

Beating the language barrier in science education: In-service educators' coping with slow learners in Mauritius

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ABSTRACT: This study describes how in-service teachers in the pre-vocational sector in Mauritius adopted specific strategies to overcome the language barrier in the learning of science (Van Driel, Verloop & de Vos, 1998). Students of form III were taught few basic ideas related to “Earth & Space” through the use of role play and ICT. The concepts chosen for this study were ‘occurrence of day and night’, ‘relative positions and motions of the Earth, the Moon and the Sun’ and ‘main constituents of our solar system’. Classroom observations, focus group discussions with students, interviews with educators and post-test for students show that role play and ICT can potentially overcome the language barrier in the learning of science at pre-vocational level. Findings reveal that reading and writing should be kept to a minimum while use of Mother Tongue (Kreol language) and hands-on activities with oral interactions must be encouraged during lessons conducted in pre-vocational schools.

KEY WORDS: Language barrier, pre-vocational learners, role play & ICT, Kreol language, basic astronomy

INTRODUCTION

The pre-vocational stream

Science education is an essential component of the Mauritian curriculum, including the revised pre-vocational curriculum introduced in 2001. However, teaching and learning of science is very closely linked to literacy. It means scientific literacy would not develop much if there is no proper language acquisition. In spite of the national urges and efforts made to promote scientific inquiry and science education in the Mauritian context, a very slow progress is reported. A report by the Mauritius Research Council (2004) regarding scientific literacy among students in Mauritius, states that we are very much lagging behind our international counterparts. The report highlights that classroom based resources are inadequate, especially for science instruction. Teacher motivation is satisfactory but low motivation level of students remains a major

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hindrance. In an attempt to motivate students, the government has come up with several schemes such as free education at pre-primary, primary and secondary levels i.e., no tuition fees are charged, free transport for students and social aids for needy students. Further efforts include compulsory education till the age of 16 so that dropouts can be minimised. Still we find that learners are not attracted to science. This situation is worse among pre-vocational learners. These are students joining the sector are those who have failed after a second attempt, in most of the academic subjects (English, French, Mathematics, History & Geography, Ancestral language and Science). Their continuous failure is attributed to lack of interest, poor parents who are not able to provide basic amenities and care, issues related to broken families, poor educational background of parents, busy or separated parents, learners not having enough competencies to climb to next level in the curriculum, tight assessment schemes not catering for low ability students and so on (Ministry of Education and Human Resources (MoEHR), 2011).

The national curriculum for the pre-vocational stream caters for areas such as basic skills in numeracy and literacy, life skills and communication skills (English, French and Creole), Basic Science and trade oriented subjects. In this stream students learn basic ideas related to trade skills, life skills, numeracy and literacy and communication skills. Poor literacy skills further accentuates learning difficulties in areas including science.

Out of the roughly 25000 students who participate in the Certificate of Primary Education (CPE) Examination, about 35% are not able to pass and move to secondary schools (Mauritius Examinations Syndicate, 2010). A second attempt is not promising either. These learners then join the prevocational stream alongside a mainstream secondary class (Auckloo, 2011). They follow a specific tailored programme with teachers specially trained to work in these schools, with focus on ways to address learning difficulties and remedial education.

RATIONALE

It is believed that most of the social ills are the products of illiteracy, which are intertwined with problems of poverty, delinquency, drug dependence, HIV AIDS, prostitution, teen age pregnancy, and crime. If we aspire to live in a better society, everything possible should be done to reverse the escalation of problems related to illiteracy and poverty which is also related to the problem of dropouts. One of the ways to achieve it is through literacy among the low ability or deprived students. Given that traditional methods have failed to motivate most of these learners, innovations need to be trialled. So this study aims to trial one innovation

which is minimisation of the language issue in the learning of science through role play and ICT.

Through this study the researchers and educators are finding out ways to engage low ability learners in meaningful learning experiences such as role play and ICT. It is believed that role play is one of the methods that can engage learners into meaningful classroom transactions (Cyparsade, Chummun, Carooppunnen and Moheeput, 2011; Cyparsade, Moheeput and Carooppunnen, 2009; McSharry and Jones, 2000). It will be an opportunity for educators to learn about new techniques, up to date resources including ICT and interactive pedagogy and also how to present information in a variety of formats (Steele, 2004).

The medium of instruction in the prevocational sector has for long time been restricted to English and French languages, although teachers use the mother tongue from time to time. Research and latest development in the Mauritian prevocational sector has prominently called for increasing use of the mother tongue or the Kreol language (MoEHR, 2011). In line with the current and recent reform that has started in this sector since 2011 (MoEHR, 2011), increasing importance is being given to the language component to facilitate learning in other areas through the mother tongue. It is also being envisaged to assess the learning of science in Kreol language just to avoid the language barrier and carry out a reliable assessment. The present research is thus in line with a merger between approaches that includes role play, ICT as well as the use of mother tongue.

AIM

The aim of this study is to support the educators' use of role play and ICT in pre-vocational schools in Mauritius for the teaching and learning of basic science and to reduce the language barrier among low ability learners.

RESEARCH QUESTIONS

1. How far can role play and ICT support learning of basic science at pre-vocational level?
2. What are the constraints facing the implementation of role play and ICT in the teaching of basic science to low ability learners through English usage?
3. To what extent the teaching and learning of concepts related to Earth and Space can be achieved through role play, ICT and Kreol?

LITERATURE REVIEW

What is being offered to students in pre-vocational education sector

For the first time there has been a National Curriculum Framework Secondary (NCF), in 2009, for Pre-vocational Education in Mauritius. According to the NCF (2009), pre-vocational education must, among others:

Enable the holistic development of each individual learner, foster the ability for critical thinking, creativity and self-expression in learners, prepare learners for lifelong learning, develop functional literacy and numeracy that will serve as the basis for vocational training, apprenticeship or further education, develop problem solving skills (NCF, 2009).

All these objectives will be translated to our students through four domains, which are Communication Skills, Numeracy and Problem-Solving Skills, Life Skills and Livelihood and Trade Skills (NCF, 2009). In line with this NCF, Numeracy and Problem Solving Skills calls for the use of ICT as a support for learning.

Work being done in pre-voc sector currently

Educators in the pre-vocational sector are performing according to what is stipulated in students' workbooks and with the aid of teachers' guides provided to them. Many of these educators do possess a specific qualification needed for teaching of low ability students (75%) and only a few of them have not undergone specific training in the field of special educational needs i.e., remedial education. All of them possess a School Certificate and many of them have a Higher School Certificate (60%). Around 11% of these educators possess a Diploma in pre-vocational education and around 9% of them have a Degree (MoESR, 2003). Though teachers have been trained, there is inadequate provision of good quality teaching – learning experiences to learners. This is making the teaching and learning process more difficult in the pre-vocational sector, where more effort should have been put to help the low ability students. Another drawback in this sector is the severe lack of resources which is the cause of poor response and retention from these students.

What was missing in pre-voc schools so far?

It has been widely recognised that periodic in-service training is essential in order to compensate for the shortcomings in or lack of training of those teachers who are in the field along with keeping them refreshed about recent pedagogical developments (Agarkar, 2005, pp.161-162).

In line with the above statement the current study has attempted to meet the shortcomings of the sector through concerted efforts. These include training and resources provided to teachers, resources provided to students, funding and also assessment of learning. Even the textbooks for the pre-vocational sector have been revised so that appropriate materials are provided to learners. Capacity building for inspectors, heads of institutions, educators (including temporary ones) have been conducted so that they can drive the implementation of the new curriculum. These were unfortunately less prominent until recent developments.

Use of role play in science lessons

The reason why role-play can help to make science relevant to many children is that it is based upon 'play' (Munirah, 2006; McSharry & Jones, 2000). If the teacher steps into his classrooms with the same kind of planning, usual strategies, almost same questions, unchanging resources and evaluation techniques, then it may become very boring for learners, especially if they are low ability ones (Cyparsade, Chummun, Carooppunnen & Moheeput, 2011; Nickerson, 2009; Sukhoo-Busawon, 2008). In this study, role play, ICT and Kreol language have been chosen as these have not been implemented so far at the pre-vocational level in the teaching and learning of science in Mauritius. Actually, learners need to internalise certain abstract concepts through the engagement of more than one sense at a time, through role play and other activities (Sharma, 2006).

Use of ICT in science lessons

The use of ICT in Mauritian classrooms has been introduced since late 1990s (Isaacs, 2007). Several initiatives have been taken by the Ministry of Education & Human Resources, the Mauritius Institute of Education (MIE) and other stakeholders.

Mauritius has attempted to promote ICTs in schools since the late 1990s which is reflected in its national ICT policy, a segment of which is dedicated to education (Isaacs, 2007, p.2).

The MIE has introduced ICT modules in all teacher education programmes as a subject and also as an important support for the teaching and learning process. All pre-service and in-service teachers are encouraged to use ICT in their planning, teaching and assessing tasks.

The introduction of ICT in the school curriculum worldwide has brought a drastic change in the way concepts are taught (Ramma, Dindyal, Kah Chye & Cyparsade, 2006, p.717).

Use of ICT in science lessons helps in creating and maintaining interest of learners especially through animations and graphics, activating mental processes of learners.

Use of mother tongue in science lessons

In Mauritius most learners' mother tongue is Kreol. However, they need to study most subjects in English and only one or two subjects are in French. In this situation there is lots of confusion in the minds of low ability learners. They are faced with two barriers in their learning process, the content and the English/French language. In this situation students of low abilities should be taught using the mother tongue to at least remove one barrier to learning. For so long, there was debate about whether creole should be used in formal instruction. The NCF 2009 has made provision for the use of Kreol in instruction especially with low ability students (MoEHR, 2003).

Motivation of low ability learners

Educators should be aware of how to motivate learners, once motivation is established (intrinsic or extrinsic), learning is easier to occur.

When people are motivated, they intend to accomplish something ... students' motivation plays a crucial role in science learning (Sevinç, Özmen & Yiğit, 2011, pp.218-232)

Engaging educators to cope with the language barrier

Though educators in the pre-vocational sector are qualified, they need additional support in schools to implement the new NCF and innovative strategies. Several training workshops were organised to explain to educators what is there in the curriculum for understanding nature, how to teach them through meaningful activities and projects, even use of innovations and ICT has been demonstrated.

METHODOLOGY

Sample

The group on which the research focused is prevocational teachers in Mauritius. A convenient sample (Cohen et al, 2002) of ten educators participated in this study. The teachers were of both genders, holding

appropriate pedagogical qualifications to teach pre-vocational students and having several years of teaching experience in the pre-voc sector. These educators were chosen as they were willing to take initiatives and few who are in the panel of curriculum writers for pre-vocational science.

Modality of the planning and intervention

"Basic Astronomy" was selected as it is directly related to students' daily life and could be illustrated with animations and graphics. The concepts that students learn at form III level in pre-voc stream are: Our Solar system, Planets and other bodies, Relative motions of Sun, Earth and Moon, Occurrence of eclipses and Occurrence of day and night on Earth. Concepts such as our solar system, planets and other bodies in our solar system, relative motions of sun, earth and moon and the occurrence of day and night on the earth, were chosen. A PowerPoint Presentation was prepared by the researchers. The PowerPoint included hyperlinks to Encarta Encyclopaedia, colourful photographs and artists' impressions related to these concepts, interactive simulations and video files showing celestial bodies and their motions. Along with ICT, it was planned to use role play to reinforce the idea of motion of the moon around the earth, simultaneous motion of the moon around the earth and motion of the earth around the sun, motion of planetary bodies around the sun, and also the occurrence of day and night on the earth.

All these chosen topics were taught by the educators, in their classes in two periods of one and a half hour each. Educators started the session by written pre-test with questions: what is a planet, what is the shape of the Earth, how many planets are there in our Solar System, name the planets found in our Solar System, what is a Moon, what causes day and night on earth, etc.

The pre-test was in English and textual information was sought through a worksheet. When the scripts were collected and analysed, it was found that most students could not answer even the simple questions. They did not understand the questions asked. They were then asked the same questions orally by the educators and most of the time it was answered in Kreol (L1). It was found that students were able to communicate more fluently in the L1 and then answer some of the questions set in the worksheet. It was also found that once L1 was used, students were ready to talk freely on the topic, they even asked questions to the educators conducting the lesson. Gradually they became much enthusiastic and the lesson became interactive.

The next step was to use the PowerPoint Presentation including animations. Role play was used to supplement the explanation. This teaching session lasted about 60 minutes. In the following lesson, presentation continued for one hour till all concepts identified by the

researcher were taught. This lesson ended with the administration of the post-test by the educators.

Tools used in this study

- Pre-test; written test with simple questions on basic astronomy with short answers
- Post-test on same topics, testing how far the educators' interventions facilitated understanding
- Second post-test on the same topics, using a worksheet with lots of visuals where students had to label several diagrams and give very short answers; this was used to test the difficulty with the English language
- Interview of educators and a pedagogical inspector to find out their perception on the study
- Focused group discussion (FGD) among students to find out their perception on the use of ICT, role play and especially Kreol

Role play

Ideas chosen for role play were Earth – Moon system, Sun – Earth – Moon system, Solar System, Occurrence of day and night on Earth. For the Earth – Moon system two students of different heights and body size were involved. The small one represented the moon and rotated around the larger body representing the earth. For the Sun - Earth – Moon system three students of different height and body size were involved (Figure 1). The small one represented the Moon and rotated around the larger body representing the Earth; while the Earth was moving around the Sun and spinning slowly at the same time. For the solar system a group leader was assigned, s/he was asked to work along with other ten members of the group to perform a role play to show how the planets move around the Sun. They had to prepare word cards on which the Sun, Moon or the name of a planet was written. While doing the role play they were supposed to express which celestial body each one represented. E.g., “Hello friends, I am the Sun; all the 8 planets rotate around me. I stay in one fixed position”. The modelling of occurrence of day and night was also demonstrated using a role play. Students were taught this concept using a globe and light from projector representing sunlight.

After viewing this model, students were asked to reflect in groups about how they can use role play to demonstrate the occurrence of day and night on the earth. Students were able to manage the role play using a torch in front of a student, who would spin slowly. When the light fell on the face of the student, s/he would say “day time!” and when there was no light falling on the face of the student s/he would say “night time!” and continue to spin.



Figure 1: Role Play for Sun-Earth-Moon System

FINDINGS

Pre-test

During pre-test learners were not very enthusiastic as they could not decipher the questions. The classroom teacher tried to explain the questions in Kreol and asked them to write answers in Kreol if they cannot manage with English. This was yet another evidence of the language barrier in the learning of science. Many students could not find out that very few considered Earth itself to be a planet. Many worksheets were returned nearly blank or with answers to only the first few questions out of 13. Most important misconceptions demonstrated by students in the pre-test: A star is a planet, the Sun is a planet, Mars is a planet (only one), planets are small and far from that Earth, Earth is not considered to be a planet, the moon is a planet, etc. These ideas have already been taught at primary level in “Earth & Environment”, but have not been grasped by the students. This situation thus informs us about prior knowledge of learners as well as their predisposition to grasp and understand additional concepts in their curriculum.

Response of students to the PowerPoint Presentation

During the interview, students said that normally they use chart paper, wax crayons, scissors, glue, soap and posters that teachers make or ask students to make. They do not even get access to Biology, Chemistry or Physics labs. In only one of the ten schools, students stated that they had been to the labs on few occasions and they liked so much the activities and demonstrations performed. Before the presentation, the objectives and content of the lesson were read and explained so that students know what to expect in the presentation. Students were very enthusiastic as the lesson unfolded through the slides and so on. They asked what is “etoile filante” i.e., a shooting star etc. All questions were answered by the researchers and educators.

Use of low cost 3D model of our solar system

Along with the PowerPoint presentation, students were shown a low cost 3D model (figure 2) of our solar system, how the planets are arranged around the Sun, their relative distances and sizes were exposed. Students could interact with the model and rotate the planets about a central axis. Some students expressed that they would create a model, given that easily available materials have been used (Waldron, 1998; Cyparsade, 2006; Wardle, 2009). Another marking point in the explanation was the Kreol version of the mnemonic, that is used to recall the positions of planets from the Sun. They were initially given the English version but it did not attract much attention.

**My Very Energetic Mother Just Served Us Noodles
Mercury Venus Earth Mars Jupiter Saturn Uranus Neptune**

The Kreol version that the researcher has devised is:

Mo Voisine Envie Met Juste So Uniforme Nef

Which means:

My neighbour wishes to wear only her new uniform

This sentence is actually related very much to school life of youngsters.

When this sentence was given on the slide, most students took notebooks to write it. In fact, during the following session, most students could recall the names of the planets in the correct order starting from the sun. Another hint was given: the last 3 planets' names start with the letters S - U - N related to the word Sun. This would also help students to recall the planets in the correct order from the sun. It should be noted that the intention was not to make learners rote learn, but to use the sentences and tips as support till the concepts are understood, the sentence is not needed.



Figure 2: low cost 3D model of Solar System

Post-test

The first post-test was conducted through the same worksheet used for pre-test. It was planned to verify how far the researchers' and educators' interventions had made the students grasp the basics of astronomy. It was very surprising to see that these students could not answer simple questions on what was taught. The first post-test was intentionally structured textually so that it may be established whether reading poses a difficulty for these pre-vocational students. Students could barely read and decipher the questions and write answers to these simple questions. To be able to assess the understanding of science content by these learners, without going through the difficulties of English language, a second post-test was devised.

Second post-test

Only large diagrams related to the topics studied were provided in the worksheets. Students were expected to discuss in groups and then answer the questions set by labelling the diagrams and adding a few words to describe what is being observed. The second post-test gave a clue to the difficulties of the pre-vocational learners. It may be that if the assessments are conducted orally and in Kreol, most students would pass in science tests. In the NCF 2009, it has been proposed to assess students using innovative strategies such as through projects, making of artefacts, presentations and also oral tests involving Kreol.

Educators' views on the use of Kreol, role play and ICT

Educators' views were also collected through interviews, they commended the remarkable enthusiasm of students when these innovations were brought to their classrooms. They are all for the use of Kreol, role play and ICT, as long as meaningful learning takes place. They mentioned that they have benefitted from the in-house training on the use of role play, ICT and Kreol in their lessons (Bender, 2005) and that further training and initiatives are needed.

Students' views on the use of Kreol, role play and ICT

Students' views were collected through a focus group discussion, after the two working sessions and after filling in the two worksheets in the post-test. It was found that students are very much interested with the content of 'basic astronomy' as it is directly related to their everyday life. In fact the learners got so much involved in the discussions and they also asked very pertinent questions. Students expressed that innovations brought to them have been beneficial as they can now understand many things which

were difficult before. They are also of the opinion that use of Kreol is very important for understanding of ideas in everyday life.

CONCLUSION

Through the methodology employed, resources prepared and the strategies deployed by the researchers and educators, it has been established that role play coupled with ICT usage can indeed stimulate the learning of basic science/astronomy by pre-vocational learners. This is also made more accessible to learners through the use of the mother tongue which thus further engages learners in meaningful interactions. Both the educators and the learners engaged in the activities which they found meaningful and appropriate. Prominent constraints included shyness of learners, language barriers and indiscipline, but these issues were counteracted by creating an appealing learning environment through innovations, that are suitable for low ability learners. So we can say that ICT, role play and the use of Kreol are very appropriate for the teaching and learning of basic astronomy by pre-vocational learners.

Limitations of the study

The sample was limited to ten educators and so it is difficult for us to say whether the influence of role play, ICT and Kreol language would significantly inform the teaching and learning of science. Only ten educators benefitted from this in-house training in Mauritius. It would have been very conclusive if a larger sample were used. This could include further research in the use of Kreol, role play and ICT in other topics in science, across different levels of the pre-vocational sector. The data analysis is only qualitative in nature, and it was not the intention to analyse the marks in detail. A longer term research would substantially inform the other dimensions of the study and theory as well as researchers and practitioners in the area.

RECOMMENDATIONS

The use of L1 is a must during activities as there is already a learning barrier which is the content. At least one barrier (language) can be removed or alleviated for appropriate learning to take place in science. Resources used should be innovative to attract and maintain the attention of these low ability students. Lots of interactions should be envisaged, ample questions should be asked and learners should be encouraged to ask questions to clarify any doubt they have in mind. Another aspect to bear in mind with pre-vocational learners is the assessment could be partly in Kreol to help learners. It is recommended to use tools such as oral tests,

demonstration of learning by drawing, labeling diagrams, oral explanations of phenomena and even problem solving by drawings, sketches, annotated diagrams, project works and oral presentations, without much language pressure. This study was driven by teacher educators, however, educators too should be able to engage in classroom research and share their good practices (Agarkar, 2005).

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