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Learning Analytics on the African Continent: An Emerging Research Focus and Practice

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Abstract

While learning analytics (LA) has been highlighted as a field aiming to address systemic equity and quality issues within educational systems between and within regions, to date, its adoption is predominantly in the Global North. Since the Society for Learning Analytics Research (SoLAR) aspires to be international in reach and relevance, and to increase the diversity and inclusivity of the SoLAR community, it is pertinent to look at learning analytics use in higher education institutions in Africa. This paper reports the first scoping review of research in the field of LA conducted on the African continent. The coding and analysis show that LA research is still in its infancy on the African continent with only 15 studies, overwhelmingly from South Africa. The study also revealed several challenges, such as limited technical support and access to LMSs, the limited visibility of African scholars at SoLAR events and publication venues, and the limited focus on interventions that involve stakeholders. The article concludes with several propositions and provocations to advance the adoption of LA in Africa and open up space for critical conversations about the potential of learning analytics in contexts with characteristics different than those found in the Global North.

Notes for Practice

- Current research on the state of the field points to the relative absence of published research in LA from the African context.
- Very little, if anything, is known about the state of the field of LA on the African continent. The present research is a first attempt to map this.
- In line with a commitment from SoLAR, as well as the International Conference on Learning Analytics and Knowledge (LAK), to increase participation from marginalized groups and communities, and to diversify understandings of the potential and practice of LA, it is crucial to establish a baseline.

Keywords

Learning analytics, Africa, Global South, scoping review

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1. Introduction

Since the emergence of learning analytics (LA) as a research field and praxis in 2011, LA has grown, not only in adoption but also in geopolitical spread (Foster & Francis, 2020; Wong & Li, 2020). Several studies report on the growth of LA in contexts such as, but not limited to Europe (Tsai et al., 2020), Australia and Malaysia (West et al., 2018), and Latin America (Dos Santos et al., 2017; Hernández-Leal et al., 2021; Pazmiño-Maji et al., 2021). As the field matured and interest in LA and adoption spread, the research, theoretical developments and institutional adoptions have been, and continue to be, predominantly from the Global North (Gašević, 2018; Prinsloo, 2020; Williamson et al., 2020). In using the descriptors of the Global North and the Global South, we acknowledge that these descriptors are, in many ways, problematic and contested despite their use in scholarly literature (Toshkov, 2018). There is an inherent danger in investigating the purported low levels of adoption of LA on the African continent, and generally in the Global South, that the low adoption levels are used to support assumptions about the Global South being technologically backward, behind, and less developed. The Global South and, in the context of this article, Africa are anything but homogenous and backward, although there are clear differences regarding equality indices and adoption of technologies compared to other contexts. In this article, we use the descriptors of the Global North and South as broad, provisional categories (e.g., Arora, 2016; de Sousa Santos, 2012, 2015).

Despite empirical evidence on the benefits of deploying LA and attempts in the LA community to diversify its members (e.g., through the LAK conference travel scholarship) and reach,1 evidence on the adoption and use of LA on the African continent remains scarce. Looking at the participation of African delegates to the annual Learning Analytics and Knowledge (LAK) conferences does point to increasing interest from researchers from the African continent. The total registrations from delegates from the African continent since 2018 nearly doubled. In 2018 there were 362 delegates (two from Africa), in 2019 a total number of 507 delegates with eight from Africa, and in 2020 there were eight African delegates in a total of 557 attendees. For LAK 2021, the number of delegates from Africa was 10 in a total of 630 registrations. There has, however, never been an African delegate attending the Doctoral Consortium at LAK (SoLAR, 2021). Other evidence suggesting increased interest can be found in the University of Ghana's 2020 week-long virtual symposium on LA with speakers from Ghana, the UK, and South Africa (University of Ghana, 2020).

How then should one understand the relatively low or unreported uptake of LA on the African continent?

First, it is important to consider that despite several reviews covering different areas of LA (e.g., Viberg et al., 2018; Ifenthaler & Yau, 2020), there has not yet been any attempt, as far as we could establish, to provide a review of LA on the continent of *Africa*. Therefore, though the low registration numbers at LAK may indicate low adoption of LA, we need empirical evidence before making any substantive claims regarding the state of LA adoption on the African continent. Besides, the overall mission of the Society for Learning Analytics Research (SoLAR) is to advance the field of LA globally and to work on initiatives to expand overall membership while being as diverse and inclusive as possible. This is critical to SoLAR's aspirations 1) to be a truly international society, 2) to maintain the intellectual health of the field, and 3) to prevent groupthink. The society emphasizes the need to continue to diversify in geography, gender, ethnicity, discipline, methodology, and so on. One action area to increase SoLAR's visibility is to promote LA in underrepresented regions by actively reaching out to members.[2] However, without mapping the current state of LA in underrepresented regions such as Africa, such efforts could be hard to achieve. In addition, LA has been highlighted as a field aiming to play a role in social change by addressing systemic equity and quality issues within educational systems between and within regions through data-informed decisions. With widening social and economic gaps between Africa and the rest of the world, it could be argued that LA has the potential to address inequalities in education and through education on the African continent (Gašević, 2018; Prinsloo, 2020). From this background, we argue that a review of the current state of LA is necessary to provide a basis for different initiatives by SoLAR, researchers, and educational managers, as well as to guide specific LA interventions.

In this regard, this paper reports the first scoping review of research in the field of LA conducted on the African continent. A scoping review is a type of knowledge synthesis that follows a systematic approach, summarizing a range of evidence to convey the breadth, depth, and knowledge gaps of a field (Levac et al., 2010). This approach is appropriate for reviewing educational research across a range of domains, particularly those "breaking new ground" (Munn et al., 2018), as is the case with LA.

2. Background

While this article attempts to verify claims of low levels of adoption, we must also consider four aspects of the wider context: 1) levels of Internet penetration, 2) levels of digitalization, 3) the diversity and participation in scholarly publications and networks of the African continent, and 4) the evident porousness of the boundaries between educational data mining (EDM), academic analytics, and learning analytics.

According to Ischebeck (2020), the U.N. Broadband Commission found that the worst Internet availability is found in sub-Saharan Africa, including Somalia, Niger, and South Sudan, with Internet penetration rates of less than 2%. A study by the U.N. Broadband Commission (2020) found that the number of individuals on the African continent using the Internet has increased from 81 million in 2010 to 294 million in 2019 (p. 21), against a total population of about 1.3 billion, equaling about 21% of the population. According to Internet World Stats (2021), there was a 12.98% growth in Internet use from 2000 to 2021, and currently 43% of Africa's population has access to the Internet. By 2030 it is estimated that 75% of Africa's population will be using the Internet (Allen, 2021). According to *Forbes*, everything points to the expectation that "Africa is the next frontier for the Internet" (Tuerk, 2020). Countries on the African continent where e-learning has become mainstream have "huge levels of local and foreign investment, as well as above-average Internet access and connectivity" (Ischebeck, 2020). Close to 800 million people in sub-Saharan Africa still do not have access to the mobile Internet while 65% of the population will have access to smartphones in 2025 (GSMA, 2020). As we will discuss later, combined with the possibility that Learning Management Systems (LMSs) may not, for the near future, be the main source of student learning data, the

[1] Society of Learning Analytics (SoLAR): https://www.solaresearch.org/about/
[2] About SoLAR: https://www.solaresearch.org/about/

increased penetration of smartphones on the African continent suggests the potential of using mobile learning data in LA (e.g., Gašević, 2018; Kizilcec & Goldfar, 2019).

It is also possible to consider the relationship of the relatively low levels of digitization of higher education on the African continent with the use of LMSs and the subsequent potential for LA. Though there is evidence of the increasing digitization of higher education, it is unclear to what extent universities on the African continent have embraced institutional LMSs or moved teaching and learning online. In their systematic review of LMS acceptance and adoption in sub-Saharan Africa, Bervell and Umar (2017) report that most African educators have little knowledge of or interest in the use of LMSs. They found studies on LMS use in Ghana, Nigeria, Tanzania, Uganda, Zimbabwe, and South Africa.

According to Business Market Insights (2020), the "education and LA market in Middle East and Africa (MEA) is expected to grow from US$307.3 million in 2019 to US$1,490.0 million by 2027; it is estimated to grow at a compound annual growth (CAGR) rate of 22.4% from 2020 to 2027." Moodle is, by far, not only the most popular LMS on the African continent but also the fastest growing; its market share of 53% in 2008 grew to more than 78% by 2021 (Hill, 2021).

The third element to consider before making normative claims about the adoption of LA on the African continent is the immense diversity in and between the 54 states (as represented in the United Nations), including the diversity of languages and access to and participation in scholarly publications and networks. While scholarly publishing in LA is dominated by English, several higher education systems include French, Portuguese, or Arabic together with languages such as Yoruba and Swahili. The continent is immensely rich in indigenous languages; Nigeria, for example, has over 500 languages. Britain and France, as colonial powers in Africa, shaped many education sectors. English and French also replaced local languages (Teferra & Altbach, 2004) in what de Sousa Santos (2015) and others refer to as "epistemicide." Despite increasing efforts to include indigenous languages as languages of tuition, French, English, and Portuguese continue to dominate the higher education landscape (Teferra & Altbach, 2004). However, the continued dominance of colonial languages in African higher education does not necessarily translate into access to and participation in international scholarly networks and editorial boards and regimes (Collyer, 2018; Hountondji, 1997; Jöns & Hoyler, 2013). In light of the low adoption of LA on the African continent, it is quite possible that researchers attempting to publish may be told that their findings are not novel or of interest to the LA community in the Global North.

The relationship between EDM and LA, in the specific context of Africa, is the fourth element that might potentially explain the seemingly low uptake of LA. Since the emergence of LA as a distinct research focus and practice, its relationship with EDM was part of that evolution. For example, very early on, such authors as Ferguson (2012) and Siemens and Baker (2012) mapped this relationship. Ferguson (2012) distinguishes the two in this way: "Educational data mining focused on the technical challenge: How can we extract value from these big sets of learning-related data?" while LA "focused on the educational challenge: How can we optimize opportunities for online learning?" (p. 3,011). Siemens and Baker (2012) refer to EDM and LA as two "distinct research communities" (p. 252), while acknowledging that EDM preceded LA. They further propose that "it is important for researchers and educators to recognize the unique attributes of each community" (p. 252). Though Baker and Inventado (2016) state that EDM and LA can be used interchangeably, they also state that

> *The core differences between the communities are in terms of emphasis: whether human analysis or automated analysis is central, whether phenomena are considered as systems or in terms of specific constructs and their interrelationships, and whether automated interventions or empowering instructors is the goal (p. 86).*

In a recent attempt to investigate the similarities and differences, Lemay, Baek, and Doleck (2021) executed a structural topic modelling approach on EDM and LA and found that "there appears to be disciplinary differences in terms of research focus, there is little support for a clear distinction between the two disciplines, beyond their different lineage." The trend points to a convergence within the field of educational research on the applications of advanced statistical learning techniques to extract actionable insights from large data streams for optimizing teaching and learning. Both fields have converged on an increasing focus on student behaviours over the last five years.

Regarding LA in the Global South, Dos Santos et al. (2017) researched the context of Latin America, and though the authors acknowledge the linkages between EDM and LA, they also note the differences; their systematic mapping used only the search term "learning analytics." A different approach is the research by Maphosa and Maphosa (2020) on EDM in sub-Saharan Africa. Their systematic review searched for "educational data mining" OR "learning analytics" OR "academic analytics" AND ("Africa" OR "developing countries") focusing on the IEEEXplore, ACM, Science Direct, Emerald Insight, EBSCOhost, Sabinet, and Google Scholar databases. They do not report on which of these search terms were found in which of the 24 articles in the final corpus; instead, they report on authors, the objective of the data collection, the algorithm used, the tool used, as well as the dataset (e.g., number of records) and the country. They defined the latter as indicative of the location in which the research was conducted. Though not acknowledged, they excluded theoretical/conceptual research.

Finally, the history of institutional research on sub-Saharan Africa shows the dominance of EDM and a recent emergence of LA as research focus and practice within the broader context of institutional research (Botha & Vilyte, 2021; Lemmens & Henn, 2016).

At present, it is not clear how the above four aspects — 1) access to the Internet, 2) the state of digitalization in African higher education, 3) the diversity in and scholarly context of the African continent, and 4) the evident porousness of the boundaries between EDM, academic analytics, and LA — impact on the purported low adoption of and/or low participation in scholarly discourse and research on LA. In the broader context of the Global South, there is some evidence (Falcão et al., 2020; Hilliger et al., 2020) that the Global South is becoming part of the global LA community, pointing to the capacities, skills, infrastructure, and human resources that will be needed to institutionalize a context-appropriate, ethical approach to LA, and to respond to context-specific identified needs and risks. With specific attention to what LA can mean for institutions in the Global South, Gašević (2018) outlines benefits such as "support for learning at scale, the provision of personalized feedback at scale, increased numbers of graduates, the identification of biases affecting the success of underrepresented and under-supported populations, optimization of the use of resources, and the development of data literacy" (p. 17).

There are, however, also concerns that these attempts to include the Global South, need to be understood in terms of the inherent "asymmetrical power relationship between the one who invites and the one who accepts the invitation" (Prinsloo, 2018a, p. 24), as well as recognition that accepting the invitation or becoming part of the community may involve questioning normalized assumptions, values, and practices. In a first initial response to the specific invitation by Gašević (2018) and the broader attempt to include the South, Prinsloo (2018a) points to specific initial concerns and questions such as "the potential of LA in data-poor environments where individual or institutional access to the Internet and wireless technologies may be non-existent, poor, intermittent and/or expensive" (p. 25). He further points out that the South uncritically accepting and adopting "as is" practises and understandings may be not only inappropriate but less effective (see also Selwyn, 2020).

3. Research Problem and Question

In his taxonomy, Miles (2017) refers to seven possible research gaps that warrant investigation: 1) evidence, 2) knowledge, 3) practical-knowledge conflict, 4) methodological, 5) empirical, 6) theoretical, and 7) population (p. 2). In light of the background provided above, it is not clear how widely LA has been adopted on the African continent. As such it falls into the "population gap" category. Due to the unknown nature of the outcome of this research, it may also fall in the "knowledge gap" referring to situations where "knowledge may not exist in the actual field," or the "empirical gap" referring to the fact that "no study to date has directly attempted to evaluate a subject or topic from an empirical approach" (Miles, 2017, p. 4).

Flowing from our understanding of research gaps, the broad research question informing our research is this: *What is known about LA in the African context?*

4. Methodology

In considering an appropriate research design to answer the research question, two options were considered, namely a systematic or a scoping review. While there are similarities between them, they serve different purposes and approaches (Munn et al., 2018; Tricco et al., 2018). Scoping reviews are considered appropriate when researchers attempt to map research gaps in a particular field, without knowing exactly what search terms will answer their question; systematic reviews require a well-defined, clearly articulated question (Arksey & O'Malley, 2005). In this study we opted for a scoping review, resulting in an iterative process as we refined and mapped different possibilities (Arksey & O'Malley, 2005). Scoping reviews have the following characteristics:

- Guided by an a priori protocol
- Systematic approach of searching for information
- Clear and transparent processes resulting in reproducible research
- Designed and executed to increase reliability and reduce error, using multiple reviewers
- Extract and present data in a structured way. (Munn et al., 2018, p. 5)

To increase the rigour of this scoping review, we used the checklist by Cooper et al. (2019) and implemented the PRISMA (PRISM-ScR) guidelines (Tricco et al., 2018). PRISM-ScR was developed according to published guidance by the Enhancing the Quality and Transparency of Health Research (EQUATOR) network for reporting guidelines (Tricco et al., 2018) and used in previous scoping reviews (Kaliisa, 2021b; Major et al., 2018). The review followed the following four stages: 1) identifying the research questions, 2) identifying and selecting relevant studies, 3) charting data, 4) collating, summarizing, and reporting results. These stages are further described below, highlighting how they were executed in this study.

4.1. Identifying the Research Questions

We started by identifying a research question to guide our scoping review. As with most scoping reviews, we came up with a general question about summarizing the breadth of evidence regarding LA implementation and research on the African continent. Thus, we formulated our research question as follows: What is known about LA in the African context? In following Cooper et al. (2019), the criteria for this stage of the scoping review include the following:

1. The rationale/purpose for the scoping review is stated
2. An appropriate methodology is used
3. At least two reviewers conduct the review
4. The research question is used to guide the scope of inquiry

4.2. Identifying and Selecting Relevant Studies

A strength of scoping studies is that they include the breadth and depth (comprehensiveness) of evidence in a given field (Levac et al., 2010; Cooper et al., 2019). The criteria provided by Cooper et al. (2019) were considered in the study selection: 1) describing the inclusion and exclusion criteria clearly; 2) an iterative process for searching the literature, refining the search strategy, and reviewing articles for inclusion; 3) involving at least two reviewers who independently review the title and abstracts, reaching consensus on studies for inclusion; and 4) summarizing the study selection in a flow chart (see Figure 1).

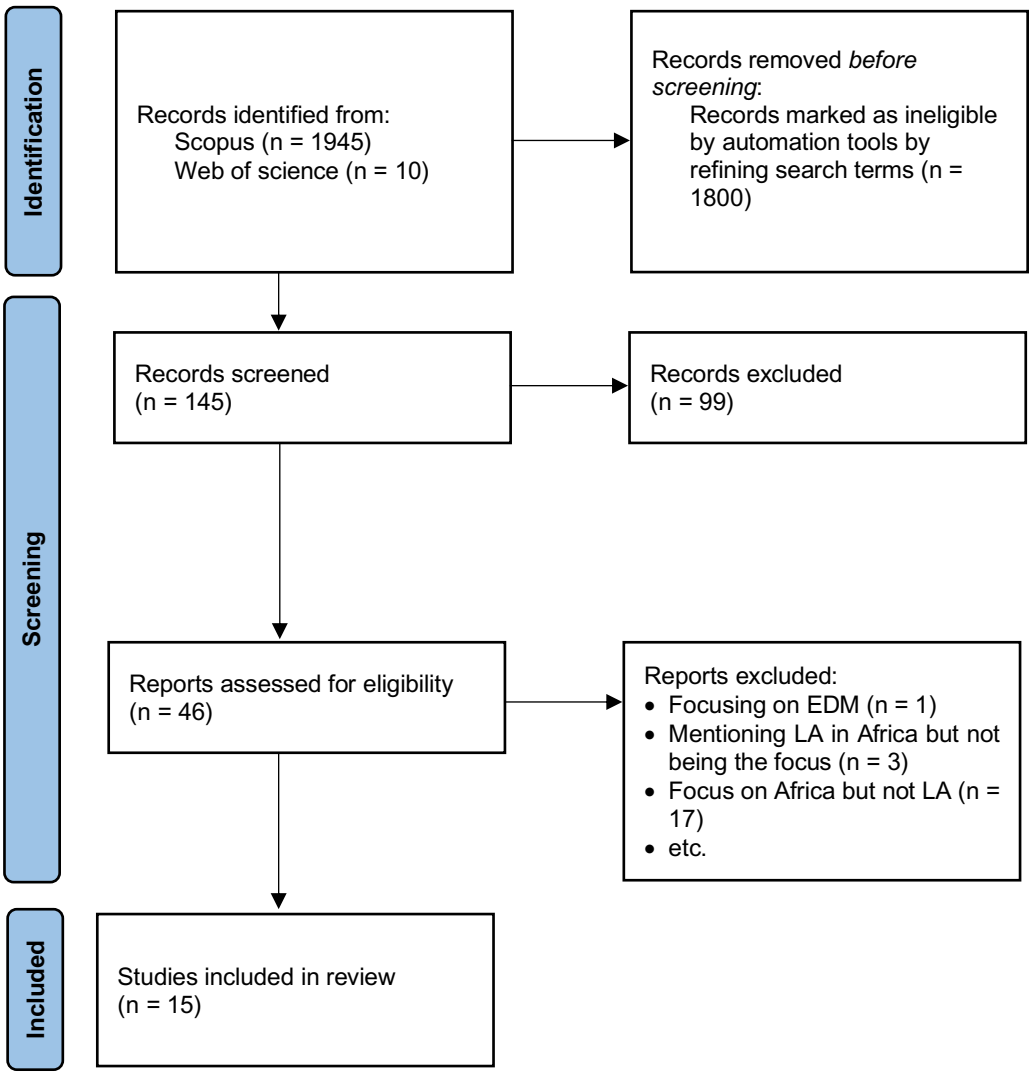

Figure 1. The flow diagram for the scoping review process.

Thus, to identify relevant studies, we took several steps. First, the two researchers met to discuss decisions surrounding the study inclusion and exclusion criteria, reported in Table 1. After the inclusion/exclusion criteria was formulated, the two researchers created the search terms, and the sources to search for relevant research articles. The search string used included variations and different combinations of the following words: "learning analytics" AND "Africa" AND/OR "global south" AND/OR "develop* count*" (see Table 1 below). For this research, two databases were identified, namely Scopus and Web of Science.

The screening was based on titles, abstracts, and full text skimming, and was carried out between 5 March 2021 and 29 June 2021. It is important to note that this process was iterative, with frequent discussions between the two researchers to avoid potential ambiguity about the broad research question and to ensure that the abstracts selected were relevant for full article review. All disagreements were solved through social moderation (e.g., consensus). Following these procedures, the final dataset included 15 papers (see Table 3 for full study details).

Table 1. Inclusion and Exclusion Criteria

Inclusion	Exclusion
• Papers reporting on an LA study conducted *in* or directly relating to or mentioning LA in Africa • Papers published in a peer-reviewed journal or conference proceedings • All articles (empirical, theoretical, conceptual, editorials, book reviews) • Study is published in English	• Papers reporting predominantly on EDM and not LA • Papers not reporting on an LA study conducted in or directly relating to or mentioning LA in Africa • Non-scholarly peer-reviewed journal or conference proceedings • Articles in press • Study not published in English

Table 2. Sources, Keywords, and Number of Articles Found

Source	Keywords	Number of Articles
Scopus	("Learning analytics") AND ("Africa") OR ("develop* country") OR ("Global south")	26
Scopus	("Learning analytics") AND ("Africa") OR ("Global south") OR (develop*)	1862
Scopus	("Learning analytics") AND ("Africa")	15
Scopus	("Learning analytics") AND ("develop* world")	3
Scopus	("Learning analytics") AND ("Global south")	1
Scopus	("Learning analytics") AND ("Africa") OR ("develop* count") OR ("Global south")	38
Web of Science	("Learning analytics") AND ("Africa") OR ("develop* count") OR ("Global south")	10

Table 3. Reviewed Papers by Author, Country of Study, Context, and Target Audience

Author	Country	Context	Target
Fynn (2016)	South Africa	Higher education	Researchers and research ethics review committees
Janse van Vuuren (2020)	South Africa	Higher education	Teachers
Kizilcec & Goldfarb (2019)	Kenya	High school/K–12	Students
Kritzinger et al. (2018)	South Africa	Higher education	Teachers and student advisors
Lemmens & Henn (2016)	South Africa	Higher education	Researchers and higher education administrators
McKenney & Mor (2015)	South Africa	K–12	Teachers, software developers, and learning designers
Mwalumbwe & Mtebe (2017)	Tanzania	Higher education	Students
Ngqulu (2018)	South Africa	Higher education	Directors and managers of e-leaning centers, senior management, and technicians
Ojanen et al. (2015)	Zambia	Primary	Students and teachers
Okewu & Daramola (2017)	Nigeria	Higher education	Students and teachers
Olivier (2020)	South Africa	General	Researchers and research ethics review committees
Popoola et al. (2018)	Nigeria	Higher education	Educational research community and regional policy makers
Prinsloo et al. (2012)	South Africa/UK	Higher education	Researchers and higher education administrators
Prinsloo et al. (2015)	South Africa	Higher education	Researchers and higher education administrators
Willis et al. (2016)	South Africa/UK/US	Higher education	Researchers and research ethics review committees

4.3. Charting the Data

The following criteria suggested by Cooper et al. (2019) were considered in charting the data:

- A data charting format and variables were collectively decided upon
- The two researchers used sifting and sorting of data as well as Excel spreadsheets including abstracts, comments from the full text, and an analysis of the identified variables.
- A numerical analysis of the extent and nature of included studies was reported.

The two researchers jointly developed a data-charting manual to determine which variables to extract from the identified studies. Since we were uncertain about the nature and extent of information to extract from the included studies, both researchers started with screening a sample of five studies, discussed the results, and amended the screening and data extraction manual before beginning the full screening of the studies that informed this review. The final screening/coding manual included the following variables: authors, title of research, LA approach, purpose, context, sample population and size, analytical approaches, and summary of findings. The full description of the screening manual and explanation for each variable is provided in Table 2. The coding was performed in several stages. Initially, two coders took a grounded approach and reviewed two studies for training purposes and to gain familiarity with the literature. In this case, initial codes were formed based on the descriptions and contextual information provided in the papers and of relevance to the research questions. Next, each coder independently coded a further four papers and then discussed coding challenges to refine the coding scheme. We used social moderation where two raters coded all the papers and then discussed all the areas where ratings differed until agreement was reached. Finally, the coders split the papers and proceeded with coding the full sample following the revised codes.

4.4. Collating, Summarizing, and Reporting Results

This stage involved a summary and analysis of results coded at the charting stage. First, we came up with a descriptive numerical summary of the results, which highlights the key characteristics of the included studies (e.g., context, focus of the study, study population, country where the study was conducted, etc.). Since the dataset was relatively small, this stage was completed manually without assistance from any software. We undertook a narrative analysis of the identified studies using individual papers as the unit of analysis. We tabulated the included studies to provide an overview of the different codes. For this final stage of a scoping review, Cooper et al. (2019, p. 235) list the following as criteria:

- Presenting results in a logical descriptive, diagrammatic, or tabular format
- Presenting a narrative account of results
- Aligning results with the review aim, purpose/research question
- Discussing issues associated with bias
- Discussing implications for future research, education, practice, and/or policy
- Including within the conclusion a description of the current state of the overall literature in relation to the topic

5. Methodological Norms

Steps to ensure trustworthiness in scoping reviews are well documented, not only by the various authors discussed earlier (Cooper et al., 2019; Tricco et al., 2018; Munn et al., 2018). In the process of this scoping review, starting from the guiding question to reporting and discussing the findings, we followed the PRISM-ScR guidelines and included in the narrative how we addressed the pointers provided by Cooper et al. (2019). We were also guided by published scoping reviews such as Kaliisa (2021b), Major et al. (2018), and Templier and Pare (2018).

6. Findings and Analysis

RQ. What is known about LA in the African context?

6.1. Descriptive Information of Included Studies

The scoping review reported in this paper consists of 15 studies — 10 empirical and 5 conceptual — using existing literature as sources of data. The studies were published between 2012 and 2020, with most papers (n=12) published between 2016 and 2020, indicating a slight gradual increase in interest in LA among African researchers. Regarding sample sizes, two studies had between 1,084 and 1,841 participants (e.g., Popoola et al., 2018; Kritzinger et al., 2018), while four studies had between 100–1000 participants. Four studies were not explicit about the sample size, while five were conceptual, without participants. All 15 studies focused on LA, with only one study combining LA and some elements of academic analytics (e.g., Okewu & Daramola, 2017).

6.2. Limited Representation at SoLAR Events/Publication Channels

The included studies consist of eight journal articles,[3] five conference papers,[4] and two book chapters. Even though SoLAR has a designated annual conference (LAK) as well as a dedicated journal (*Journal of Learning Analytics* [JLA]), only one of the 15 studies (Prinsloo et al., 2012) was published at LAK, while none of the journal articles were published in JLA. These findings complement the official figures from SoLAR showing that the number of participants from African institutions at LAK events (e.g., annual conference and summer institutes) is very low compared to those from the rest of the world.

This finding opens more questions than it answers, and the reasons why the relatively low numbers of articles and conference papers from Africa are found in a range of journals and conferences outside of LAK and JLA necessitates further research. It does, however, imply that considering the potential benefits of LA to increase the effectiveness of pedagogy and contribute to student retention, then SoLAR, LAK, and JLA could investigate opportunities to support research in, and the implementation of, LA in underserved regions, as has been argued (Gašević, 2018). LA research could becoming ouroboric and incestuous if the field does not intentionally discover and explore new epistemologies, indigenous philosophies, and

[3] The journals were *CBE: Life Sciences Education; Data in Brief: Elsevier; The Electronic Journal of Information Systems in Developing Countries; Educational Technology Research and Development; South African Journal of Higher Education; British Journal of Educational Technology;* and *International Review of Research in Open and Distributed Learning* (two papers).

[4] The conferences were the International Conference on Learning Analytics and Knowledge (LAK); the International Conference on Computing Networking and Informatics; the IST-Africa Conference; the ACM Conference on Learning@Scale; and the International Conference on e-Learning.

different understandings of student data, student learning, and the power dynamics inherent in teaching. If there is a commitment to critically look at the often-unquestioned assumptions and epistemologies guiding most LA research from the perspective of global/colonial imaginary (e.g., de Oliveira Andreotti et al., 2016; Prinsloo, 2020), there is potential for "other" voices not only to participate, but also to enrich the field and practices of LA.

6.3. Geographical Discrepancies within African Countries

Our findings showed that the overwhelming number of LA studies on the African continent — 10 of the 15 included studies — were conducted by researchers from South Africa (but not necessarily on LA in South Africa). Beyond South Africa, two studies were conducted in Nigeria (Popoola et al., 2018; Okewu & Daramola, 2017), while Tanzania (Mwalumbwe & Mtebe, 2017), Zambia (Ojanen et al., 2015), and Kenya (Kizilcec & Goldfarb, 2019) were represented by one study each (see Figure 2). It is also worth noting that even though some studies were conducted in African countries, the authors were not affiliated with African institutions (e.g., Kizilcec & Goldfarb, 2019). The countries represented in this study reflect the systematic review done by Bervell and Umar (2017) reporting on studies on the use of LMS in Ghana, Nigeria, Tanzania, Uganda, Zimbabwe, and South Africa. It is therefore interesting that though there is research on the use of the LMS in the context of Ghana, Uganda, and Zimbabwe, they are not yet represented in findings on the use of LA on the African continent, while Zambia is included in our findings but not in their 2017 research.

The big geographical discrepancies between African countries regarding LA outputs raise interesting questions, such as how the authors in these different geopolitical contexts came to do research on LA as well as questions about their networks and links to international LA discourses, practices, and influences. Using these figures across geographical divides as an indication of institutional adoption of LA, however, is unwarranted. It is also unclear whether there is any correlation between the observation that South Africa dominates studies in LA on the African continent and is also the country with the highest levels of local and foreign investment and above-average Internet access and connectivity (Ischebeck, 2020). While the geographical distribution of this research provides some tentative insights into the "state of the field" of LA on the African continent, these findings must be considered in the light of and integrated into the other findings.

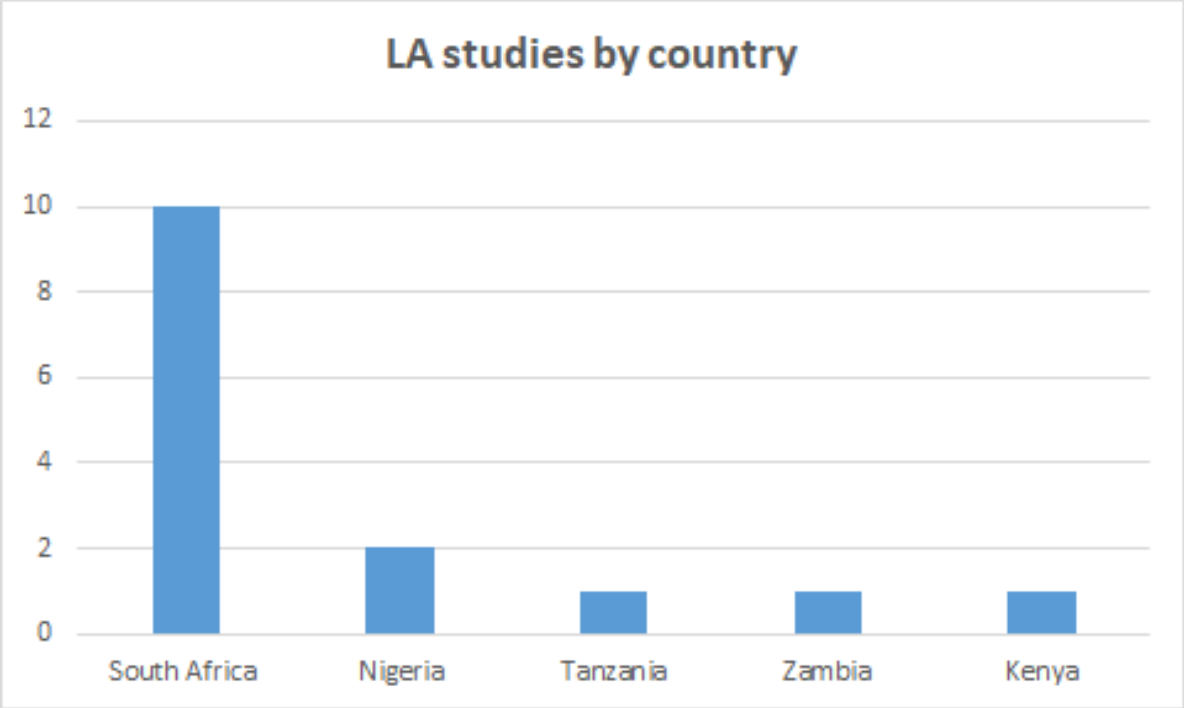

Figure 2. LA studies by countries of research from our 15 included studies.

6.4. The Dominance of Assessment and Self-Reported Data Sources

The most frequently utilized types of data were *assessment* data (n=6) collected from sources such as tests and GPA scores. Five studies used data from interviews, while five others used log data and demographic data from student information or learning management systems. Surveys were used by three studies, while two others used observation (see Figure 3). The limited use of LMS data points could be explained by their limited use in African institutions of learning (Business Market Insights, 2020). As mentioned earlier, Bervell and Umar (2017) point out that "evidential facts" pertaining to LMS use on the

African continent "are scattered." Of particular interest is the absence of research into LA from institutions such as the African Virtual University, which is completely online, and the University of South Africa (Unisa) and the Open University of Nigeria (NOUN), which are the largest distance education institutions on the African continent, with millions of enrolments and institutionalized use of an LMS.

Meanwhile, since the primary source of data for most LA research is collected from LMSs (Dawson et al., 2019), future growth in LA research on the African continent will depend on infrastructural provision of LMSs and creative data sourcing (Gašević, 2018), perhaps using alternative platforms; mobile technologies, for example, are widely spread and available (Kaliisa, 2019). In other words, the collection of data that support access to learning resources with mobile devices and social media could offer much in quality and efficiency in the African context (Gašević, 2018). Kizilcec and Goldfar (2019), for example, used analytics from a popular SMS-based mobile learning platform to predict student achievement and behaviour. While the authors noted low rates of persistence and performance, they also highlighted the potential of mobile learning platforms to provide accessible information about student learning, which could be leveraged for LA purposes.

Since most higher education institutions in Africa are face-to-face, there is an opportunity to leverage new methodologies such as multimodal LA, which collects data from physical learning environments using technologies such as sensors and cameras (Spikol et al., 2018). By doing so, richer data about student learning processes could be collected, other than relying on the traditional summative assessments (e.g., end of semester exams), and student self-report surveys, which are narrow in scope. Leveraging multimodal LA, of course, is intimately linked to Internet penetration and the state of digitalization of higher education in the particular context.

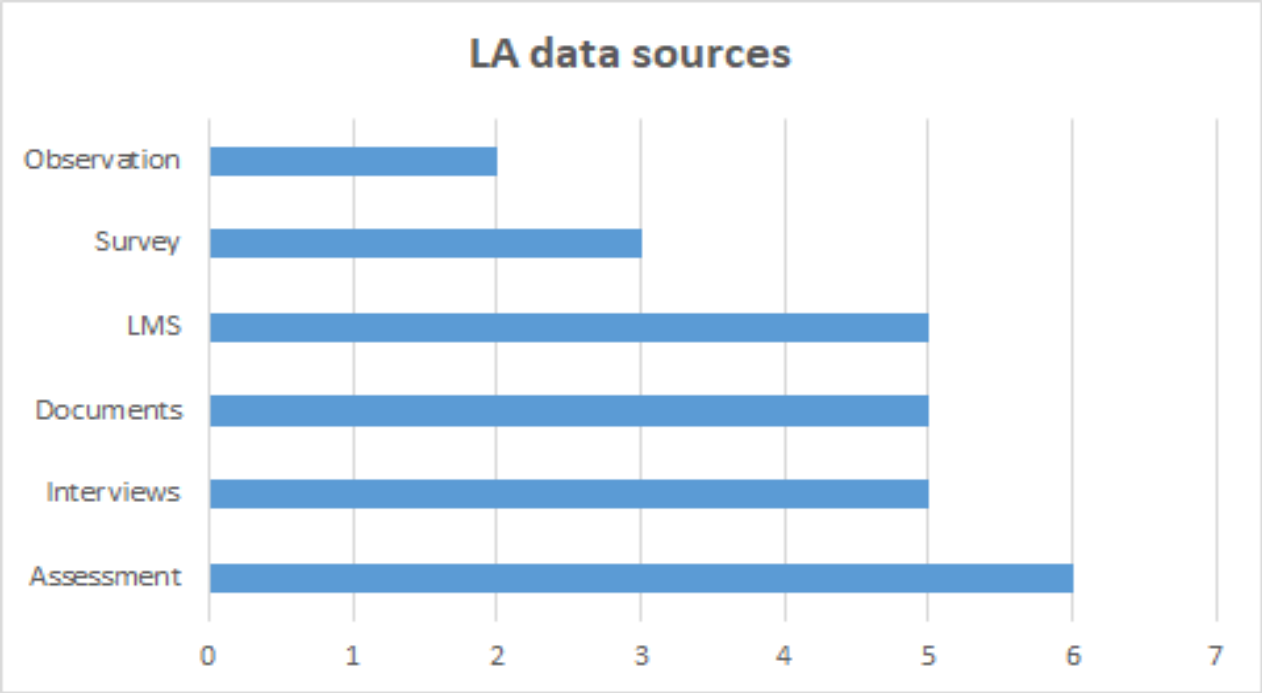

Figure 3. Sources of LA data used in our 15 included studies.

6.5. Teachers and Researchers as a Dominant Target Group

Most studies targeted teachers and researchers, with each group represented by five studies. Students were targeted by four studies while ethics committees were targeted by three studies each. Two studies targeted policy-makers and technical personnel. Student advisers and learning designers were targeted by one study each (see Figure 4). The focus on teachers as a target audience is promising since literature has emphasized the need to involve teachers in planning to adopt LA given their critical role in practice. Previous research has shown that the lack of technical support is a key barrier for the adoption of IT by teachers in developing countries (Prinsloo, 2018). This implies that for LA to succeed in Africa, beyond questions of infrastructure and expertise, it is vital to include teachers as essential stakeholders and provide them with adequate training and a well-designed, well-resourced institutional support strategy (Prinsloo & Slade, 2017).

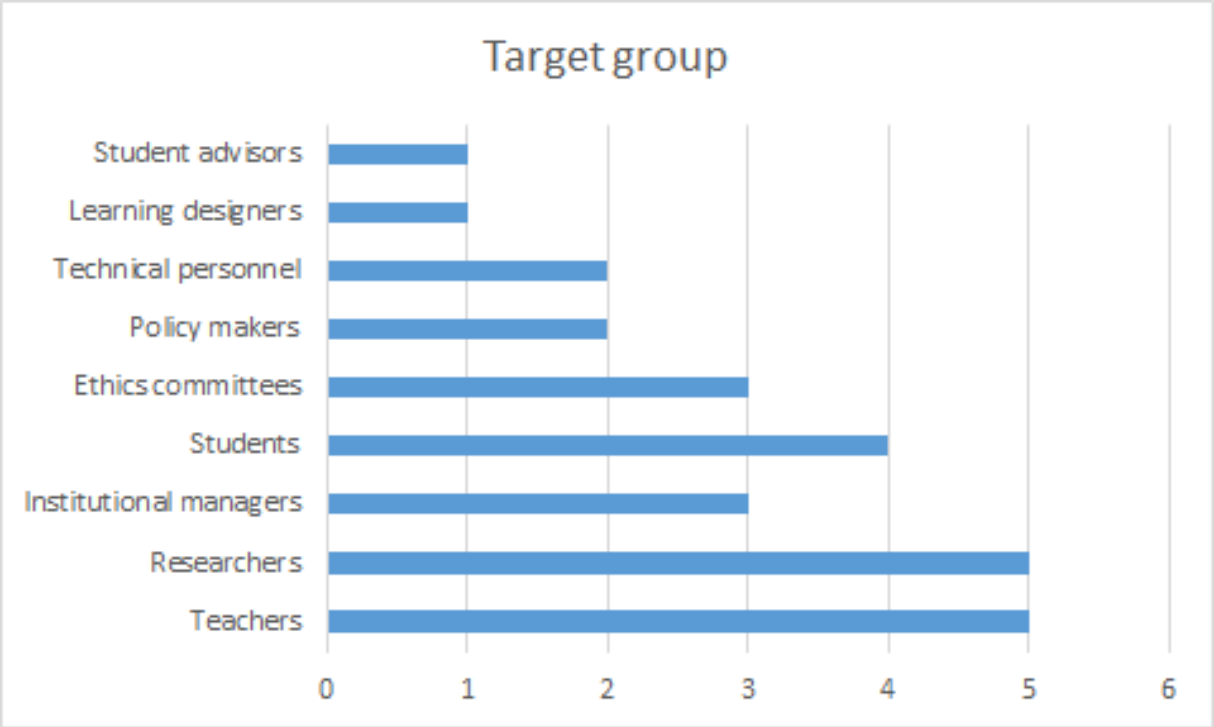

Figure 4. Target groups for our 15 included studies.

6.6. Higher Education and Distance Learning Institutions as Dominant

Most of the reviewed studies were conducted within the context of higher education (n=11), specifically large distance-learning institutions (e.g., the University of South Africa [USA]). Interestingly, while one would presume that the predominance of LA research in the context of distance learning points to the centrality of the LMS, a closer look reveals that most of this research is conceptual/theoretical and exploratory. The rest of the studies focused on secondary/K–12 (McKenney & Mor, 2015; Kizilcec & Goldfarb, 2019), primary (Ojanen et al., 2015) and general education systems (Olivier, 2020). The focus on higher education is a trend in LA research in other parts of the world, including the Global North (Lee & Cheung, 2020).

6.7. The Conceptual and Exploratory Nature of LA Studies

Our analysis revealed that most LA studies conducted on the African continent are exploratory (n=7). This means that the researchers have focused on using LA to predict learner performance (Mwalumbwe & Mtebe 2017) or to support teachers and educational managers (McKenney & Mor, 2015). We also observed conceptual studies focusing on ethical LA issues (n=3) or general concerns (n=4) such as challenges and frameworks for LA. The exploratory and conceptual nature of LA studies on the African continent could imply that LA research is still emerging (Lemmens & Henn, 2016). While the same trend has been observed across all existing LA studies (Dawson et al., 2019), to move the field forward and convince key stakeholders (e.g., educational managers), research must move from exploratory to more applied and holistic studies to showcase the potential of LA to improve teaching and learning. This is particularly important for African institutions working under constrained budgets (Oketch, 2016), with the decision to invest in LA infrastructure requiring concrete evidence of its potential return (Prinsloo & Slade, 2017). Besides, while the adoption of LA in the African context will undoubtedly depend on political support and resource allocation in the institution, the relatively low levels of Internet and LMS penetration and use will continue to play a major role.

6.8. Ethics as an Area of Interest

Our analysis revealed several studies focused on ethical issues (Willis, Slade, & Prinsloo, 2016; Fynn, 2016; Olivier, 2020). Given the limited focus on ethics in most African countries, especially within social science research, it is interesting to see some studies already engaging in this debate and suggesting relevant frameworks to guide LA implementation on the continent. While efforts in the Global North to design relevant LA ethics frameworks, such as the SHEILA framework, have been initiated (Tsai et al., 2018), the contextual issues (e.g., ethics and privacy) embedded within the African continent might require localized solutions since educational technologies come with several ideologically and culturally specific viewpoints (Selwyn, 2020).

7. Conceptual Operations

In the preceding section, we provide an analysis of our findings of this scoping review centred on the question, "What is known about LA in the African context?" Since the final corpus included only *15* papers, it is impossible to make claims about the "state of the field." From these few scholarly articles, as well as the factors discussed in our introduction — low levels of Internet penetration, low levels of LMS use, diversity, scholarly context — we propose several conceptual operations for thinking about LA on the African continent.

Many studies report on the state of the field in LA (e.g., Viberg et al., 2018; Papamitsiou et al., 2014). It is important to note that those studies — each with their own methodologies, scope, data sources, and forms of analyses — map the "field" according to what is visible, what is published (mostly in English-language journals). Research on the "state of the field" does not report on what is *not* visible or *not* found. To a certain extent, such a report makes visible that which is already visible, and while the methodologies used always acknowledge their inclusion and exclusion criteria, the visible often achieves the status of the "real." In this respect, this scoping review attempted to map not only the little that is visible regarding LA on the African continent, but also the silences, the invisible that cannot be counted, reported in a flow chart, or analyzed in a table. As such, this research may destabilize our notions by pointing to the unsaid, the not-yet-said, and the we-don't-know.

If the adoption of LA is linked to, if not dependent on, institutional use of LMSs, then another research question should precede our current question: "What do we know about the use of LMSs in African higher education?" If this assumption is, indeed, worthy of contemplation, it points to two considerations: first, the central position of the LMS in most LA research; second, the possibilities for LA in data-poor environments.[5]

Our research question, "What is known about LA in the African context?" also reveals an onion-like form, illustrating a variety of interdependent factors such as Internet penetration, reliable electricity, local socio-economic (in)equalities, and the diversity and entanglement of continental research in intercontinental/international asymmetries of inclusion and exclusion.

While the historical links between EDM and LA have been acknowledged since the emergence of LA (Siemens & Baker, 2012), we must consider that LA, as a distinct form of research and practice, may be more connected to EDM than we often acknowledge (Chen et al., 2020).

8. Some Propositions and Provocations

As acknowledged in the Introduction, at least four considerations come into play in the state of LA adoption and research on the African continent: 1) the levels of Internet penetration, 2) the levels of digitalization, 3) the diversity and participation in scholarly publications and networks, and 4) the evident porousness of the boundaries between EDM, academic analytics, and LA. The first three of these fall mostly outside the locus of control of institutions of higher learning and are therefore excluded from the propositions and provocations that follow.

Taking cognizance of the similarities and differences between EDM and LA, as well as the fact that institutional research is well established at least in Southern Africa (Botha & Vilyte, 2022; Lemmens & Henn, 2016; Maphosa & Maphosa, 2020), it is important to leverage existing EDM practices and, as institutions become more digitized and datafied, the open discussions on the specific potential and practices inherent in LA.

Context is everything (Prinsloo, 2018b). For example, the comparative research by West et al. (2018) in Australia and Malaysia has shown that "context and infrastructure for LA are at different stages of development" (p. 122). Not only are there differences in the use of educational technology, there are also different strategic drivers. Interestingly, "Malaysian academics express a higher level of concern around ethical issues compared to their Australian counterparts" (p. 135). The authors conclude that "Cultural differences [need] to be explicitly addressed and considered properly, particularly when interpreting and understanding the results of the study" (p. 137). Though it may not be the intention of LA researchers in the Global North to claim that their theoretical approaches and findings may be universally valid, there may be unspoken assumptions that often marginalize ontologies and epistemologies from the Global South (de Sousa Santos, 2012, 2015; Torres & Alburez-Gutierrez, 2021).

Considering the historical and current asymmetries in power relations between the Global North and the Global South, any attempt from the North to share expertise and to support the institutionalization of LA in the South should be done with care and sensitivity. Africa is, in many respects, a "new frontier" for educational technology providers, data brokers, and venture capitalists, who see the immaturity of institutional LMS adoption as an opportunity not to be missed. We must acknowledge the reality of data colonialism (Couldry & Mejias, 2019) and the Global South as a "data frontier" (Prinsloo, 2018b, 2020).

[5] Here, the notion of "poor" refers to the *amount* of available data and the fact that student datasets are full of gaps, making it almost impossible to, for example, determine risk profiles.

There is ample evidence that Africa is often a victim of projects designed in and exported from the Global North aimed at transforming educational practices (e.g., Prinsloo, 2018a, 2018b). Many of these projects fail or exacerbate the inequalities they aim to address. Any collaboration between the Global North and South must seriously account for historical precedents and build in checks and balances to value and ensure local ownership and buy-in. If these issues are not addressed ahead of the intended interventions, LA adoption on the African continent could bypass the high expectations and proofs of concept voiced in the literature to become yet another example of technology that failed to fulfil its early promise to positively influence educational practices (Kaliisa et al., 2021a).

Having acknowledged the asymmetries in power realities and the embedded concerns in the digitalization of learning, we must also acknowledge that many African higher education institutions do not have the resources, or necessary skills sets or understanding, to navigate the claims made by LMS and LA providers. With SoLAR's long history, and the depth of different expertises in the wider network of LA researchers and practitioners, providing invaluable support to African higher education institutions who want to explore the potential of LA should be an organizational goal. We foresee building local/continental/regional partnerships and support systems to facilitate experience and resource sharing (e.g., special interest groups to share expertise and experiences).

Obviously, in the context of Africa, relying only on peer-reviewed articles published in English and found on digital databases may render LA research and institutional practices invisible. To what extent can an organization such as SoLAR, and the annual LAK conference, make space for sharing insights and/or research with/from targeted regions in the Global South (as equal partners) to foreground novel approaches and challenges, and to destabilize some of the normative assumptions in LA? What is the potential of secondary sources to provide insights into LA in the Global South? How can insights, practises, and even new theoretical considerations emerging in/from the Global South be foregrounded, engaged with, and enriched?

In line with its commitment to and mission of promoting equity, SoLAR is in a unique position to partner with African higher education institutions, researchers, and scholars to map the potential of LA with a critical understanding of contextual demands.

The above list of propositions and provocations is meant to invite conversations that deepen our understanding, confront complexities, and increase inclusivity and diversity in LA.

9. Study Limitations

One limitation of this study is that it may not represent all existing LA studies conducted by African researchers due to possible errors during the search and selection processes. We limited the scoping review to specific keywords, journals, and databases; thus, papers that did not explicitly state the keywords or publish in these specific sources could have been missed.

10. Conclusions

This scoping review set out to map the available evidence and the state of LA research on the African continent, intending to characterize and establish the opportunities and challenges of LA adoption in Africa. We have investigated the countries where LA is conducted on the African continent, the focus, target group, nature of the data collected, and the common approaches used. Our main findings include the fact that LA research on the African continent is still in its infancy with only 15 studies, mainly from South Africa. We also recognize the limited sources of LA data with much dependence on secondary sources (e.g., reviews), and traditional approaches (e.g., surveys and interviews). The findings reveal a gradual increase in the number of LA publications over the years, which is a promising trend for increased interest in LA.

However, our study also revealed several challenges that need immediate attention if LA adoption in Africa is to become a success. For example, the limited technical support and access to LMSs, the limited visibility of African scholars at SoLAR events, the limited focus on interventions that involve stakeholders, as well as ethical issues that could affect the development of LA. To address the existing challenges and support the implementation of LA, we have made some critical propositions and provocations to guide the uptake and adoption of LA in Africa, as well as to provide pointers for engagement for SoLAR and LA researchers in the Global North. First, as a point of departure, we have recommended that LA researchers in Africa should engage in applied studies that can justify investment in LA infrastructure despite the financial constraints of their institutions. Second, we suggest more baseline and design-based studies to benchmark stakeholder interests and existing practices as a way to spark LA initiatives of relevance to African institutions. As noted in existing literature (Kaliisa et al., 2021a), active involvement by stakeholders in shaping LA interventions is a prerequisite to achieving the desired benefits for education systems.

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