Content Analysis of Youth Scientific Programme: An Innovative and Integrated Approach For Sustainable Development Among SEAMEO Member Countries

Sarmiento, C., Wahyudi, Cheah Ui Hock and Ng Khar Thoe
R & D SEAMEO-RECSAM, Penang Malaysia
Email: chona@recsam.edu.my

Key words*:*
Content Analysis; Regional Congress in Science education; Young Scientist; Regional Center for Expertise (RCE)

Abstract

The "Search for Young Scientist" (SSYS) Congress as a Youth Programme highlights the innovative and integrated approach of RECSAM as a Regional Center for Expertise (RCE) in Science and Mathematics Education. The scientific projects done by the youth features ESD dynamics on public awareness, education and training to acquire understanding about sustainability, development of knowledge, skills, perspectives and values needed by the youth in making decisions to improve quality of life. The paper also discusses some limitations on the data and the methodology applied to the analysis.

This paper presents two areas of interest. Firstly, it is to analyse the nature of the young scientist projects to showcase transformative science education for sustainable development. Secondly, a content analysis was done on the project documents using the multi-dimentional methods including Library Information Search (LIS) on the secondary documents from the past Congress. The analysis was grounded on the three pillars for Sustainable Development (ESD), a framework to evaluate SSYS in the last ten years.

1. INTRODUCTION

The Search for SEAMEO Young Scientist (SSYS) is a ten year on-going program in SEAMEO RECSAM which was first initiated in 1997. Since its inception this youth programme at the Regional level has continued and is held every two years with a specific theme. It is considered as RECSAM's visionary programme for youths from Southeast Asian countries to enhance RECSAM's visibility as a Regional Center of Expertise (RCE) in science and mathematics education as articulated in its vision.

The SSYS activity is highlighted by scientific exhibitions displaying experimental set-ups which are followed by individual project presentations during the Congress. The programme plays a vital role to inspire youths involvement in the development of investigatory projects spurring their interest towards careers in science and engineering and harnessing their potential to do research for scientific advancements.

The science projects also serves as the platform for the youths to apply their scientific knowledge, create possible solutions to problems, mitigate control measures, generate low cost technology, including interventions on some

environmental concerns for the benefit of communities and society at large. The Congress had also increased young learners awareness to be proactive to take part in scientific explorations at their capability levels.

The early guidelines on the nature of the investigatory projects, presentations, and judging criteria in accordance to the Congress themes were provided in advance to each participating country by the Conference Coordinator. The data gathered from archives, provided a backdrop to evaluate the SSYS on its decade of implementation. Furthermore, this study emerged from these two research questions:

1. What are the nature, types of experiments and scientific engagement youths make to be proactive in the SSYS programmes?

2. Has the SSYS themes over the decade relate to sustainable development on youths involvement to provide solution, generate low cost technology and applications of scientific approach at their capacity levels?

From the UN's Declaration for the Decade of Education for Sustainable Development (DESD 2005-2014), this endeavour particularly on the youths involvement will serve first, to further recommend future areas to be exploited as opportunities for directions, trends, challenges to support and guide the advancement of the youth development profession. Second, to explore new domains of partnership that provides a repository for knowledge areas needed to address the needs of youth from an Asean perspectives for regional collaboration and partnership in youth development.

2. Overview of the Youths Role and the Theme on Sustainable Development

Youths have roles in sustainable development for they are the future citizens and can be part of the solution. Young people can develop the skills, knowledge and attitudes that enable them an take an active role in society. Indeed the concept of taking a social role is an important part of development. Young people can become central actors around the issues that directly affect their lives. This means that young people can be a force for community development. Development in this broad context needs to be first laden initially at a community based level because people in communities essentially know what and why it is needed. Regional cooperation among youths are eventually born from community–based developments. The community-based development acknowledges that people have solutions to their own problems when sustainable programmes evolve out of experiences of ordinary people and their perceptions of what problems should be addressed. Young people can develop the skills and knowledge to work as partners with adults in their community to determine critical issues and responses to solving community problems.

The youth activities, services and learning approaches have become

popular in the world for the development of youth in this decade for sustainable education. Research has clearly shown evidence on the value of youths services and activities in many communities. A study done in US on 47,000 youths from 6th to 12th grades revealed that those who were engaged in these activities an hour or more were less likely to engage in high-risk behaviors (Benson, 1993). Development theorist have found that experiences during adolescence help shape lifelong learning values, suggesting that early service results in long-terms payoffs (Conrad & Hedlin, 1986).

The goals of involving youth in development is to teach and change young people to define and articulate concerns of interest to them; and to design, negotiate and implement solutions to those concerns. The challenge to involve young people in development is to create the opportunities, experiences and settings in which they develop the knowledge and skills to be catalyst for change.

Youth comprise nearly 30 percent of the world's population (UN, 2004). The involvement of today's youth in the environment, development, decision-making and in the implementation of programmes is critical to the long–term success of Agenda 21. The UNCED Agenda 21 in Rio de Janiero, 1992 called for:

> "Advancing the role of youth and actively involving them in the protection of the environment and the promotion of economic and social development".(UNCED,1992)

Its basis for action has called on youths from all parts of the world to participate actively at all relevant levels of decision-making processes because it affects their lives today and has implications for their future. In addition to their intellectual contribution and their ability to mobilize support, the youth bring unique perspectives need to be taken into account.

The numerous actions and recommendations within the international community have been proposed to ensure that youth are provided a secure and healthy future, including an environment of quality, improved standards of living and access to education and training. These issues need to be addressed in development planning.

3. MULTIDIMENTIONAL CONTENT ANALYSIS

To answer our research questions a number of methods were employed on both quantitative and qualitative data acquired. The data consisted of the SSYS Final Reports analyzed using secondary analysis approach, the Project Reports while other documents used content analysis and LIS Method (Jarvelin and Vakkari, 1990). Although researches using LIS discipline lack testing methods, the combination of various approaches were done to ensure that the analyses were exhaustive on all the archived documents gathered.

3.1 Methods

On the tenth year of the SSYS implementation, all secondary data related to the SSYS were archived and collected. These included documents of 11 participating countries including New Zealand which participated in 2002 and

2004 respectively. The secondary documents gathered from archives, consisted the SSYS Programme Books, the SSYS Final Reports, and the Experimental Project transcripts submitted to the exhibition. The extent of the document analysis was critical to establish the categories for analysis and minimize weakness in the use of various approaches.

3. 2 Analysis and Aggregation for Content Analysis

The analysis and aggregation phase included:

1. Building a document inventory taxonomy based on identified variables
2. Determining the structure and context of each project work
3. Looking for opportunities to share constructs or abstractions across designs and explorations
4. Examining the field of study or discipline, nature of the experiment, research design, samples and application of the technology, control or production measures.

The data gathering phase involves the engagement and inventory of all documents to be established in the analysis. Secondary analysis was done on the qualitative data cited by Hammersley, (1997); Hinds, Vogel, & Clarke Steffen (1997); Sandelowski, (1997); Szabo & Strang (1997); Thorne, (1990) together with the (LIS) approach adapting the scheme devised by Jarvelin & Vakkari (1990, 1993). The data were further categorized for document inventory which was further refined into various variables. Each project representing a country entry were treated as document type with specific definition associated on the particulars of each project report. Qualitative analysis is a technique used to analyse data other than the use of numbers. The analysis involved coding or creating categories for classifications outlined by Szabo and Strang (1999); Popay, Rogers & Williams, (1998); Sommer and Sommer (1997); Corti, Foster & Thompson, (1995); Corti & Thompson,(1998).

.

4. THE SSYS PROGRAM: I997- 2006

The analysis on the SSYS documents consisted of two main parts. The first part analysed the trends on the distribution of participants gender, the SSYS scientific projects according to various categories, namely research design, samples used, nature of experimental projects, and the area of study or discipline to answer research question 1. The second part of the evaluation was done on the content analysis to answer research question 2. Moreover, the discussion on the evaluation of the scientific reports from the individual project were analysed based on the three pillars of sustainable development.

4.1 The SSYS Youth Participants

The SSYS youth participants were secondary or pre-university students in the 15-19 aged-group taking science subjects in their respective countries. The students engaging on these science special projects were closely supervised by their science teachers and endorsed by their respective Ministry of Education to

represent their country in the SSYS congress. The participants gender are presented in Table 4.1.

Table 4.1 *SSYS Participants Gender (n= 135)*

Actual no. of Participants 1997- 2006

	Frequency	Percent
Males	**65**	**48.14 %**
Females	**46**	**34.07 %**
Not identified	**24**	**17.79 %**
Total	**135**	**100 %**

Table 4.1 shows the distribution of SSYS young scientists taking part in the congress. To determine the participants gender, the programme books were collected to draw out the names of the total participants as delegates to every SSYS conference. Identifying the gender was a difficult task since most registered name collected from archives were not gender specific for other Southeast Asian names.

Concerted efforts were made to identify the participants gender from the list of names reviewed. In cases that gender could not be determined, assumptions were done on gender specific names, associating the names with the "appropriate gender". However, there were instances that the assumption did not apply, since other names are not gender specific for Thailand, Lao's, Cambodia, Indonesia, and Myanmar. Identification was not done specifically due to the lack of sensitivity to culture specific knowledge.

It could just be assumed that the participants for the SSYS were predominantly boys with the limitations of identifying other gender from the list of names. More boys (48.14 %) were represented from the data as revealed in Table 1.

4.2 Total Number of Experimental Projects

The distribution on the number of projects contributed by each country across ten years of the SSYS program is presented in Table 4.2. and shows the figures on the average number of each country projects illustrating two trends. Firstly, starting from 13 projects in 1997 the number has increased to 21 in 2006 with the participation of two countries Myanmar and New Zealand. Secondly, the three countries Malaysia, Singapore and Philippines did more than two project entries in the series of SSYS congress. These three countries with initiatives to do more than two projects each congress provided a considerable increase in the total number of experimental projects within the decade.

Table 4. 2 . *Number of Projects Generated over Ten years (n=86)*

SSYS	Number of Country Participating 1997	1999	2002	2004	2006		
Countries	**9**	**7**	**9**	**11**	**10**	**Total**	
Brunei Darussalam	1	1	2	1	1	6	7 %
Cambodia	1	1	0	1	2	5	6 %
Indonesia	1	1	2	2	2	8	9 %
LAO-PDR	1	0	2	0	1	4	5 %
Malaysia	2	2	2	4	5	15	17 %
Myanmar	*	*	1	1	1	3	3 %
Philippines	2	3	2	2	3	12	14 %
Singapore	2	4	4	3	4	17	20%
Thailand	2	2	1	1	1	7	8 %
Vietnam	1	0	0	2	1	4	5 %
New Zealand	*	*	2	2	0	4	5 %
Total	**12**	**14**	**18**	**20**	**21**	**85**	**100%**

***** not member yet

It can be observed that Singapore had contributed the highest number of projects with (20%), followed by Malaysia, as the host country with (17%) and Philippines with (14%). Indonesia contributed (9%) of the projects, consistently with two entries since Year 2002 onwards. On the other hand, Thailand contributed (8%) likewise started submitting more than one entry per congress however were not consistent over the decade. Myanmar had the least contribution at (3%) attributed to joining the congress only in Year 2000. The other countries with also least number of projects was due to their inconsistency to join the congress bi-annually.

4.3 The SSYS Bi-Annual Themes/ Title of Projects

The SSYS themes within the ten years of implementation have consistently uphold the theme on Education for Sustainable Development for the last two consecutive years. The past themes for each bi-annual congress are presented in Table 4.3.

Table 4.3 *SSYS Bi-Annual Themes*

Period	Year	Theme
Year 1	**1997**	Conserving the Environment Through Youth Science Research
Year 2	1999	Technology For Us
Year 3	2002	Creating Intelligent Cities for the Harmonious Societies of the New Millennium
Year 4	2004	Towards a Sustainable Future
Year 5	2006	Sustainable Development For a Better World

In general, the experiments were analysed according to the three pillars for sustainable development:

Socio-Cultural Implications. 7.05 % of the experiments conducted by the youth were related to control measures for community intervention. Others

include generation of low costs technology from locally available materials. It also showcased experiments involving use of local flora to eradicate pest, future vaccines from animals, and how to sustain biological methods of pest control. Other projects were water loss regulation of local plants, active components of plants and animals as potential inhibitors and prospects for agricultural productivity in their respective community. Many of the control-measure experiments shows concerns considered as indirect youth services to help low income families in communities to cope economically. Its socio-cultural implications relates to the traditional practices of the community defined by the youth projects through the application of scientific approaches. Youths concerns over their community's agricultural practices build ties between them and their community families and communities relies on agriculture as way of life.

Environment Protection. The youths are often reported to take part in activities that support community improvement. These activities were presented in experimental projects benefiting the community they live. The (50%) experimental projects included cleaning rubbish, as well as protection of areas by converting waste to ecologically viable substances which are worthy efforts in sustaining environment resources seen at stake. In some cases the experiments included provision of framework for maintaining traffic flow, preservation of forest, conversion of waste and effluents into plant fertilizers. These demonstrated youths concern over environmental hazards and the nature of degradation in the environment common to Asian community in the suburbs.

Environmental improvement, resource management and utilization are popular activities done by the youths to draw concern. One experiment demonstrated adopting a mechanism for traffic control and congestion minimizing pollution using computer simulation, recycling, reforestation, drain stenciling, wildlife habitat and preservation, and environmental education which are common community activities related to youth.

Economic Prospects. The majority of the projects were geared towards technology generation (27.05%) and design of equipments (15.29%) with economic implications for further refinement. These projects appear to be an indirect–service in terms of design facilitating low cost production from locally available materials to help the low income wage earners in the community. Another category of the projects relates to advocacy involving use of common indigenous materials however the experiments needs more refinement. Considerable efforts at this level showed that the youths provided values for their communities to benefit on this experiments from their projects. Many of this projects shows economic prospects contributing to their community economies in terms of monetary savings as well as opportunities for technology commercialization.

Overall, the 86 science projects revealed relevant implications addressing the three pillars for sustainable development in terms of socio-cultural aspects, economic prospects and environmental protection. These perspectives take into account the youths intellectual contribution and their ability to mobilize support to

bring unique perspectives that needs to be taken account. The (50%) of the studies presented control measures on prevailing situations to their community; (7.05%) on production of materials for economic gains; (15.29%) were machine designs for further enhancement and (27.05%) on generation of technology with further recommendations for improvement.

4.4 The Field of Study

Table 4.4 presents the data of various experiments done in different areas of discipline throughout the 10 Year SSYS congress.

Table 4 .4 *Field of Study*

Areas of	10th Year of Implementation						
Study	**1997**	**1999**	**2002**	**2004**	**2006**	**Total**	**%**
Forestry	*	1	*	*	1	2	2 %
Microbiology	*	2	1	2	4	9	10 %
Biotechnology	2	7	5	7	6	27	31%
Biodiversity	*	*	*	*	1	1	1%
Environmental	4	*	2	1	2	9	10 %
Chemistry	*	2	4	1	3	10	12 %
Biology	5	2	3	7	2	20	23 %
Physics	1	*	2	1	1	5	6 %
Others	*	*	1	1	1	3	3 %
Total	13	14	18	20	21	86	100%

Table 4.4 suggests a wide variety of subject areas that were explored by the youths. From the initial launching, there were only four areas of discipline covered, however one discipline was added towards the second year of implementation. This same table also suggest that the disciplinary focus has expanded over time. Towards the sixth year of the congress, the top three areas of disciplines included more studies on biotechnology (31%), biological sciences (23%) and the environment (10%). The experiments done on environment promotes primary environmental care that address the basic needs from their community level advocating integrated management of resources. A general growth (12%) could also be observed in chemical experiments. The studies in chemistry reflected analysis of plant active crude extracts used locally as insecticides, plant active constituents, and test for heavy metals. The studies in Forestry (2%) and Biodiversity (1%) where the least areas explored possibly because its nature requires longer time with many factors to be considered for a short study.

4.5 Classification of Research Projects/ Country

The conducted experiments were further analysed into either applied and basic research experiments. These results are presented in Table 4.5. The categorization of experiments classified as “applied researches” included studies involving designs to solve *practical problems* rather than acquisition of

knowledge to improve *conditions*. The typical studies done by the youths on these areas were in agricultural production, resource management or control of specific problem as well as increasing and improving energy efficiency and consumptions. On the other hand, the criteria to categorise "basic researches" were also considered as (*fundamental* or *pure*) as a research interest to a scientific question. The main motivation is to expand knowledge, which is not to create or invent something.

Table 4. 5 . *Classification of Research Projects*

	Nature of Research			
Country	**Basic**	**Applied**	Total	Percent
Brunei Darussalam	2	5	7	8 %
Cambodia	5	*	5	6 %
Indonesia	5	3	8	9 %
LAO-PDR	4	*	4	5 %
Malaysia	9	6	15	17 %
Myanmar	3	*	3	3 %
Philippines	*	12	12	14 %
Singapore	8	9	17	8 %
Thailand	*	7	7	8 %
Vietnam	4	*	4	5 %
New Zealand	4	*	4	5 %
Total	44	42	86	100 %

On the average, the values reflected in Table 4.5 represented an almost equal number of both basic and applied researches in both domains within the last ten years of SSYS programme. Generally, those countries that had more than ten entries were more likely doing applied researches in various disciplines.

4.6 Nature of the Project Samples

The data comparing at least six sample types were used by the youths in their experiments. The distribution of the samples used across the ten year SSYS programme is shown in Table 4.6

Table 4. 6 *The Project Samples*

Projects	10th Year of Implementation						
Samples	**1997**	**1999**	**2002**	**2004**	**2006**	**Total**	**%**
Plants	5	3	3	4	9	24	28 %
Animals	1	*	3	1	3	8	9 %
Microorganisms/ Bacteria	*	*	*	3	2	5	6 %
Fungus	*	1	1	1	*	3	3 %
Insects	1	3	*	*	1	5	6 %
Organic Substance	6	3	11	11	6	41	48 %
Total	13	14	18	20	21	86	100%

In terms of the sample used, Table 4.6 presents more or less the likelihood

of using locally available materials or other substances (48%) and plants (28%) compared to other types as experimental samples. This data may explain that the materials are endemic to the community of the participants, and plants are inexpensive and easy to handle. The same table also revealed the higher tendency of youth to choose materials and substances commonly found in nature, followed by those preferring plants. There was an equal ration of experiments using bacteria or microorganism (6%), and insects (6%) as objects of study. The fungus (3%) was the least among all types of samples used in the experiments.

4.7 Nature of Research Design

Table 4.7 lists the nature of research design employed on the experiments done by the youth in the 10 Year SSYS congress. The same table indicates that a higher percentage of the experiments (45%) were done through observational and intervention studies. An almost equal proportion of research design between (7%-8%) employed both cross sectional and longitudinal designs. This probably explains that the preferred designs demonstrate less engagement time and initial studies to be established prior to the selected problem. Moreover, about (37%) of the experiments were conducted under laboratory conditions or using field trials. The majority of the conducted experiments were done in the laboratory on microbial assay and plant extraction.

Table 4. 7 Projects Research Designs

Research Design	1997	1999	2002	2004	2006	Total	%
Cross sectional Study	1	1	2	2	1	7	8 %
Longitudinal Study	1	0	1	3	3	8	9 %
Controlled/ Uncontrolled	7	4	6	7	8	32	37 %
Observation/ Intervention	4	9	9	8	9	39	45 %
Total	13	14	18	20	21	86	100 %

In this framework, the experimental designs employed however, involved smaller field, shorter time with lesser number of tested relationships. However, designs using cross sectional and longitudinal designs required more financial support and greater need for statistical analysis which is considered a higher level for a youth investigatory project.

4. CONCLUSIONS AND RECOMMENDATIONS

The total 87 experimental projects across 11 countries consistently implying the philosophical framework of three pillars for sustainable development. Given the participants developmental age and their abilities, the age group of 15-19 in particular have strong pro-tendencies and would be expected to participate in

more scientific activities to support their schools and communities and country as well .

Analysing the projects according to the three pillars for sustainable development, it is evident that (50%) of the experimental projects focused on environmental protection. All countries had projects similar to these concerns on recycling, conservation and resource management. In general (27%) of the projects were related to technology generation either using local materials, access to technology, fuel sources and supply with implications of further economic gains. The remaining (15 %) on equipment designs revealed youth abilities to create new and improve low costs technologies where such practices are sustainable. In the light of these findings, the following recommendations are given:

1. The SSYS project is a major on-going program for youths with academic excellence to design innovative projects in science. The project could be expanded to extend youth activities in a wider scale of affiliation to prospective career for training and honing of skills related to scientific endeavors.

2. An extension link should be provided in their communities from Ministries of Education as an excellent opportunity to explore the connections between issues and political process for youths to represent policy development in the future.

3. Civic clubs are natural links among youth groups, to get involved and provide opportunities for expanded community service and involvement of youths. The role of the teachers in this type of activities are crucial. Teachers can guide them to reflection and motivation to serve as important models for community leadership.

4. The role of youths selection, planning and implementing long term holistic projects in response to the need of their school and community is critical. Maximizing their participation in these nature of academic exercise can greatly increase their interest in future science and engineering courses as future scientist and technocrats in the 21st century.

5. In evaluating various types of projects, it is important that data banks are provided to consider many factors that influence the effectiveness of the program itself. The challenge is to follow up on what can be learned from the inputs of the youths to ensure their involvement in community, in education for sustainable development. Youths services and activities make a positive difference in their locality for youth leadership and to their community at large.

6.0 References

Benson, P. L. (1993). *The troubled journey: A portrait of 6th-12th Grade Youth*. Minneapolis: The Search Institute.

Conrad, D., & Hedlin, D. (1986). National assessment of Experimental Education: Summary and Implications, Experiential Education and the Schools. In R. Craft & J. Kielsmeire (Eds.). Boulder, CO: Association for Experiential Education.

Corti, L., Foster, J., & Thompson, P. (1995). *Archiving qualitative research data*. Retrieved September, 2006, from http://soc.surrey.ac.uk/sru/SRU10.html

Corti, L., & Thompson, P. (1998). Are you sitting on your qualitative data? Qualidata's mission. *International Journal of Social Science Research Methodology, 1*(1), 85-89.

Hammersley, M. (1997). Qualitative data archiving: some reflections on its prospects and problems. *Sociology, 31*(1), 131-142.

Heaton, J. (1998). Secondary analysis of qualitative data. *Social research Update, 22*.

Hinds, P. S., Vogel, R. J., & Clarke_Steffen, L. (1997). The possibilities and pitfalls of doing a secondary analysis of a qualitative data set. *Qualitative Health Research, 7*(3), 408-424.

Jarvelin, K., & Vakkari, P. (1990). Content Analysis of Research Articles in Library and Information Science. *Library Information Science Research, 12*, 395-421.

Jarvelin, K., & Vakkari, P. (1993). The evolution of library and information science. 1965-1985: A Content analysis of journal A-articles. *Information Processing and Management, 29*(1), 129-144.

Popay, J., Rogers, A., & Williams, G. (1998). Rationale and standards for the systematic review of qualitative literature in health services research. *Qualitative Health Research, 8*(3), 329-340.

Sandelowski, M. (1997). "To be of use": Enhancing the utility of qualitative research. *Nursing Outlook, 20*(2), 66-74.

Sommer, B., & Sommer, R. (Eds.). (2002). *A Practical Guide to Behavioral Research: Tolls and Techniques* (5 ed.). Oxford: Oxford University Press.

Szabo, V., & Strang, V. (1997). Secondary analysis of qualitative data: Advances in nursing science. *Methods of Clinical Inquiry, 20*(2), 66-74.

Thorne, S. (1990). Secondary analysis in qualitative research: Issues and implications. In J. M. Morse (Ed.), *Critical Issues in Qualitative Research Methods*. London: Sage.

United Nations Report. 1992. Conference proceedings on Environment and Development. Rio de Janiero. Chapter 25.