Abbreviations

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

Formulas and equations

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

Tables, Figures, and Figure Legends

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.

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Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

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Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

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Tips for writing a good quality Social Science Research Paper

Techniques for writing a good quality homan social science research paper:

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of homan social science then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

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9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.
Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

19. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

20. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

21. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

22. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

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Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

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To make a paper clear: Adhere to recommended page limits.



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- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.



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Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

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- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
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- Recommendations for detailed papers will offer supplementary suggestions.

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References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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