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Harnessing Indigenous Knowledge Systems for Socially Inclusive Science Communication: Working towards a 'Science for Us, with Us' Approach to Science Communication in the Global South

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Introduction

Recent trends in science communication have demonstrated that there is an increasing need for scientific information as well as the ability to access it. This has been especially true during the COVID-19 pandemic, where the extent of misinformation and disinformation (Ahinkora et al, 2020) has been a source of concern, with information-sharing as a public prerogative no longer monopolised by scientists and science communicators. The complexity of the current communication ecology is exacerbated by the diversity of available sources of information and the ever-increasing need to be first, right, and credible in sharing information. This era thus requires reflective thinking about the contextualisation of science communication epistemologies.

There has been increased appreciation of the fact that many scientific and social innovations that have the potential to empower society and facilitate social transformation can only achieve that aim through inclusive engagement methodologies and approaches. For example, Chivers and Hargreaves (2018) note that inclusive public engagement and participation methodologies are instrumental in realising socio-technical transitions. In the Global South,

scientists and science communicators are increasingly acknowledging the significance of socially inclusive methodologies and approaches that will enhance participation in knowledge creation, knowledge-brokering, and science communication systems (Covello, 2021). Their transformative efforts are however hampered by the reality that most of the epistemologies and science communication insights are Eurocentric and fall short of being contextualised to Global South contexts. This lack of contextualised approaches results in the unequal distribution of and access to opportunities for effective public engagement with the processes and outcomes of science in the Global South.

The continued marginalisation of local insights through Eurocentric approaches to science communication calls for evidence-based advocacy for the advancement of socially inclusive approaches to science communication. In as much as the deficit model is often defined as one-way communication from scientists to the public without acknowledging other knowledge forms (Wibeck, 2013), this chapter argues that in marginalising the Indigenous knowledge systems in the Global South as a knowledge and communication base, the Eurocentric dominance of science communication in these regions is also in effect a problematic manifestation of the deficit model in practice.

Drawing from practical examples of science communication in the Global South, this chapter provides insights into how Eurocentric approaches to science communication, applied in these regions of the world, miss out on the opportunity to harness Indigenous knowledge systems. It then provides evidence-based examples of specific ways in which more contextualised approaches can be used and the value they would add to science uptake and appreciation. In particular, the chapter explores some of the key elements and practices of communication that can be harnessed to inform contextualised science communication and thus enhance inclusivity and co-creation in designing, implementing, and evaluating science communication and engagement in the Global South.

Science communication perspectives and practices: shifting paradigms from deficit models to public engagement

Traditional science communication perspectives and practices have been characterised by the persistence of the oversimplified deficit model in which communication is treated as a one-way stream whereby scientists or knowledge producers provide the publics with information intended to fill a knowledge gap (Wibeck, 2013). In this way, public audiences are treated as lacking relevant knowledge or experience and as not scientifically literate or interested in science (Simis et al, 2016). The point of departure for the deficit model is that 'deficits in public knowledge are the central

culprit driving societal conflict over science'(Nisbet and Scheufele, 2009, p 1767). For that reason, low scientific literacy and lack of trust in science, as well as a lack of public understanding of science, are directly associated with deficits in scientific knowledge and are deemed to be easily remedied by disseminating knowledge to the public.

The challenge with the deficit model as applied in the Global South is that it misses out on the opportunity to harness the wealth of Indigenous knowledge systems that already exist locally and the in-depth contextualised understandings that these knowledge systems offer. Deficit model approaches to science communication also fail to harness the potential value of co-creation and collaboration with target audiences and the resulting empowerment of social actors to solve societal problems using scientific evidence (Mason and Mega, 2021; Scheufele et al, 2021). Co-created science communication approaches benefit from the core knowledge systems and practices of the target communities as well as existing experiential and contextual knowledge in these communities. They also benefit from harnessing the already inherent information-sharing tools, resources, and practices among the target audiences, which deficit models cannot do.

Exploring public engagement as an alternative

Given the deficiencies in the deficit model, and acknowledging the wealth of Indigenous knowledge systems that could inform behaviours and practices, science communication practices in the Global South are undergoing a paradigm shift towards participatory models with pillars of public participation and engagement as well as inclusivity. Recent literature (Alhassan et al, 2019; Weingart et al, 2021) shows that while the word 'engagement' seems to dominate policy and science communication discourses, clear definitions of key principles of engagement with science are lacking. There are also vague definitions of key concepts such as 'publics', 'citizen stakeholders', and 'non-scientists', which are often used very loosely in these discourses. This definitional fuzziness is even more glaring in the Global South context where it is widely known that there are 'sciences' and knowledge systems that are embedded and rooted in culture. But to what extent are these included in the definition of science and society? And to what extent are they incorporated into science communication and engagement activities?

Despite the ambiguity in the definitions of key concepts, there is a general understanding that the main objective of these participatory and engaging science communication practices is to provide opportunities for mutual learning between scientists and members of the public affected by science (Metcalfe, 2020). Such learnings include increased awareness of the cultural relevance of science and recognition of the importance of multiple perspectives and domains of knowledge to scientific endeavours.

According to Bauer and Jensen (2011, p 3), 'over the years, the term public engagement has taken the specific meaning of communicative action, to establish a dialogue between science and various publics'. In this way, the public is enabled to actively think about and become involved in science.

The public engagement approach often uses and builds on public understanding efforts while moving towards more comprehensive and interactive opportunities for dialogue and exchange. Through engagement, scientists and the public participate in discussions about the benefits and risks of science and technology impacting their daily lives. In doing so, questions and concerns can be better understood and addressed. Furthermore, involving a wide range of interested stakeholders can connect seemingly unrelated viewpoints, with potentially far-reaching effects. Public engagement with science is therefore seen to offer a more holistic, interactive approach that has the potential of getting people excited about science, increasing public trust in science, and embracing public attitudes and perceptions about science (Felt and Fochler, 2008).

Inclusivity as a pertinent characteristic of public engagement with science approaches: where are the gaps?

One of the characteristics of public engagement approaches to science communication is that they embrace inclusivity. Particularly for the Global South, where the communication ecology and participation in science systems are characterised by inherent inequalities, contextualising public engagement designs to give the public a voice is imperative. Inclusivity has, however, become very elusive, and science engagement continues to be driven by and approached through the lens of 'the scientist' (Simis et al, 2016). In addition, most of the public engagement approaches, frameworks, and epistemologies originate from the Global North (Weingart et al, 2021). This privileging of Eurocentric frameworks in Global South scenarios means that public engagement in these regions misses some of the critical actors, systems, and knowledge systems that exist in them. In addition, attempts to apply these Western-derived models and frameworks in the Global South further compromise inclusivity and become a barrier to the effectiveness of public engagement efforts, as it results in Indigenous communities and knowledge systems remaining at the margins of participation in knowledge production and access to science, as well as science communication, as noted by Finlay et al (2021).

One of the gaps rarely acknowledged in science communication discourses in the Global South is the persistence of the deficit model, which manifests itself in the adoption of Eurocentric approaches in contexts in which they do not adequately fit to the exclusion of contextualised local approaches.

The available literature (Seleti, 2010; Rasekoala, 2015; Ishinaha-Shinere, 2017; Finlay et al, 2021) has consistently asserted that there is a need to revisit the landscape of science communication in the Global South, re-envisioning not only epistemologies but also policies and practices. The lack of acknowledgement of the cultures that define local knowledge systems in the science communication system (Finlay et al, 2021), as well as widespread misunderstandings that lead to the trivialisation of these cultures, as observed by Seleti (2012), is a good example of this deficit model in practice. Seleti (2010) has long advocated for the mainstreaming of Indigenous knowledge systems within science policy frameworks on the African continent as a direct means of delivering emancipative Afrocentricity and epistemic liberation for African citizens and African languages in which these Indigenous knowledge systems are embedded. In fact, Ishinaha-Shinere (2017) remarks that this colonial thinking has become so systemically entrenched that science and technology (S&T) policies in the Global South will use justifications such as 'the shying-away of young people from S&T', 'accountability for research investment', and 'problem-solving on issues related to S&T and society' to cement traditional Western hegemonic science communication approaches in their systems. These disconcerting observations are consistent with earlier work by Palmer and Schibeci (2014), who observed the persistence of this same deficit model among the funding bodies that support research and science communication in the Global South. While there is an amplification of communication within the research community, Palmer and Schibeci (2014) established that there is less emphasis on communication with the broader community by these international funding organisations. This in itself is a demonstration of how the deficit model in the Global South is not only practised but also institutionalised and financially enabled to be sustainable. This chapter argues that this is a definition of the deficit model that is rarely acknowledged.

Science communication scholars agree that combatting the deficit model in the Global South requires that systems are opened up to accommodate a wide spectrum of cultures, knowledge systems, and practices. According to Finlay et al (2021), this entails creating spaces for reflective thinking and institutional practices. It also entails acknowledging the many creative practices, values, and knowledge systems that already exist in the Global South.

Multilayered exclusion factors that compromise inclusive science communication

Dimensions of exclusion, such as scientific literacy, the digital divide, and language barriers, continue to compromise the effectiveness and inclusivity of public engagement approaches to science communication. The inability of researchers to translate research into linguistically accessible formats that can

be used to communicate and engage the non-researcher public compromises the potential for use and uptake of research and thus restricts its impact (Matias et al, 2021). An additional challenge is the continued neglect of the use of Indigenous languages and Indigenous communication methods, actors, tools, and platforms in public engagement as noted by Sobane et al (2021). This form of exclusion is more marked in multilingual contexts, where it has been proven that multilingual knowledge transfer facilitates improved public understanding and encourages the use of science in policy and practice. Kago and Cissé (2022) propose language harmonisation as one of the strategies that can be used to facilitate linguistic inclusivity in science engagement. There has been growing awareness that addressing inclusivity in science communication is crucial to ensuring that the knowledge that scientists and innovators invest in actually gets to different sectors of the population and thus has greater potential for impact. However, with all the different levels of exclusion remaining unaddressed in communication practices, the question of 'whose science and for whom' becomes glaring.

An additional layer of exclusivity is borne from the advent of digital communication, which has revolutionised science communication practices. Several studies identify the dialogic nature of digital platforms as an important feature in engaging different publics because it allows an exchange of views about the science and enables deliberations over the trustworthiness and applicability of science (Cahill and Ward, 2007; Wilcox, 2012). Digital science communication is therefore valued for its ability to facilitate the visibility of different voices in a dialogue where all voices are heard and valued, thereby closing the gaps between information-rich and information-poor publics (Jang et al, 2019). Digital communication has also been lauded for its potential to draw the attention of the public and keep them interested, engaged, and participatory in science-related matters (Park et al, 2020). Digital platforms are also seen as useful in the production of visualised tools that allow target audiences to have a better understanding of science, as well as enabling audiences of different levels of literacy to access and consume information (Bucchi and Saracino, 2016).

Although digital communication technologies have offered growing opportunities for science communication due to their cost-effectiveness and the ability to reach geographically disparate audiences almost simultaneously and for a lower cost burden (Bucchi and Trench, 2014; Lubinga and Sitto, 2021), internet access and affordability is one of the greatest barriers to inclusive access to scientific information (Okoth, 2022). Digital science communication often marginalises rural audiences and those whose socio-economic situation poses challenges of affordability in terms of access to digitised communication. In most cases in the Global South, these include rural-based knowledge producers and practitioners whom the digital divide bars from participating in specific digital science communication conversations. Rural-based science communication actors very often rely

mostly on traditional media and basic digital connections such as text-based messaging as sources of information for engagement and participation.

While public engagement with science and its application seems to offer a more participatory inclusive approach, in the Global South there continues to be a need to have clearly defined mechanisms and epistemologies that account for *all* the publics. In particular, it is pertinent to have clearly defined participant roles to answer profound questions such as 'whose science and for whom?'

The increased marginalisation of Indigenous knowledge systems is another exclusionary factor in science communication. As noted by Finlay et al (2021), there is a dire need for science communication practices to be transformed to accommodate knowledges, practices, and systems often misunderstood and marginalised. Inclusivity in science communication needs to clearly account for the lenses and framings of Indigenous people and the existing knowledge that they hold. As Seleti (2010) observes, there is value in working towards the interfacing of Indigenous knowledge with other knowledge systems since they have a great deal of relevance and usability that can inform better processes of engagement. In particular, there is value in using the voices of Indigenous people in science communication to allow them to hear their stories being told in their voices and through their own experiences (Seleti, 2012). The value of Indigenous knowledge is further reiterated by Khumalo and Baloyi (2017), who show that these systems, which have sustained Indigenous communities for centuries before colonialism, were rendered underutilised by colonial practices and neglected, in contrast to the marked promotion of Western knowledge systems.

To overcome this exclusion, Finlay et al (2021) recommend transformed science communication systems and practices that acknowledge other knowledge systems in the knowledge economy, some of which have existed longer than Western knowledge, as noted by Rasekoala and Orthia (2020) and Seleti (2012). Of essential importance is the need to acknowledge the unique expertise, experience, and successful practices that have been built on ancient communication traditions (Rasekoala, 2015; Purnomo and Fauziah, 2018). In outlining some of the characteristics of this transformed science communication ecology, Rasekoala (2015) recognises citizen-centred approaches, co-creative joined leadership, and participatory approaches that involve social scientists and local actors as some of the enablers, pillars, drivers, and sustainers of this transformed landscape.

Inclusive science communication in the Global South: Indigenous knowledge good practice scenarios and exemplars

The emergence of digital communication technologies and the COVID-19 pandemic has made it imperative for science communication epistemologies

and practices to lean more towards digital and online science communication. While these innovations and conventions may have altered interpersonal communication and hence science communication practices, some scholars (see, for example, Ayangunna and Oyewo (2014)) acknowledge that Indigenous communication systems still exist and that science communication can tap into these systems. In particular, Sobane et al (2021) note that there are often well-established community systems and practices of communication in the African context, for example, which can be harnessed to develop multi-sectoral engagements that will create awareness about science and enhance appreciation of its value in everyday use. In the following section, the chapter highlights some of the inclusive, impactful, and transformative innovations that Indigenous communication systems can offer to science communication epistemologies and practices across diverse regions of the Global South.

Available literature shows that even before the introduction of mass communication, there were Indigenous communication systems for information sharing across different societies. These systems were important in that they facilitated the preservation and adaptation of specific cultural information. According to Mundy and Compton (1991), these systems continue to exist alongside the mass media and digital communication technologies. The key characteristics of these systems are the multiplicity of voices and communication actors, as well as the diversity of platforms and languages that can be used. This chapter argues that, if these are incorporated into science communication epistemologies and practices, they have the potential to inform inclusive and contextualised forms of engagement.

The multiplicity of voices and communication actors

The involvement of diverse voices in the design, implementation, and evaluation of science communication enables it to be inclusive and accessible to a wider audience. As observed by Sobane et al (2020) in a study of COVID-19 communication in selected Southern and East African countries, several communication actors have taken up the communication of COVID-19 prevention messaging. These include creative artists in the entertainment industry (performance artists, singers, and comedians), language services companies, fine artists, and community media such as community radio and newspapers. Of particular importance is the existence of Indigenous communication actors who already have a trusted voice within their community. Such people include community religious leaders, traditional leadership, traditional healers, and midwives. These communication actors are rooted in the community-based contexts of communication and attuned to the cultural sensibilities of their communities. In addition, the way they repurpose and repackage messaging in different formats to enhance reach

and accessibility for different population groups is informed by the contexts and knowledge of what works in that targeted audience.

In communication about the development of an irrigation tank in the dry plateau of the Deccan in Southern India, Baumgartner et al (2004) note that the involvement of an elderly former village headman, some farmers, a few boys, and the village teacher in communicating information about the project to outsiders created a strategy with a multiplicity of local contextualised voices with more potential for reach and impact. Actors such as these are important in that they are already trusted and depended on by the local community, as noted by Wang et al (2019).

Another example of the engagement of multiple actors in a science communication initiative is a project Dutta and Das (2016) conducted to establish factors affecting the communication practices and expectations of individuals living in the villages of Purulia, in rural Eastern India. They found that social embeddedness and co-designing communication tools with rural communities are key aspects of a successful communication strategy. The communication designers drew several science communication digital images, and the community made inputs into how the images could be made more culturally meaningful (that is, to communicate the exact/desired meanings) to the local Indigenous communities. This co-creative approach ensured that the designs were effectively contextualised and socially embedded in the community's beliefs and culture, thus creating better prospects of uptake. In particular, co-design fostered inclusivity while social embeddedness allowed communication design to emerge organically through embracing local knowledge.

A multiplicity of voices increases the potential reach and uptake of communication by diverse groups, since each voice may have a specific appeal to and potential influence on a particular section of the population. Communication through multiple voices also enables contextualisation and simplification of the information, which, in turn, allows the public to better interact and engage with the information.

Additionally, multiple voices enable communication in different languages, making messages accessible to speakers of those languages. Despite the widely acknowledged language diversity in the Global South, and the acknowledgement of this as a valuable resource for science communication, English is still the dominant language of science communication. Over the years, scholars have proposed several ways in which science can be made accessible to those who do not speak English. These include resources such as translanguaging (Makalela, 2016) and ad-hoc interpreting and translation (Fatahi et al, 2010) for face-to-face interactions, as well as translating documents into accessible languages (Sobane et al, 2020). As Márquez and Porras (2020) note, English has become a gatekeeper that prevents people from accessing and participating in scientific discourse, while also barring the

multiple cultural interpretations of science. This compromises the effective translation of research into action as noted by Momen (2009).

Effective science communication design, implementation, and planning need to carefully consider and harness the multilingual characteristics of the societies in which they are embedded. As complementing voices that repurpose, repackage, and translate science, science communicators should adequately tap into language diversity and address the communication needs of those who cannot access the science in English and yet need to be scientifically aware and informed for science uptake.

The value of multimodality in enhancing the reach of science communication

Another identified characteristic of Indigenous communication that can benefit science communication and is already being harnessed effectively in some cases is multimodality (Burn and Kress, 2018), which refers to the use of a variety of communication methods, including writing, audio-visual products, and creative arts. These modes offer innovative means to capture the attention of different audiences and improve science uptake. The development of communication tools in local languages facilitates access to science for a majority of the population who are local language speakers. Scholars of Indigenous communication note that the use of interactive platforms and channels of communication opens up opportunities for co-creative learnings and better appreciation (Mundy and Compton, 1991). According to Etumnu and Fab-Ukozor (2021) communication in Indigenous communities is done through different modalities to amplify the reach. These include artistic performances and narrative approaches that translate science into products that can easily be consumed by users.

A recent example is the Ethiopian government's efforts to communicate policies and programmes that alleviate rural food insecurity (Nigussie, 2021). In parts of rural Ethiopia, such as in the Tigray region, communicators have started integrating folk media forms, elements of Aa'dar (oral poetry) and Goila (folk songs) for example, into food security communication. These have reportedly shown the highest potential for science uptake because of their edutainment characteristics. Each culture has its own forms: song, dance, puppetry, festivals, plays, storytelling, debates, proverbs, parades, and so on. If these are integrated into science communication practices, they have the potential to facilitate co-creation with affected communities, engender culture-sensitive science communication, and enhance the prospects for trust in and appreciation of science.

In Latin America and the Caribbean, for example, a range of science communication practices are embedded in the social order and Indigenous communication skills that allow communities to respond to different adverse risks in their everyday lives. Indigenous people have used their traditional

knowledge to prepare for, cope with, and survive natural disasters for many years. In Honduras and Chile in South America and Haiti in the Caribbean, people respond to climate disasters through need-pooling (Postigo, 2021). In these contexts, culture and social relationships that facilitate need-pooling are found to be fundamental in governing risk recognition and disaster risk communication.

Some Latin American countries have built remote networks of scientists and science communicators that come together to create communication projects in different media platforms, inclusive of science museums, interactive science centres, natural history museums, environmental parks, zoos, botanical gardens, and aquariums. The focus is on regionally produced research, science policy, and science-related stories from the region using local languages (Weitkamp and Massarani, 2018). There is an acknowledgement that still more opportunities need to exist in terms of communicating science with regional relevance. The remote network offers quality and culturally relevant scientific information for non-scientific audiences in Latin America. From their different disciplines and concerns, science communicators intend to restore the value of science as a fundamental part of the Latin American human cultural heritage.

In a study exploring the integration of scientific and Indigenous knowledge to enhance the community's capacity for disaster risk reduction, Wang et al (2019) observed that in Haikou Village in the Ningxia Hui Autonomous Region of China, Indigenous communication tools are still prevalent and can easily be harnessed for science communication. Gongs, hand-actuated alarms, and oral notifications that can also be amplified by long-distance loudspeaker can be used alongside mobile phones to communicate to the public and send alert messages to distant ranges of 5–10 km during a disaster. By so doing, Wang et al (2019) show that Indigenous communication methods were optimised for effective information dissemination through the integration of new technologies. This created an effective community-based disaster risk reduction system and an effective communication system that can be repurposed for other science communication initiatives.

Conclusion

Given the multiple factors that affect access to science communication, this chapter argues that science communication epistemologies adapted from the Global North need to be rethought when being applied to the Global South. In particular, there should be careful consideration of the ways in which systems and policies can work towards the alleviation of the deficit model, which is manifested in the blind adoption of Eurocentric approaches in the Global South. Factors such as scientific literacy and interest and the ecology that affects them have to be taken into account in designing and implementing

science communication in the Global South. Also important is a careful reflection on the communication seeking and sharing behaviours in targeted communities and the ways in which already existing communication ecologies can be harnessed to bridge the communication gap between science users and knowledge producers. While it is good to use the new technologies that in so many ways accelerate the reach of communication, there is value in establishing ways to manage the digital divide and enhance science communication. The Global South has a wealth of communication practices, tools, and platforms, as well as culturally oriented communication actors that can be harnessed to enhance science communication epistemologies for these regions.

References

Ahinkorah, B.O., Ameyaw, E.K., Hagan, J.E. Jr, Seidu, A.-A., and Schack, T. (2020) 'Rising above misinformation or fake news in Africa: another strategy to control COVID-19 spread', *Frontiers in Science Communication*, 5(45): 1–4.

Alhassan, R.K., Nketiah-Amponsah, E., Ayanore, M.A., Afaya, A., Salia, S.M., Milipaak, J. et al (2019) 'Impact of a bottom-up community engagement intervention on maternal and child health services utilization in Ghana: a cluster randomised trial', *BMC Public Health*, 19 (971): 1-11.

Ayangunna, J.A. and Oyewo, B.A. (2014) 'Indigenous communication, religion, and education as determinants of attitudes towards STI/HIV/AIDS education in Igando community, Lagos state, Nigeria', *African Journal of Social Work*, 4(1): 59–77.

Bauer, M.W., and Jensen, P. (2011) ,The mobilization of scientists for public engagement', *Public Understanding of Science*, 20(1): 3–11.

Baumgartner, R., Karanth, G.K., Aurora, G.S., and Ramaswamy, V. (2004) 'In dialogue with Indigenous knowledge: sharing research to promote empowerment of rural communities in India', in A. Bicker, P. Sillitoe, and J. Pottier (eds) *Investigating Local Knowledge, New Directions, New Approaches*, Aldershot: Ashgate, 207–23.

Bucchi, M. and Saracino, B. (2016) '"Visual science literacy": images and public understanding of science in the digital age', *Science Communication*, 38(6): 812–19.

Bucchi, M. and Trench, B. (eds) (2014) *Routledge Handbook of Public Communication of Science and Technology*, New York: Routledge.

Burn, A.N. and Kress, G. (2018) *Multimodality, Style and the Aesthetic: The Case of the Digital Werewolf*, New York: Routledge.

Cahill, J. and Ward, I. (2007) 'Old and new media: blogs in the third age of political communication', *Australian Journal of Communication*, 34(3): 1–21.

Chilvers, J., Pallett, H., and Hargreaves, T. (2018) 'Ecologies of participation in socio-technical change: the case of energy system transitions', *Energy Research & Social Science*, 42 : 199–210.

Covello, T.V. (2021) *Communicating in Risk, Crisis, and High Stress Situations: Evidence-Based Strategies and Practice*, New Jersey: The Institute of Electrical and Electronics Engineers.

Dutta, U. and Das, S. (2016) 'The digital divide at the margins: co-designing information solutions to address the needs of Indigenous populations of rural India', *Communication Design Quarterly Review*, 4(1): 36–48.

Etumnu, E.W. and Fab-Ukozor, N. (2021) 'Indigenous Communication and the Prospects for Survival in the Modern Era' in I. Nsude (ed) *African Communication System in the Era of Artificial Intelligence*, Enugu: Rhyce Kerex Publishers, pp 69–79.

Fatahi, N., Mattsson, B., Lundgren, S.M., and Hellström, M. (2010) 'Nurse radiographers' experiences of communication with patients who do not speak the native language', *Journal of Advanced Nursing*, 66(4): 774–83.

Felt, U. and Fochler, M. (2008) 'The bottom-up meanings of the concept of public participation in science and technology', *Science and Public Policy*, 35(7): 489–99.

Finlay, S.M., Raman, S., Rasekoala, E., Mignan, V., Dawson, E., Neeley, L. et al (2021) 'From the margins to the mainstream: deconstructing science communication as a White, Western paradigm', *Journal of Science Communication*, 20(1): C02 1–12.

Ishihara-Shineha, S. (2017) 'Persistence of the deficit model in Japan's science communication: analysis of white papers on science and technology', *East Asian Science, Technology and Society*, 11(3): 305–29.

Jones-Jang, S.M., Mortensen, T., and Liu, J. (2019) 'Does media literacy help identification of fake news? Information literacy helps, but other literacies don't', *American Behavioral Scientist*, 65(2): 371–388.

Kago, G. and Cissé , M. (2022) 'Using African Indigenous languages in science engagement to increase science trust', *Frontiers in Communication*, 6: 1–5.

Khumalo, N.B. and Baloyi, C. (2017) 'African Indigenous knowledge: an underutilised and neglected resource for development', *Library Philosophy and Practice (ejournal)*, Available from: https://core.ac.uk/download/pdf/188123787.pdf

Lubinga, E., and Sitto, K. (2021). Health communication in Africa. In Winston Mano and Viola Milton (eds). *Routledge Handbook of African Media and Communication Studies*. New York: Routledge, pp 217–233.

Makalela, L. (2016). 'Ubuntu translanguaging: an alternative framework for complex multilingual encounters', *Southern African Linguistics and Applied Language Studies*, 34(3): 187–96.

Márquez, M.C. and Porras, A.M. (2020) 'Science communication in multiple languages is critical to its effectiveness', *Frontiers in Communication*, 5(31): 1–5.

Mason, S. and Merga, M. (2021) 'Communicating research in academia and beyond: sources of self-efficacy for early career researchers', *Higher Education Research & Development*, 41(6): 2006–2019.

Matias, A., Dias, A., Gonçalves, C., Vicente, P.N., and Mena, A.L. (2021) 'Science communication for social inclusion: exploring science & art approaches', *Journal of Science Communication*, 20(2): 5–24.

Metcalfe, J. (2020) 'Chanting to the choir: the dialogical failure of antithetical climate change blogs', *Journal of Science Communication*, 19(2): 1–19.

Momen, H. (2009) 'Language and multilingualism in scientific communication', *Singapore Medical Journal*, 50(7): 654–56.

Mundy, P. and Compton, L. (1991) 'Indigenous communication and Indigenous knowledge', *Development Communication Report*, 74(3): 1–3.

Nigussie, H. (2021) 'Back to the village: integrating folk media into rural food security communication in Ethiopia', in H.S. Dunn, D. Moyo, W.O. Lesitaokana, and S.B. Barnabas (eds) *Re-imagining Communication in Africa and the Caribbean*, Basingstoke: Palgrave, pp 273–292.

Nisbet, M.C. and Scheufele, D.A. (2009) What's next for science communication? Promising directions and lingering distractions', *American Journal of Botany*, 96(10): 1767–1778.

Okoth, D. (2022) 'Reliable internet unavailable for 90 pct of poorest', *Scidev.net*, Available from: https://www.scidev.net/global/news/reliable-internet-unavailable-for-90-pct-of-poorest/

Palmer, S.E. and Schibeci, R.A. (2014) ,What conceptions of science communication are espoused by science research funding bodies?', *Public Understanding of Science*, 23(5): 511–527.

Park, Y.J., Sang, Y., Lee, H., and Jones-Jang, S.M. (2020) The ontology of digital asset after death: policy complexities, suggestions and critique of digital platforms," *Digital Policy, Regulation and Governance*, 22(1): 1–14.

Postigo, J.C. (2021) 'Navigating capitalist expansion and climate change in pastoral social-ecological systems: impacts, vulnerability and decision-making', *Current Opinion in Environmental Sustainability*, 52: 68–74.

Purnomo, A.R. and A.N.M. Fauziah (2018) 'Promoting science communication skills in the form of oral presentation through pictorial analogy', *Journal of Physics: Conference Series,* 1006(2018): 1–7.

Rasekoala, E. (2015) 'Science communication in a post-2015 world: the nexus of transnational, multidisciplinary and sociocultural contexts', in B. Schiele, J., Le Marec and P. Baranger (eds), *Science Communication Today – 2015: Current strategies and means of action*, Paris: Universitaires De Lorraine, pp 39–45.

Rasekoala, E. and Orthia, L. (2020) 'Anti-racist science communication starts with recognising its globally diverse historical footprint', Available at: https://blogs.lse.ac.uk/impactofsocialsciences/2020/07/01/anti-racist-science-communication-starts-with-recognising-its-globally-diverse-historical-footprint/

Scheufele, D.A., Krause, N.M., Freiling, I., and Brossard, D. (2021) 'What we know about effective public engagement on CRISPR and beyond', *Proceedings of the National Academy of Sciences*, 118(22): 1–8. Available from: https://www.pnas.org/doi/epdf/10.1073/pnas.2004835117

Seleti, Y. (2010) 'Interfacing Indigenous knowledge with other knowledge systems in the knowledge economy: the South African case'. Library Symposium 2010*: Presidential Meeting. Knowing is not enough: engaging in the knowledge economy*. Stellenbosch University. 18–19 February 2010, Available at: http://scholar.sun.ac.za/bitstream/handle/10019.1/396/seleti_knowing_2010.pdf?sequence=2

Seleti, Y. (2012) 'The value of Indigenous knowledge systems in the 21st century', in J.K. Gilbert and S.M. Stocklmayer (eds) *Communication and Engagement with Science and Technology*, New York: Routledge, 267–78.

Simis, M.J., Madden, H., Cacciatore, M.A., and Yeo, S.K. (2016) 'The lure of rationality: why does the deficit model persist in science communication?', *Public Understanding of Science*, 25(4): 400–14.

Sobane, K., Nyaga, S., Ssentanda, M., and Ntlangula, M. (2020) 'Using multi-voiced and creative approaches to enhance COVID-19 messaging: learning from east and southern Africa', *HSRC Review*, 18(3): 43–4.

Sobane, K., Riba, I., and Lunga, W. (2021) 'The value of the fusion of Indigenous and contemporary knowledge in developing communication as interventions to reduce teenage pregnancy in South Africa', in B. Falade and M. Murire (eds) *Health Communication and Disease in Africa*, Singapore: Palgrave Macmillan, pp 333–345.

Wang, Z., Liu, J., Xu, N., Fan, C., Fan, Y., He, S. et al (2019) 'The role of Indigenous knowledge in integrating scientific and Indigenous knowledge for community-based disaster risk reduction: a case of Haikou Village in Ningxia, China', *International Journal of Disaster Risk Reduction*, 41: 1-9.

Weingart, P., Joubert, M., and Connoway, K. (2021) 'Public engagement with science -origins, motives and impact in academic literature and science policy', *PloS ONE*, 16(7): 1–30.

Weitkamp, E. and Massarani, L. (2018) 'Branching out: new JCOM América Latina for dynamic science communication community', *JCOM: Journal of Science Communication*, 17(2): E.

Wibeck, V. (2013) 'Enhancing learning, communication and public engagement about climate change – some lessons from recent literature', *Environmental Education Research*, 20(3): 387–411.

Wilcox, C. (2012) 'Guest editorial: it's time to e-volve: taking responsibility for science communication in a digital age', *The Biological Bulletin*, 222 (2): 85–87.