



Bay of Bengal Large Marine Ecosystem Project



Feasibility study - The methods and approaches to implementing a SEREAD teacher training programme in BOBLME countries

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Feasibility study - The methods and approaches to implementing a SEREAD teacher training programme in BOBLME countries

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in support of the Intergovernmental Oceanographic Commission of UNESCO

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Acronyms used

BOBLME	Bay of Bengal Large Marine Ecosystem
IIOE	International Indian Ocean Expedition
IOC	Intergovernmental Oceanographic Commission
IOGOOS	Indian Ocean Global Ocean Observing System
NOAA	National Oceanic and Atmospheric Administration
PPO	Perth Programme Office
SEREAD	Scientific Educational Resources and Experience Associated with the Deployment of Argo profiling floats in the South Pacific Ocean
SPC	Secretariat for the Pacific Community
UNESCO	United Nations Organization for Education, Science and Culture

1. Introduction

The BOBLME Project is working with Bangladesh, India, Indonesia, Malaysia, Maldives, Myanmar, Sri Lanka and Thailand to lay the foundations for a coordinated programme of action designed to better the lives of the coastal populations through improved regional management of the Bay of Bengal environment and its fisheries. Incorporated in this vision is the BOBLME Project's objective to undertake capacity development activities which will improve social and economic wellbeing through education and information. In particular the BOBLME Strategic Action Plan refers to supporting activities that seek to empower coastal people to participate in and benefit from sustainable development practices.

The building of knowledge and awareness in climate change amongst teachers and their school children is an important component of sustainable development in many BOBLME countries. The Perth Programme Office (PPO), in support of the Intergovernmental Oceanographic Commission (IOC) of UNESCO, has been supporting a teacher training programme in the Southwest Pacific developed under the Argo program¹ and termed SEREAD (Scientific Educational Resources and Experience Associated with the Deployment of Argo profiling floats in the South Pacific Ocean). SEREAD teaches basic scientific ocean/climate fundamentals to teachers in a hands-on approach that uses existing examples, relevant to the country that the training is being undertaken in, that build upon student's everyday observations and experiences. Through training teachers, the program aims to excite students and inspire them to study and understand the physical world around them and includes introductions to oceanographic, weather and climate change concepts.

The PPO met with the staff from the BOBLME Project at the annual Indian Ocean Global Ocean Observing System Regional Alliance (IOGOOS) meetings in Phuket, Thailand in October 2014 to discuss a number of opportunities for collaboration in support of BOBLME Project objectives. The second International Indian Ocean Expedition (IIOE-2) provided the background for these discussions, in particular opportunities for BOBLME countries to become active participants and recipients of the new science generated out of the proposed science collaborations and research that will be conducted under IIOE-2. The SEREAD concept was discussed at these meetings and subsequently the BOBLME Project contracted the PPO to undertake a desk top assessment into this program and how it could be implemented in BOBLME country schools.

2. Objectives

The objective of this project is to undertake a desk-top feasibility study which explores opportunities to adapt the SEREAD program to BOBLME country schools, in particular identifying the key steps required to develop such a program during BOBLME Phase 2.

The overarching outcome from this assessment will be an improved understanding of the merits and methods of adapting the SEREAD program to BOBLME countries and how this could be undertaken and over what timeframe.

¹ Argo is a global array of autonomous profiling floats that measure the temperature and salinity of the upper 2000m of the ocean.

3. Approach

The feasibility study consisted of a desk-top assessment into the SEREAD program, including discussions with key international SEREAD science education consultants and SEREAD project manager's and reviewing of SEREAD educational materials, to identify and document an approach to adapt the SEREAD program to the BOBLME region such that it could be implemented, potentially through a pilot project, in one or several BOBLME countries.

4. Background to SEREAD and current program activities

SEREAD was developed as a hands-on educational program and resource for Pacific Island schools to provide regionally relevant information related to teaching ocean climate science (i.e. the oceans role in the climate system) in both primary and secondary schools. It includes utilising real-time/real-world oceanographic data (via Argo floats) as a means to support student learning of the physical world around them.

The program has the following objectives:

- Provide a teaching resource on climate change that complements the current teaching curriculum and demonstrates the value of scientific knowledge through realistic and locally relevant applications
- Teach students the fundamental measurements that describe the physical state of the ocean (temperature, salinity, ocean current) and the exchanges between the ocean and the atmosphere of heat and water
- Develop teaching resources that use data gathered by the Argo program, thereby helping teachers and students understand how scientists use data
- Facilitate the interactions between scientists, students and teachers

SEREAD activities are currently overseen by a steering committee, including experts from inside and outside of the Pacific Islands region (SPREP², PPO, Scripps Research Institute, NIWA³ and SEREAD educational consultants), many of whom also provide the financial resources to facilitate training activities. Training is undertaken by a team of SEREAD educational consultants, who have also been responsible for developing the teaching resource materials. Some of these consultants have been engaged separately to adapt SEREAD content for other educational purposes in the region (i.e. SPC picture-based resources, see description and link in latter section of the report) and outside (i.e. Mauritius).

SEREAD implementation generally consists of the SEREAD educational consultants developing a partnership agreement with national Ministries of Education, conducting in-country teacher training workshops with teachers from local schools and then often returning 6-8 months later to meet again with trained teachers to further develop or adapt teaching approaches. The benefit of focusing primarily upon the development of teachers skills under SEREAD is increased longevity/sustainability of educational outcomes. Individual teachers can incorporate SEREAD material into their curriculum year after year, thereby introducing these lessons to a new range of students each year.

The teacher training is based around a series of SEREAD resources, which provide the scientific background and tools to teachers to enable them to incorporate climate science into their curriculum. The resource material is tailored to the country that the training is being undertaken in, and therefore directly relevant to that countries circumstances. The first resources developed for SEREAD consisted of hard-copy text:

² Secretariat of the Pacific Regional Environment Programme

³ National Institute of Water and Atmospheric Research, New Zealand

- 'What is Weather' – the science of weather for junior primary students. Inc. teachers notes, worksheets and student worksheets.
- 'What is Climate' – the science of climate for upper primary students. Inc. teachers notes, worksheets and student worksheets
- 'Oceans rising' – the science of climate change for junior secondary students. Inc. teachers notes, worksheets and student worksheets
- Teaching and learning strategies – A booklet of literacy and experiential activities

See **Appendix I** for links to these texts. More recently, some additional resources have been developed for on-line use. These include teaching modules covering subjects such as:

- Ocean acidification
- Argo and climate change
- Argo floats
- Oceans and currents
- Salinity
- Temperature

Each module is made available on-line on the 'Blendspace' website and contains a number of resources to assist teachers, i.e. video's, reports, website links and teaching exercises. It provides an interactive environment between the in-country teachers and the SEREAD consultants enabling on-going communication on the outcomes of class lessons and modification to improve learning outcomes. Screen shots of the SEREAD Blendspace are provided in **Appendix II**.

To date, SEREAD training has been conducted in the Island States of the Southwest Pacific (Cook Islands, Samoa, Tonga, Fiji, Tuvalu and Kiribati) and a modified program has been undertaken in Mauritius in the Indian Ocean. It is an on-going program and each year the SEREAD steering committee discusses opportunities for implementation and prioritises proposed training activities.

The PPO has a history of supporting SEREAD activities in the Southwest Pacific Ocean and is therefore most familiar with this program. It is however just one example of a climate change related educational program for school children. There are numerous others that have been developed around the world. NOAA for example has extensive on-line resources available for teachers from K-12 via their educational resources website (http://www.education.noaa.gov/Climate/Climate_Change_Impacts.html), the Secretariat for the Pacific Community (SPC) has also developed a series of country specific picture based education resource for students, teachers and facilitators in the Southwest Pacific (<http://www.spc.int/cc-project/>) and UNESCO has a dedicated program related to improving education on climate change around the globe (<http://www.unesco.org/new/en/education/themes/leading-the-international-agenda/education-for-sustainable-development/climate-change-education/>).

5. Discussion and next steps

The recently adopted IIOE-2 program by the IOC's 147 Member States provides an important platform and spring-board for the expansion of SEREAD into the Indian Ocean. IIOE-2 will result in an increased focus on improving the observational infrastructure in the Indian Ocean and associated scientific understanding of how the Indian Ocean influences the climate of the region. This evolution of new scientific understanding through IIOE-2 will provide a vibrant background for students to understand the real-world relevancy of ocean observations and climate science studies. There are opportunities therefore for the new data to be integrated into new teaching modules relevant to the different countries around the Bay of Bengal. Students could also follow and connect with scientists undertaking research in their region. IIOE-2 is likely to focus the scientific world's attention on the Indian Ocean and ensuring this focus translates down to school children will be an important objective of IIOE-2.

The BOBLME Project provides an ideal sub-regional focus for implementing SEREAD. The BOBLME Project has successfully developed strong partnerships with all countries surrounding the Bay of Bengal under the objective of improving regional management of this important shared environment/resource. The networks already established by the BOBLME Project would therefore provide a spring-board for the introduction of SEREAD and also facilitate opportunities for funds to be identified to successfully implement it. The goal of undertaking SEREAD in the BOBLME region would be to 'generate substantial, knowledge, awareness and discussion amongst BOBLME country students, teachers and communities of the global ocean observing systems, climate change, sea level rise, global warming and local impacts'.

In order for SEREAD to be implemented in the Indian Ocean, the program would need to be modified to be relevant and appropriate for the Indian Ocean. The following points outline a number of tasks that would need to be completed in order for a pilot SEREAD training program to be developed and subsequently rolled out in the BOBLME region. They are broadly listed in chronological order.

1. Identification of a suitable country/region within the BOBLME region for SEREAD to be piloted. A number of factors need to be considered in making this decision:
 - Obtaining high level support. The countries'/region's Ministries of Education need to be consulted and their acceptance for SEREAD to be linked to their curriculum and included in their teaching programs agreed upon. Without the agreement of the relevant Ministries of Education and support of senior officials, the pilot project will not succeed. Gaining this support may take some time and will require the close involvement of in-country champion(s) to assist in all liaison and negotiations very early on. Strategies to alleviate hurdles, such as any change in key personnel, would also need to be developed.
 - The scale of the pilot project. Consideration of whether the pilot program would be rolled out across an entire country (i.e. India) or only in a province/region within that country would need to be determined. Issues of scale would also need to include discussing the likelihood of transferring the pilot project to surrounding regions/countries. For example the Maldives could be an ideal pilot location given its size and the project could be rolled out across the entire country initially, however the regional climatology and educational system may be significantly different to other BOBLME countries and therefore any future SEREAD program may not be as readily transferable to another BOBLME country.
 - The country(s) most in need of this type of program. Which BOBLME countries do not undertake climatology and climate change related education at primary and/or secondary levels and therefore would benefit from a SEREAD type program.

- IT networks/infrastructure. While not critical, teachers that have good on-line/internet access would be better able to maintain communication with the SEREAD educational consultants after initial in-country training has been undertaken. SEREAD is developing a number of on-line resource tools and exercises to expand the reach of the program. Utilisation of this style of teaching/learning has proven successful and allows for the program and activities to be developed and expanded over time without the need for additional in-country intensive training.
2. Determine the target audience. SEREAD has been successfully implemented in both primary and secondary schools in the southwest Pacific, however the pilot should/could be tailored to just one of these. Modifications to the primary school resource materials may be more readily achievable as secondary educational curriculum are often more closely tied to tertiary qualification requirements and it therefore may be more difficult to modify the SEREAD material to meet these needs in the first instance.
 3. Establishment of core team. One of the earliest steps following the identification of the likely country(s) where SEREAD would be piloted (including having obtained the in-principle support of their Ministries of Education) would be a workshop of key personnel engaged in the pilot project. The key personnel and their overarching roles on the project would include:
 - SEREAD education consultants/developers. To advise on the methodology and approach for rolling out SEREAD and to train in-country educators in the conducting of teacher training;
 - Climate scientists. To provide expertise and understanding of the relevant climate systems in the region and to modify resource materials appropriately;
 - In-country educators. To translate resource materials into local languages and to help in conducting training;
 - In-country project champion. To act as primary liaison between the SEREAD education consultants, project managers and the relevant Ministries of Education and the schools involved in the pilot project;
 - Project managers – PPO staff. To work with all project team members to facilitate the successful roll-out of the SEREAD pilot project and to report on progress and outcomes to the project sponsors.
 - Project sponsors – BOBLME Project staff. To provide financial resources to implement the pilot project and to liaise with country officials to facilitate the smooth implementation of the project.

The workshop would determine the project timeline, tasks and reporting requirements amongst all team members.

4. Modify the resource materials. While the core scientific principles and teaching methodologies are already developed through the current range of SEREAD resource materials, any proposal to implement SEREAD in the Indian Ocean would require some modifications. As an example, the weather and climate system (i.e. monsoons) are very different in the Indian Ocean in comparison to the Pacific Ocean and scientific input by meteorologists/climatologists expert in the region would be required to modify the scientific text associated with these factors. A further consideration when modifying this text would be the proposed areas within the BOBLME Region where the program is proposed to be rolled-out. The climate in the Maldives for example is very different to the climate in Indonesia or Thailand. In this context, it may be possible to develop and tailor the content of SEREAD to a group of countries that have similar climates (i.e. Bangladesh and India;

Indonesia and Malaysia). Developing the text such that it is suitable for a group of countries would extend the life of the resource material beyond the pilot phase.

5. Formation of strong partnerships. These are important on a number of levels:
 - Any program will need the core support of SEREAD education consultant(s) with experience in the implementation of SEREAD in other countries. Their role is critical in the provision of training to in-country educators and for ongoing support to facilitate their teaching of SEREAD modules to students, as well as an advocate for the program as a whole. They would be required to work closely with in-country educators to:
 - i. Use scientific data to enhance science education about climate change
 - ii. Model teaching strategies to enhance student understanding
 - iii. Provide Ministries and teachers with resources – books and CDs
 - iv. Co-construct and co-facilitate the programme with in-country educators, Ministry personnel and teachers
 - v. Provide ongoing mentoring to in-country educators
 - Strong partnerships between scientists/climate change experts and in-country educators who would roll-out the training is also critically important. There would be frequent communication between the scientists and the educators throughout the tailoring of the SEREAD resource materials (likely to take several months) and throughout the pilot. The educators would be required to translate the science into the local language and would therefore need to have a sound scientific background themselves. It is also important that the correct links between the SEREAD training and the school curriculum are clear and integrated into the development of the resources.
 - The IOGOOS network of scientists and government officials will be important as this organisation/entity has connections to a large number of marine science institutions and experts throughout the BOBLME region. They could be important advocates and in-country champions for the pilot program, as well as being able to identify experts suitable to assist in the revision and review of training materials. IOGOOS is also a co-sponsor of IIOE-2 and therefore could facilitate links between scientists undertaking research activities and the use of gathered data in educational exercises under SEREAD.
 - UNESCO offices within the region, including IOC. Provision of linkages to other UNESCO capacity building activities occurring throughout the region, as well as educational contacts within countries that may be able to assist.

On this basis, an ideal scenario to undertake the SEREAD pilot program in a country/region would be as follows:

- All Ministerial/Government approvals obtained and agreements with individual schools where the program will be rolled-out established.
- Training materials modified to country/regional requirements.
- SEREAD educational consultants and in-country education assistants run in-depth training sessions over 3-5 days with primary trainees (i.e. Ministry staff or teachers from recipient schools). Over the course of the 3-5 days, the workshops and practicals of SEREAD are taught to the trainees and approaches to integrate these into school lessons are developed.
- Trainees return to Government agencies/schools and begin to teach SEREAD components to students.

- On-line interaction and support with SEREAD education consultants and in-country educators provided remotely through web-based 'Blendspace' format or similar. Enables posting and linking to websites, videos, additional resource materials etc. For example new teaching modules can be posted and teacher trainees assigned a regular set of tasks against which they report progress back to the SEREAD educational consultants who can provide quick feedback and advice on how to continue.
- Follow-up visit by SEREAD education consultants and in-country educators 6-8 months after initial training sessions to reconnect with trainees rolling-out SEREAD and to address any issues/modify training modules or approaches as required. Opportunity to make new connections with regional/country schools following on from the experience gained in rolling-out of the program to date.

One alternative approach could include the SEREAD educational consultants only training the in-country education assistants at the third dot point listed above - 'train the trainers' scenario. This would likely be 1-2 individuals, with a scientific background and capacity to be trained in English, but who can then translate and subsequently train the relevant country/region's Ministry staff or country teachers directly in their native language. This scenario may be more practical in circumstances where English is a substantial language barrier to the effective rolling-out of training to numerous individuals.

An estimated timeframe to complete the pilot project in a BOBLME country/region would be 2-3 years, depending on the time required to secure the agreement of the relevant Ministries of Education for the program to be an accepted part of the school curriculum. The estimated costs of adapting and implementing SEREAD in the BOBLME region have not been calculated as part of this study.

6. Conclusions

This desk-top feasibility study has confirmed that the BOBLME Region provides an ideal setting for the SEREAD teacher training program to be modified and piloted in the Indian Ocean, initially within one country, but with future opportunity to expand to other countries around the Bay of Bengal. International scientific interest in the Indian Ocean, as focussed through IIOE-2 over the period 2015-2020, also provides an ideal timeframe for a pilot project to be commenced. However, it is recommended that further detailed discussions with relevant stakeholders are required to fully explore a number of primary constraints to implementation, namely:

- The views of Ministries of Education around the Bay of Bengal as to whether they would support the implementation of a SEREAD program in their schools;
- The availability of in-country educators and in-country advocates to support the rolling-out of SEREAD training and
- A suitable funding source which would be sufficient to roll out the pilot project, with opportunity for further funding to be obtained for other subsequent training activities.

If these constraints are resolved, SEREAD teacher training has the potential to substantially improve the knowledge, awareness and interaction of students, teachers and communities around the Bay of Bengal in ocean climate science, including how climate change may impact these communities and how everybody has an important role to play in mitigating future impacts

Appendix I SEREAD resource materials

Embedded reports are two documents, which comprise the complete set of SEREAD resource materials:

Water, Weather & Climate Change: A Teaching Resource for Schools Teaching Climate Change



SEREAD_
Waterweathe

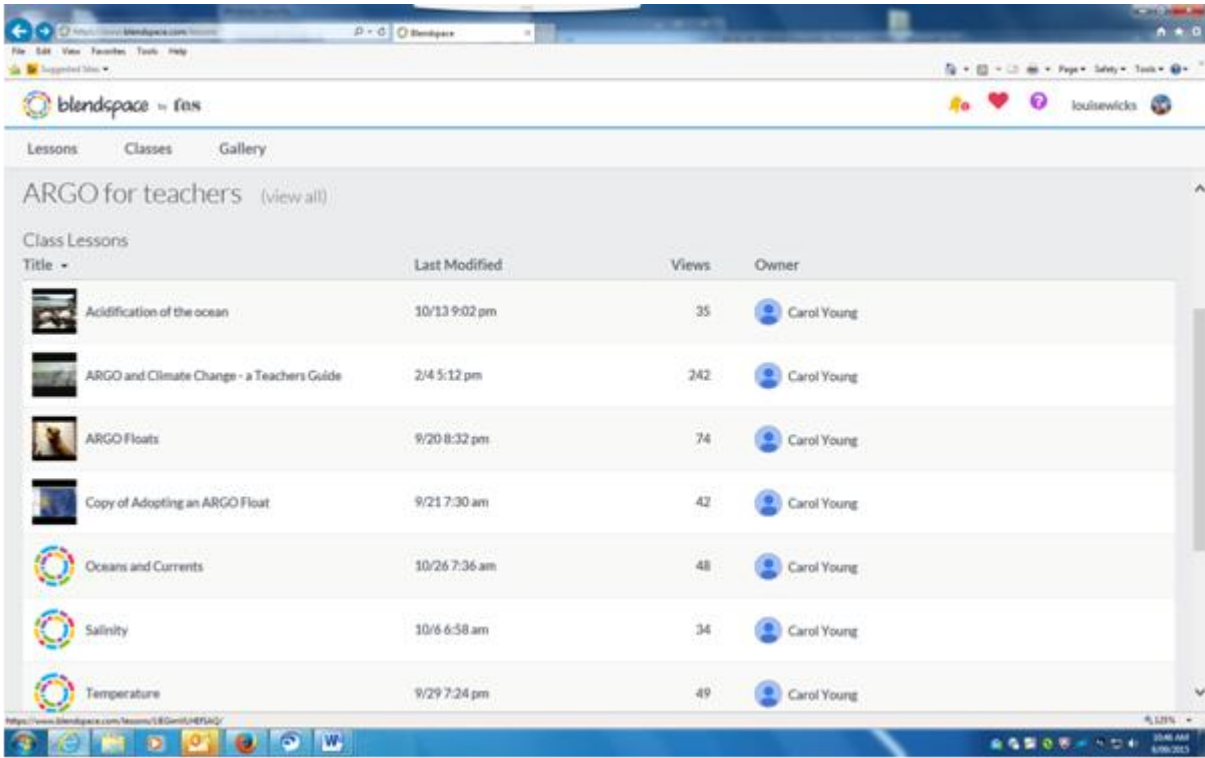
Teaching and Learning Strategies: Teaching Resources for Years 7-12 Children



SEREAD
Teaching and

Appendix II Example of on-line SEREAD resources – Blendspace

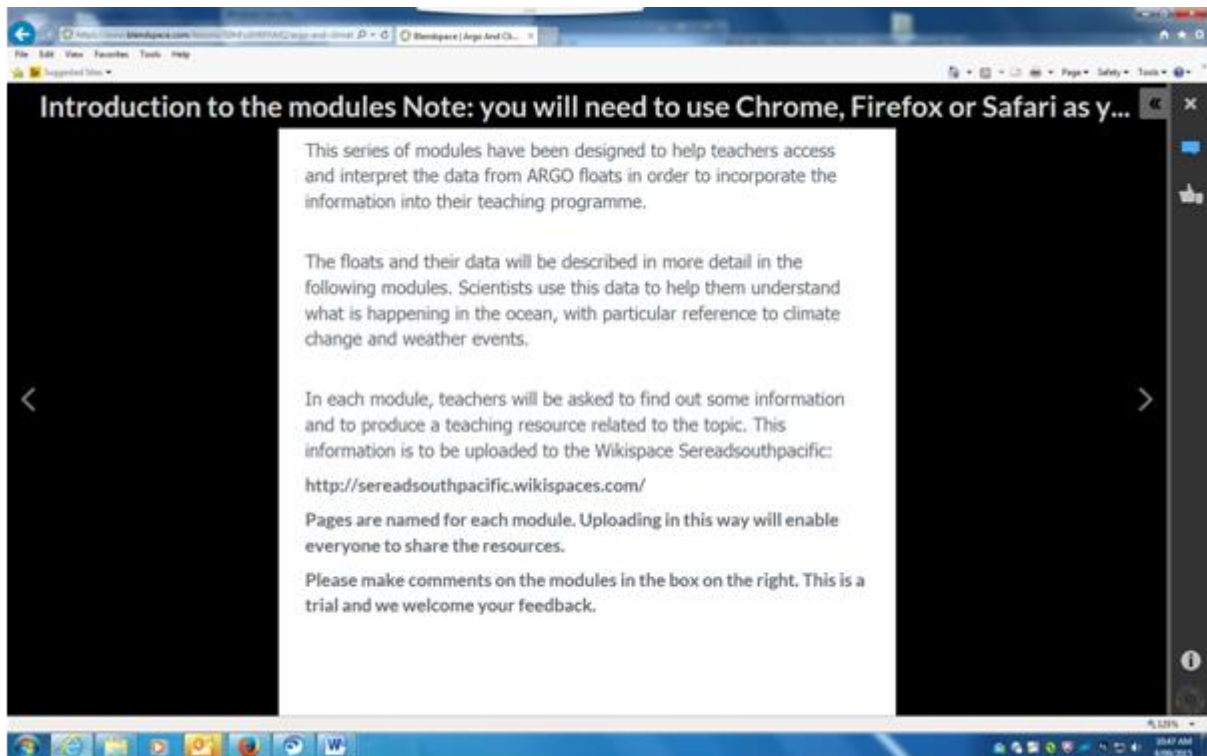
1. The Argo for teachers Blendspace 'home page'. Contains links to all class lessons/modules



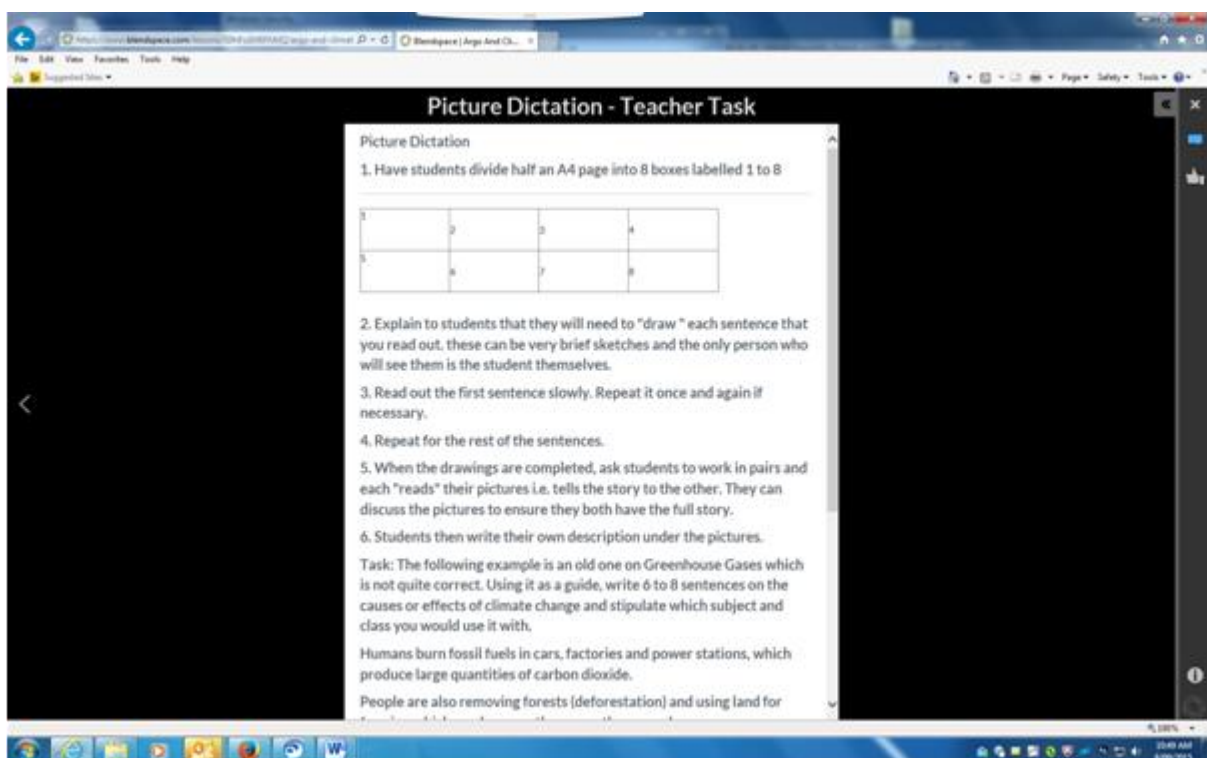
2. The contents of the Argo and climate change – A Teachers Guide module. This includes video's and teachers guides on how to teach this topic



3. View of one of the pages in the module which provides instructions to teachers



4. A further page in the module which provides details of a class exercise that teachers can undertake with their students





Bangladesh, India, Indonesia, Malaysia, Maldives, Myanmar, Sri Lanka and Thailand are working together through the Bay of Bengal Large Marine Ecosystem (BOBLME) Project to lay the foundations for a coordinated programme of action designed to better the lives of the coastal populations through improved regional management of the Bay of Bengal environment and its fisheries.

The Food and Agriculture Organization (FAO) is the implementing agency for the BOBLME Project.

The Project is funded principally by the Global Environment Facility (GEF), Norway, the Swedish International Development Cooperation Agency, the FAO, and the National Oceanic and Atmospheric Administration of the USA.

For more information, please visit www.boblme.org



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