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The affordances of project-based learning and classroom action research in the teaching and learning of Natural Sciences

Abstract

In this paper I reflect on the experiences of Life- and Natural Sciences teachers in the Northern Cape who engaged in classroom action research (CAR). The context was a short-learning programme (SLP) facilitated by the North-West University on epistemological border-crossing between indigenous knowledge and the school science curriculum. After the SLP teachers had to submit evidence-based portfolios; and the CAR was part of this portfolio. The activity that was the focus of the teachers' action research (reported on in the portfolios) was learners' engagement in project-based learning such as, among others, ethnobotanical surveys. During the SLP in June 2017, teachers were shown how learners could engage in ethnobotanical surveys. In the portfolios, teachers had to reflect on their own and learners' experiences of engaging in such ethnobotanical surveys. These portfolios were analysed, and several emerging themes were identified from the data. Individual interviews were also conducted with a sample of teachers. Three of these themes are presented in this paper. The findings indicate that project-based learning holds affordances such as the realization of affective outcomes in science education. It also assists science teachers to become more critical and reflective, and enhances self-directed learning. One of the recommendations in this paper is that CAR should be promoted in both pre-service and in-service teacher education programmes.

Keywords: Classroom action research; project-based learning; ethnobotanical surveys; teacher professional development; prolepsis.

1. INTRODUCTION

In 2016 the North-West University (NWU) offered a short-learning programme for Life Sciences and Natural Sciences teachers, with the primary aim of assisting them to better contextualize curriculum topics through the infusion of indigenous knowledge. Although the Curriculum and Assessment Policy Statement (CAPS) advocates for the inclusion of indigenous knowledge, it does not provide teachers with much guidance (or the necessary subject content) on how to facilitate such epistemological border-crossing in the science classroom. Most teachers were not trained in how to infuse indigenous knowledge into CAPS themes, as several researchers have pointed out



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(Mothwa, 2011; Jautse, Thambe & De Beer, 2016; Cronje, De Beer & Ankiewicz, 2015; De Beer & Petersen, 2016). The short-learning programme (SLP) dealt with how to incorporate indigenous knowledge (IK) in the science classroom and how it can be aligned to the tenets of science. Taylor and Cameron (2016) show that there are three different perspectives on the infusion of IK into science. The first view is the inclusive perspective, i.e., that IK is part of science. The second exclusive perspective is that IK and science are separate domains of knowledge. This, among others, entail that IK cannot be subjected to the same verification processes as science. The third perspective is that IK and science should be seen as intersecting domains. Zinyeka, Onwu & Braun (2016) show that there are aspects about which both systems agree. Cronje et al. (2015) concur, and show that IK shares several similar tenets with the natural sciences. Among others, both IK and the natural sciences are characterized by their empirical, tentative and inferential nature. There are, of course, also differences. Science is predictable, whereas IK often includes a metaphysical component. Furthermore, IK is holistic, whereas natural science follows a reductionist approach (Cronje et al., 2015:324). Zinyeka et al. (2016:257) show that the most important difference between science and IK, which a teacher should take note of, is that:

IK systems accept aspects of the universe as mysterious, their sources and ways of knowing embrace spirituality, whereas modern or orthodox science and its useful methods and ways of knowing does away with the notion of spirituality and instead sees the universe as being knowable.

In the design of the SLP we highlighted the tenets that are shared between IK and science, but did not focus on the metaphysical component of IK. In the cooperative learning activity, namely, De Bono's thinking hats, teachers briefly engaged with the metaphysical nature of IK. This raises questions regarding content validity. Zamanzadeh, Ghahramanian, Rassouli, Abbaszadeh, Alavi-Majd and Nikanfar (2015:165) define content validity as the "ability of the selected items to reflect the variables of the construct in the measure, and addresses the degree to which items of an instrument sufficiently represent the content domain". In the design of the SLP the metaphysical nature of IK was downplayed. Consequently, this aspect was not included in the research instruments.

Odora Hoppers (2004) refers to the marginalization of IK in the classroom as 'knowledge apartheid'. Where teachers do refer to IK, it is often done through an example or two, but such engagement lacks the rigor of science embedded within the syntactical nature of the subject, and without cognizance of the tenets and nature of science. In describing how IK is often dealt with in the science classroom, De Beer and Whitlock (2009) use the metaphor of dead biotic tissue preserved in bottles of formaldehyde.

During the SLP, teachers were shown how learners can engage with IK through inquiry learning. For example, teachers engage hands-on during the programme, using an adapted Kirby Bauer technique, to test whether *muthi* (medicinal) plants have antimicrobial activity. This takes teachers (and the learners) on a journey of inquiry learning, where they have to formulate hypotheses, design experiments, make careful observations, and communicate their findings. The Kirby Bauer laboratory protocol is a simple way of determining the susceptibility of a micro-organism to an antimicrobial substance (present in the medicinal plant). Microbe-seeded agar plates are used to test for antimicrobial activity (Mitchell & Cater, 2000; De Beer & Whitlock, 2009). Such inquiry-based learning opportunities enable learners to see how IK can have its place in the natural sciences.



Figure 1: Teachers engage in an adapted Kirby-Bauer technique

Apart from its focus on problem-based learning, the SLP also emphasized cooperative learning. Cooperative learning, according to Johnson and Johnson (n.d.) provides the foundation for effective self-directed learning. According to these authors, self-directed learning can be defined as a situation in which: (a) the individual is able to define his or her own goals; (b) the goals are related to his or her central needs or values; (c) the individual is able to define the paths (i.e., procedures, strategies, resources) to be taken to achieve the goals; and (d) the achievement of these goals represents a realistic level of aspiration for the individual, i.e., not too high or too low, but enough to be challenging (Johnson & Johnson, n.d.:3). Teachers were expected to formulate learning goals for themselves during the SLP, and to reflect in their portfolios on how they will pursue these goals. For example, several of the teachers indicated that they were not well-trained in laboratory techniques and microbiological protocols such as the Kirby Bauer technique, and that they need to improve their knowledge and skills to infuse such inquiry approaches in their teaching.

Teachers, for example, used De Bono's thinking hats during the SLP, to discuss the advantages and disadvantages of including IK in science curriculum themes. Since most classrooms are characterized by large learner diversity, with many cultural groups represented, the SLP designers included a focus on self-directed learning in the programme. It was hoped

that teachers would continue learn more about the IK of other cultural groups represented in their classes, so that these may be included in future lessons.

After the SLP, teachers were given three months to complete an evidence-based portfolio, in which they, for example, had to provide lesson plans in which they showed how they had incorporated IK in their lessons after the SLP. In the portfolios teachers also had to provide evidence of reflection on these lessons, and pointers on how they would improve the lessons in future. However, NWU researchers came to realise that the SLP had limited success. Although teachers expressed their enthusiasm to implement IK in their teaching after the SLP, very little transfer actually took place into the classroom after the intervention (White & De Beer, 2017; Jacobs, 2018; Mentz & De Beer, 2019). Classroom observations and evidence provided by teachers' portfolios, suggested that many teachers reverted back to transmission-mode (chalk-and-talk) teaching and learning; with only lip-service paid to IK. This is unfortunate as transfer into the classroom is 'where the rubber hits the road', and should be the yard stick to measure the success of teacher professional development programmes. This, of course, is not a new phenomenon. Zeichner and Tabachnick (1981:7) speak of the "wash out" effect, whereby newly acquired insights and teaching skills are replaced with long-standing practices and beliefs. Ramnarain and Schuster (2014) provide one possible explanation for this phenomenon. These authors show that systemic pressures (e.g., expectations from parents or principals), often result in 'teaching-to-the-test', in order to ensure good learner performance, despite the teacher's own pedagogical orientations. Although many teachers might realise that IK holds affordances for better contextualization of science topics, they might rather limit their teaching to those aspects addressed in the CAPS curriculum, due to systemic pressure and the limited time (and very prescriptive pace-setters).

For this reason, researchers distilled (in true design-based research tradition) design principles for future SLPs. These are dealt with in another publication (De Beer & Kriek, n.d.). Such design principles include taking *real* teacher needs into consideration when planning SLPs; emphasizing inquiry learning; and building these programmes on strong theoretical frameworks. One design principle, which is the focus of this paper, is to assist teachers in their reflective practices. Research indicates that reflection is essential for teacher professional development. Teachers' reflective abilities can be enhanced by engaging them in classroom action research (CAR) (De Beer, 2019).

Teachers who participated in a later SLP in the Northern Cape (June 2017) were therefore exposed to a revised SLP (unlike earlier programmes in Limpopo and the North West Province), in order to ensure more transfer into the science classroom, and enhanced reflective practice. This second SLP involved teachers in action research that investigated the affordances of project-based learning in the science classroom. One of the activities that teachers engaged with during the SLP was an ethnobotanical survey (De Beer & Van Wyk, 2011). The Northern Cape (Hantam region) was once the home of many Khoi-San communities, and many of the teachers (and learners) in the district are of Khoi-San descent. In this, generally, socio-economically stressed region, many people still use medicines derived from plants growing in the local environment. De Beer and Van Wyk (2011) described a survey whereby learners engage in preparing herbarium voucher specimens of plants from the region; develop a questionnaire; conduct a survey; compile a matrix, and then present their findings according to an Ethnobotanical Knowledge Index (EKI) and Species Popularity Index (SPI). Teachers could plan such project-based learning using CAR. In this paper we present the data collected after teachers engaged in CAR.

2. PROJECT-BASED LEARNING AND CLASSROOM ACTION RESEARCH

Teachers were requested to engage learners in project-based learning after the SLP, as described above. Furthermore, teachers were required to conduct classroom action research (CAR), and to reflect on this CAR in their portfolios.

Project-based learning: Engaging in ethnobotanical surveys (amongst others)

Krajcik and Shin (2016:276) state that project-based learning environments have six key characteristics, namely:

- Project-based learning should start with a driving question, or a problem to be solved;
- The teacher should clearly determine the learning goals to be achieved;
- Learners should explore the driving question by participating in scientific practices;
- Learners should engage in collaborative activities to find solutions to the driving question;
- Learners are scaffolded with learning technologies; and
- Learners create a set of tangible products that address the driving question.

For the ethnobotanical surveys, a suitable driving question could be: 'Indigenous knowledge is an oral tradition. If knowledgeable elders die, this knowledge is often lost to future generations. How can we, therefore, preserve the rich ethnobotanical knowledge of the Namaqua district?'

There are so many aspects to this driving question that learners need to consider. For example, issues of ethics and intellectual property should be studied. The San became the first cultural group in South Africa to produce a code for research ethics- an important consideration in biology research (South African San Institute, 2017). The question has the potential to engage learners with the complexity of such epistemological border-crossing, and the conundrum of research ethics in the field of IK.

Apart from ethnobotanical surveys, the facilitators of the SLP also referred to other possible IK projects. One such IK project is soap making (in the Northern Cape there is a strong history of soap making). Plants used traditionally for soap making contain relatively large amounts of a group of compounds known as saponins (Van Wyk & Gericke, 2018) that dissolve fat and oily substances. Historically animal fat and lye are used in soap making, a process known as saponification (Van Wyk & Gericke, 2018). Instead of using lye or caustic soda in this process, plants such as *Seepganna* and *Asbos* can be added.

Classroom Action Research

Mettetal (2002) describes CAR as midway between teacher reflection at the one end, and traditional educational research at the other. Classroom action research is more data-based and systematic than reflection, but also less formal and controlled than educational research (Gravett & De Beer, 2015). During the SLP in the Northern Cape teachers were shown how CAR should follow steps such as:

- a. Identifying a research problem (and formulating a research question);
- b. Planning an intervention (in this case, project-based learning);
- c. Acting and collecting data or evidence (e.g., in the form of learners' portfolios or projects);
- d. Analysing this data; and
- e. Evaluating the intervention and deciding on how this will inform teaching practice in future (Gravett & De Beer, 2015).

Mostly, teachers decided to focus their CAR on ethnobotanical surveys, although a few teachers did choose other interventions. Examples of projects other than ethnobotanical surveys included a project on the water resources in drought-ridden Calvinia; and a project on soap-making, that was historically an important cultural practice in the region. However, even the latter project on soap-making included ethnobotanical aspects. This teacher's learners realized that the *Asbos* (*Mesembryanthemum junceum*, a Karoo plant) was used traditionally to make 'boerseep' (traditional soap), as this plant's lye was used instead of caustic soda.

Research methods and ethical considerations

This paper reflects on design-based research, during which Life Sciences and Natural Sciences teachers from the Northern Cape (Namaqua district) engaged in CAR. Data were collected from 37 teachers who participated in the intervention. Not all of these teachers submitted portfolios; of the 24 portfolios received, six of teachers misunderstood the CAR assignment. These teachers thus described projects in which learners engaged, without framing them in terms of CAR. This paper, therefore, focuses on the data obtained from 18 portfolios. Individual interviews were conducted with a few ($n = 5$) of these teachers, and convenience sampling was used. Teachers were asked to describe their lived experiences of engaging in CAR. These interviews were transcribed and analysed. All submitted portfolios, which included teachers' reflections on CAR, were analysed. I utilized Saldana's (2009) coding technique. In-vivo codes (codes taken from the exact words spoken by the participants, or captured in the portfolios) were identified and grouped into categories, and from these categories, emergent themes were identified. Open coding was applied. Construct validity of the interview protocol was ensured by asking a panel of experts (including the university's Statistical Consultation Services) to peruse the protocol.

Ethical clearance was obtained from the NWU's Faculty of Education Ethics Committee (NWU-00271-16-A2), and we adhered to all the guidelines for ethical research. Teachers were assured that they could participate in the SLP, even if they chose to not participate in the research. They were also assured that they could withdraw from the research at any stage, without any negative consequences.

3. FINDINGS

Unlike previous cycles of the SLP, e.g., the interventions in Limpopo Province in 2016 (Jacobs, 2018; White & De Beer, 2017), where little transfer took place into the classroom after the SLP, it was encouraging to see that there was a genuine attempt by many Northern Cape teachers to replace transmission-mode teaching for inquiry learning, and to attempt the CAR with enthusiasm and dedication. A number of themes were distilled from the data (both portfolios and personal interviews with teachers), of which three are discussed below.

Theme 1: The affective domain took centre stage in both learners' project-based learning, and in teachers' classroom action research

Given the difficulty of measuring conceptual change, and the complexity of showing a relationship between cognitive gains and a specific intervention, we advised teachers to rather focus on learners' affective gains during their CAR. For this reason, the majority of teachers formulated research questions related to affective outcomes, such as: 'What is the effect of learners' engagement in an ethnobotanical survey on their attitudes and interest in Life Sciences?'; or 'How did learners experience their involvement in ethnobotanical surveys?'. Several teachers also researched the views that learners hold, e.g., 'How does learners' engagement in a project on making and packaging traditional soap change their views on IK and entrepreneurship development?' Teachers obtained data to answer their research questions through the application of questionnaires, studying artefacts (learners' projects), and arranging focus group interviews with the learners. Close to 80% of the teachers reported that there was a renewed 'energy' in the classroom; and that learners were very interested in, and inspired by, the project-based learning. Sixteen of the 18 portfolios (90%) included photographs as evidence of learners' engagement in the respective projects. It was encouraging to note how the facial expressions and body language of the learners indicated intense engagement with, and enjoyment of, the activities.

This theme can best be illustrated through a vignette. A teacher in Calvinia engaged her Grade 10 learners in ethnobotanical surveys. One of the learners, Henrico Thys, became so interested in the plants of the Hantam area that he visited the Calvinia library to ask for books on the plants of the region. He was, amongst others, given a thesis on the ethnobotany of the Agter-Hantam by De Beer (2012). In this work, photographs are shown of novice botanists in the area, who were consulted by the researchers. In the book, Henrico saw a photograph of his uncle, Martiens Thys, and this inspired the boy to consider a career in ethnobotany, because of the "knowledge in the blood". Both the portfolios and the interviews conducted with teachers indicated that affective outcomes were achieved, and that the learners enjoyed the learning experience. Several teachers also reflected on how this will encourage them to engage in action research more often. One of the teachers commented during the interview that:

I did the action research with a very difficult class, and it was wonderful for me to see how the learners were all engaged, and how they got excited about the project. It gave me joy to witness the learners' enthusiasm.

This realization of affective outcomes is important, since authors such as De Beer and Mothwa (2014) speak of the non-attainment of affective outcomes as the "missing link" in science education. Rotherham and Willingham (2010) showed that teachers often disregard problem- and project-based learning approaches, and rather make use of teacher-centred transmission-mode approaches. These authors state that it is often "a matter of chance rather than the deliberate design of our school system... we cannot afford a system in which receiving a high-quality education is akin to a game of bingo" (Rotherham & Willingham, 2010:17). I claim that the same can be said for the affective domain. So often teachers hope that such outcomes will be realized, without decisively designing learning opportunities that centre-stage the affective domain. It is, therefore, encouraging that teachers reported on the realization of affective outcomes through such project-based learning.

Theme 2: Classroom action research assists science teachers to become more critical reflective practitioners

During previous cycles in this design-based research (e.g., in Limpopo, North-West Province and Gauteng), on which authors such as De Villiers *et al.* (2016); De Beer and Petersen (2016); and White and De Beer (2017) have reported, teachers provided very superficial reflections in their portfolios. The researchers came to realize that, given the systemic pressures on teachers (e.g., the full curriculum) many teachers do not make time to reflect on their teaching (Mentz & De Beer, 2019).



Figure 2: An example of artefacts from a Teachers' portfolio, reflecting on the ethnobotanical survey

The batch of Northern-Cape portfolios included far more nuanced reflections. One of the reasons for this was the inclusion of CAR. One of the teachers commented in her portfolio:

I have so many times presented this section on water, water pollution and water conservation, yet I always get the idea that the learners are not really interested in this topic. However, as part of my CAR, I have asked the learners to use the foldscope microscopes¹ to study water from different water sources, and to, based on the organisms that they identify in the water, make judgments on the levels of eutrophication. I could not believe learners' enthusiasm, and the efforts that they have put into this project. This made me to critically think about my teaching, and whether I succeed in stimulating learners' interest in the curriculum topics. One of the learners indicated to me that he felt like a little scientist when he studied water through the foldscope at home, and his family members were all intrigued by it, and asked him questions. I have seen the value of inquiry approaches- although I must admit that I do not feel very confident in using

1 A paper-based microscope produced by Stanford University, which is imported by the NWU and rolled out in schools, as part of the NRF and Fuchs Foundation funded project.

such approaches in the classroom. It is so much easier to go for lectures, and to follow the textbook.

In a personal interview, another teacher stated:

At first I was terrified by the thought that I should do research. However, I had to do it, since I wanted to submit my portfolio. The classroom action research provided me with new insights into my own teaching. I saw how excited learners became when they did the survey, and gained knowledge on the medicinal plants in the Calvinia environment. And this was so gratifying, that I am dedicated to more often engage my learners in such activities.

Another teacher had the following to say in her portfolio:

When my learners presented their projects to the rest of the class, I could not believe that these were the same kids that were so disinterested in the work a month ago. There was an electrifying energy in the air, and I could sense the pride that learners took in their projects. This is of course the fodder that teachers live on, and I am definitely going to give my learners a similar project next year. However, I at times felt very insecure when learners came to ask questions. This project made me realise how important it is that teachers should be life-long learners.

Theme 3: Classroom action research might enhance teachers' self-directed learning

Knowles (1975:19), generally considered as the progenitor of self-directed learning, described it as "a process by which individuals take the initiative, with or without the assistance of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating outcomes". Teachers mentioned in their portfolios that they felt slightly overwhelmed by having to engage in CAR. One of the teachers stated that: "I was anxious at first, but upon completion of the CAR I enjoyed a wonderful sense of accomplishment. I learnt so much!"

Prolepsis is a teaching technique that Van Lier (2004:153) describes as "assuming that students know more than they actually do". In other words, the learning task is conceptualized in such a way that it poses a challenge to the learner. Meerkotter (1980), in a classic study, has shown that learning tasks that pose a challenge, and expect behaviour such as analysis, synthesis and evaluation, lead more often to creative learner outputs (compared to learning tasks that merely depend on regurgitation). The portfolio requirement, that teachers should engage in CAR, could be seen as a form of prolepsis, and teachers were challenged in their professional learning across the zone of proximal teacher development (Warford, 2011). Several of the teachers rose to the occasion. Most of the CAR projects focused on implementing strategies to address affective outcomes. About half of the projects focused on ethnobotanical surveys, but there were also a few notable exceptions, for example, a project requiring learners to isolate DNA from bananas; and a water quality project, where Foldscope microscopes were used by the learners.

From teachers' reflections, it became clear that they developed self-directed learning skills in the process. Marlize (a teacher in Calvinia) realized that she was not very knowledgeable on the indigenous plants of the region. She still chose to give her learners an ethnobotanical survey, and to set a learning goal for herself – to become more acquainted with the local flora. She then identified a knowledgeable person to assist her in her learning

journey – Francois, an attorney who lived on one of the nearby farms, and who happened to be a keen amateur botanist. Francois assisted her and the learners to identify less well-known plant species. Marlize also consulted library books and the internet on how to conduct CAR. She submitted a very good action research project, as part of her portfolio. Another teacher, who chose a soap-making project, consulted with the curator of the local museum, as well as with holders of this IK in the region, to learn more about the science of soap making.

4. CONCLUSION AND RECOMMENDATIONS

The theoretical framework that underpins these SLPs for teachers is social-constructivism. In the design of these SLPs the developers took cognizance of Warford's (2011) adaptation of the well-known Vygotsky construct of the zone of proximal development (ZPD) – the zone of proximal *teacher* development (ZPTD). In scaffolding teacher professional development across the ZPTD, the technique of prolepsis seems helpful. This paper focuses on the affordances of teacher engagement in CAR. The data shows that CAR assists in the development of teachers' reflection skills, and that it could also enhance self-directed learning.

However, our data also shows that SLPs have limited value, and that teacher professional development should preferably take place in longitudinal and systemic communities of practice. The intention of the project-based learning and CAR was to provide an opportunity for teachers to become more reflective practitioners, and to develop more nuanced understandings of the nature of science. Although the SLP, and CAR assignment, did make teachers more aware of the critical role of reflection, and they developed a better understanding of the nature of science, such a short intervention is not adequate. Post-intervention classroom observations showed that some of the teachers had difficulty in addressing IK in learner-centred ways (White & De Beer, 2017; Mentz & De Beer, 2019); and to effectively facilitate problem-based learning in the classroom. It is, therefore, important to consider such competency development, in terms of problem-based learning, in both pre- and in-service teacher education. One example of best practice is the Ohio schools project (Mackenzie, 2011) where science teachers were invited to participate in research conducted in laboratories, with scientists, in an attempt to make teachers more aware of the nature of science. Mackenzie (2011) speaks of the 'ecology of the classroom' – a learning space created by the teacher in which the learners engage in authentic science and develop more nuanced understandings of the nature of science. To this effect, Pretorius (2015), in her intervention, exposed a number of Johannesburg science teachers, who were all members of a community of practice, to research at the African Centre for DNA Barcoding (ACDB). Teachers worked for a week with researchers in the ACDB and engaged in processes that most of them were unfamiliar with, e.g., the polymerase chain reaction (PCR). This opportunity provided teachers with more nuanced understandings of the nature of science. A similar intervention was presented to science teachers in the Potchefstroom area in 2018 (Sebotsa, De Beer & Kriek, 2019). It is difficult to provide a similar opportunity during a SLP of two or three days. However, I am of the opinion that elements of this were present in the action projects that teachers and learners engaged in.

5. I CONCLUDE WITH TWO RECOMMENDATIONS:

Classroom action research should receive more attention in both pre-service and in-service teacher education. I concur with John Slaughter, as quoted in Chmielewski and Stapleton (2009:53), who said that "research is to teaching what sin is to confession. If you don't participate in the former, you have very little to say in the latter". Unfortunately, the literature

shows that most teachers do not engage in educational research. Chow, Chu, Travares and Lee (2015) provide a reason for this unfortunate state – that teachers lack training in research methodology and research skills. In addition, time often does not allow for classroom research, and schools do not always value the role of the teacher as a researcher.

Such teacher professional development is best achieved within well-functioning communities of practice. Teachers engaging in CAR need ‘critical friends’ with whom they can share ideas. In the Namaqua district in the Northern Cape, schools are often 200 km or more apart, which make the establishment of communities of practice very challenging (except when it happens within the context of a specific school). However, on-line communities of practice might provide a viable alternative, if teachers have sufficient internet connectivity. Olivier, Van der Westhuizen, Laubscher and Bailey (2019:4) state that e-learning can provide affordances in terms of both contextualized learning and mutual support: “Technology has to be appropriate to the community that it serves and meet and satisfy the socio-cultural needs of local people”. This is an aspect that needs to be considered when presenting future SLPs.

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