

**Biology Education in the Context of HIV/AIDS:  
A Step Towards Education for Sustainable Development (ESD)**  
*Pendidikan Biologi dalam Konteks HIV/AIDS: Satu Usaha Pendidikan  
ke arah Pembangunan Lestari*

Ong Eng Tek

Biology Department, Faculty of Science and Technology,  
Universiti Pendidikan Sultan Idris  
engtek@upsi.edu.my

**Abstract**

This paper describes the HIV/AIDS Preventive Education that was implemented in September 2009 amongst 56 Semester-5 student teachers at Universiti Pendidikan Sultan Idris (UPSI). The main purpose of this project is to build capacity in terms of HIV/AIDS knowledge among secondary school student teachers with the hope that, not only would they be aware and able to take the necessary steps to reduce HIV infection, but also to multiply the effect when they serve as trained science teachers. Given the purpose and the exploratory nature of this research project, a mixed-methodology design was employed: one-group pretest-posttest design which involved a single group that was pretested, exposed to the HIV/AIDS Preventive Education that judiciously appropriated the principled Five-Phase Constructivist Model (i.e., orientation, elicitation of ideas, restructuring of ideas, application of ideas, and review phases) with embedment of Jigsaw-II in the idea-restructuring phase, and post-tested; and this was triangulated by qualitative responses from the student teachers. The analysis of the quantitative dataset using the t-test for paired samples indicated that the post-test mean score (17.04) was statistically significantly higher ( $t = 5.02$ ,  $p < .001$ ) than the pre-test mean score (15.84), and that the effect size obtained was +0.66, which is educationally significant. Two further analyses, namely by group (i.e., because the same intervention was applied to two different groups) and by gender, supported that this result was truly the outcome of intervention (treatment) effect instead of any disguised effect. The discussion and open responses from the student teachers gathered during orientation and review phases were qualitatively analysed through a recursive process, resulting in the identification of three overarching key themes in terms of what the student teachers have learnt about HIV/AIDS which they did not know prior to the intervention: differences between HIV and AIDS, modes of HIV transmission, and HIV status by look.

**Keywords** Education for Sustainable Development, HIV (Human Immunodeficiency Virus), AIDS (Acquired Immunodeficiency Syndrome (AIDS)), Preventive Education, Five-Phase Constructivist Teaching Model, Jigsaw-II, Biology Education

## **Abstrak**

Kertas ini menghuraikan Pendidikan Pencegahan HIV/AIDS yang dilaksanakan pada September 2009 dalam kalangan 56 orang guru pelatih Semester 5 di Universiti Pendidikan Sultan Idris (UPSI). Kajian ini bertujuan untuk membina kapasiti dari segi pengetahuan HIV/AIDS dalam kalangan guru pelatih dengan harapan bukan sahaja mereka sedar dan berkeupayaan untuk mengambil langkah yang sewajar bagi mengurangkan jangkitan HIV, malah dapat menggandakan kesan sedemikian apabila berkhidmat sebagai seorang guru pelatih. Berdasarkan tujuan dan sifat eksploratori kajian ini, maka satu reka bentuk campuran digunakan: kaedah pra-ujian pasca-ujian satu kumpulan di mana satu kumpulan ditadbirkan pra-ujian, didedahkan kepada intervensi (rawatan) Pendidikan Pencegahan HIV/AIDS yang menggunakan Model Pengajaran Konstruktivis Lima Fasa (iaitu, Fasa Orientasi, Pencetusan Idea, Penstrukturan Semula Idea, Aplikasi, dan Pengimbasan) dengan penerapan kaedah Jigsaw-II semasa Fasa Penstrukturan Semula Idea, dan akhirnya ditadbirkan pasca-ujian; dan ini ditriangulasikan oleh respon kualitatif daripada guru pelatih. Penganalisisan data kuantitatif menggunakan ujian t untuk sampel berpasangan menunjukkan bahawa skor min pasca-ujian (17.04) adalah lebih tinggi dan signifikan secara statistik ( $t = 5.02$ ,  $p < .001$ ) berbanding dengan skor min pra-ujian (15.84) manakala saiz kesan +0.66 yang diperoleh adalah signifikan secara amalan. Dua analisis tambahan, iaitu berdasarkan perbandingan kumpulan (memandangkan dua kumpulan intervensi yang terlibat) dan berdasarkan perbandingan jantina, menyokong bahawa dapatan kajian ini merupakan hasil daripada kesan intervensi (rawatan) dan bukannya sebarang kesan yang terselindung. Perbincangan secara lisan dan respon terbuka bertulis daripada guru pelatih dalam Fasa Orientasi dan Fasa Pengimbasan dianalisis secara kualitatif melalui proses penelitian secara mengulang dan ini menghasilkan tiga tema utama dari segi apa yang guru pelatih telah pelajari mengenai HIV/AIDS yang mereka tidak tahu sebelum intervensi: perbezaan di antara HIV and AIDS, mod transmisi HIV, dan status HIV melalui pengamatan.

**Kata Kunci** Pendidikan ke arah Pembangunan Lestari, HIV, AIDS, Pendidikan Pencegahan, Model Pengajaran Konstruktivis Lima Fasa, Jigsaw-II, Pendidikan Biologi

## **Background**

Sustainable development was first propelled into prominence with the publication of Bruntland Commission's report, entitled "Our Common Future" (World Commission on Environment and Development, 1987: 43) which defines sustainable development as "development that meets the needs of the present without compromising [or, impairing] the ability of future generations to meet their own needs [or, to enjoy similar, if not better, quality of life and opportunity as ours]".

Sustainable development was further globalised in 1992 at Earth Summit, Rio de Janeiro, where 179 governments acknowledged the tension between human development aspirations and the so-called 'carrying capacity' of the environment, and this led to the formulation and enactment (endorsement) of key principles of sustainable development as documented in "Rio Declaration on Environment and Development" (UNCED, 1992).

For example, Principle 1 dictates that “Human beings are at the centre for concern for sustainable development” while Principles 3 and 4 insist that the “right to development must be fulfilled” and that “environment protection shall constitute an integral part of the development process” (UNCED, 1992: 9), privileging development over environment. The educational implications for sustainable development, meanwhile, are delineated in “Agenda 21: Programme of Action for Sustainable Development” whereby education should conflate environmental and development education so as to ensure the integration of “cross-cutting issues” across disciplines using a combination of innovative and traditional pedagogies (UNCED, 1992: 264-265).

The commitments made at Earth Summit in Rio de Janeiro in 1992 were reaffirmed by world leaders at the September 2004 World Summit on Sustainable Development in Johannesburg. A “Decade of Education for Sustainable Development (DESD)” was proposed, subsequently adopted by the UN General Assembly in its December 2004 session (UNESCO, 2004), and formally launched in March 2005, designating UNESCO as the lead agency for the promotion of DESD (2005-2014).

Sustainable development is generally perceived as an overlapping of dimensions (or components), namely environment, (cultural and) society, and economy (UNESCO, 2005). These three dimensions are thought to operate, metaphorically, as three overlapping same-sized circles with the overlapping area being perceived as the human well-being. The more aligned the three dimensions are, the higher the area of overlapping which, in turn, translates to higher levels of human well-being. The corollary that stems from this metaphorical perception on sustainable development is that a balanced, harmonious, symbiotically interdependent, and aligned consideration of environmental, societal and economic dimensions is needed in our pursuit of development and enhanced quality of life. In short, everyone’s quality of life will improve by reconciling economic growth, social development and environmental protection.

Therefore, Education for Sustainable Development (ESD) is perceived as an adaptive process where education is used as a tool to achieve sustainable development (McKeown, 2002). In essence, the key themes in ESD include sustainable production and consumption, fresh water management, biodiversity, conservation and protection, health promotion, human rights, peace and international understanding, importance of Information and Communication Technology (ICT) for ESD, gender equality, and poverty alleviation.

In relation to health promotion, statistics as of 2007 indicate that there were 33.2 million people living with the Human Immunodeficiency Virus (HIV) and more than 25 million people have already died of HIV and AIDS – Acquired Immunodeficiency Syndrome (UNAIDS, 2006, 2007). In Malaysia, with an average of 15 new cases reported daily, there have been 85,000 people being infected with the disease thus far and 315 have died from AIDS (Salina, 2009).

Accordingly, ensuring healthy present and future generation has been considered as an important aspect of health promotion, which subsumes under a bigger umbrella of Education for Sustainable Development (ESD). While HIV/AIDS preventive education is included in the social and cultural dimension of ESD, it has cascading effect on the economic dimension in terms of human resource and workforce. Hence, the crucial need in providing HIV preventive education to the current youths so that they are aware and be able to take

the necessary steps to reduce HIV infection. Teachers play an important role in educating the youths. In the case of Malaysia, while sex education had been denied as a school subject due to religious and cultural reasons, the Malaysian Ministry of Education has advocated that sex education, officially repackaged as “Health and Reproductive Education”, should be integrated across the school curriculum. Nevertheless, how it should be done is left to the discretion of the teachers. Therefore, building the capacity of student teachers in terms of empowering them with the knowledge and pedagogical content knowledge of HIV/AIDS seems pertinent and timely.

In view of this, the undertaken research project aimed to build capacity in terms of HIV/AIDS knowledge, whilst tacitly imbue the pedagogical content knowledge among student teachers at UPSI by capitalizing on the UNESCO-produced resources, particularly the “HIV Preventive Education: Information Kit for School Teachers” (UNESCO Bangkok, 2008) and “Building knowledge about HIV and AIDS: An interactive course for educators” (UNESCO and Japanese Funds-in-Trust, undated). Therefore, the following research question emerged: To what extent does the HIV/AIDS Preventive Education build capacity in terms of HIV/AIDS knowledge among the Semester-5 student teachers in UPSI?

## **Methodology**

### ***Research Design***

This study employed a mixed-methodological design which entails comparing, integrating, and interweaving quantitative and qualitative methods. This led to a triangulation of quantitative and qualitative data which purports to provide a fuller and deeper understanding of the phenomenon at hand (Bogdan & Biklen, 2003; Denzin & Lincoln, 2000) in this case, the impact of HIV/AIDS Preventive Education. Given the exploratory nature of this research, the “one-group pre-test-post-test design” (Gay & Airasian, 2000: 389) was deemed appropriate. This design involved a single group that was pre-tested, exposed to a treatment and post-tested. While it is acknowledged that history and maturation were not controlled, the relatively short period of time (e.g., 3-hour intervention programme) would likely to ameliorate these threats to interval validity. Additionally, qualitative responses in terms of discussion and written responses were gathered so as to illuminate what have been learnt by the participants.

### ***Sampling***

The participants of this research project comprised a total of 56 Semester-5 student teachers at UPSI. These student teachers were derived from two out of five intact groups of student teachers who followed through the course on “Strategies in Teaching and Learning Science”, officially coded as TSP2023. In other words, cluster random sampling was employed because “in cluster sampling, intact groups, not individuals, are randomly selected” (Gay, Mills, & Airasian, 2009: 129). Groups 1 and 2 consisted of 25 and 31 student teachers respectively. Given that the population of Semester-5 student teachers was 146, the sample size of 56 represented 38% of the population.

### ***Instrumentation***

The pre-test and post-test inventories that were adopted from Baker (2009) are basically the same 19-item inventory that aims to gauge the extent to which student teachers possess the relevant knowledge about the basics of HIV/AIDS. For example, a group of items measure one's knowledge about the HIV transmission [i.e., if HIV can be transmitted via (1) sharing eating utensils with an HIV-infected person, (2) blood transfusion, (3) a mosquito/insect bite, (4) sharing toilets with an HIV-infected person, (5) drug injection where needles are shared, (6) sexual intercourse, (7) from a mother to a child during a child birth, (8) physical contact with an HIV-infected person] while others gauge the aspects of diagnosis, cure/treatment, and social discrimination. This inventory has sufficient validity in that every single item subsumes within the content coverage of HIV/AIDS Preventive Education. Meanwhile, the internal consistency reliability of this inventory, established by using Kuder-Richardson split half test (KR-20) with a sample of 10 university student teachers, was found to be at 0.75, indicating an acceptable level of internal reliability (i.e., the extent to which the items in the inventory are similar to one another in content) and achieving more than the minimum level of 0.7 recommended by Nunnally (1978) and De Vaus (2001).

### ***Procedure***

The 3-hour HIV/AIDS Preventive Education was conducted at UPSI on 14 September 2009 at 8-11am for Group 1 and at 2-5pm for Group 2, using the Five-Phase Constructivist Model (Needham & Hill, 1987) which essentially comprises the following five phases, namely (1) Orientation; (2) Elicitation of Ideas; (3) Restructuring of Ideas; (4) Application of Ideas; and (5) Review (or Reflection). This model was chosen because it constituted one of the science teaching models in the TSP 2023 course. Furthermore, science-based student teachers in Universiti Pendidikan Sultan Idris (UPSI) as well as the entire Teachers' Training Institutes across Malaysia are expected to be knowledgeable at, and be familiarized with, the Five-Phase Constructivist Teaching Model and subsequently, be able to demonstrate the knowledge and skills in operationalising this particular model during the 14-week teaching practice.

The specific activities (e.g., what actually transpired within the 3-hour intervention HIV/AIDS Preventive Education Programme) using the 5-Phase Constructivist Model methodology are briefly described below,

*Orientation Phase:* Facilitator showed pictures/slides of diseases associated with HIV such as *Pneumocitis Pneumonia* and *Karposi Sarcoma* to provoke interest, curiosity and communication among students.

*Elicitation Phase:* Facilitator elicited student teachers' ideas about HIV/AIDS by: (a) administering a pretest questionnaire on HIV/AIDS, (b) encouraging group discussion on the basics of HIV/AIDS and thereafter, inviting group presentation, and (c) showing eight passport-size photographs of American men and women and

student teachers were asked to guess if they can identify which of them have HIV and why.

*Restructuring Phase:* Three main activities were carried out as follows:

In Activity One, facilitator briefed the participants that all the men and women in the photographs were having HIV, although they seemingly looked normal and healthy. The main message was that it is not possible to tell one's HIV status by looking at the person.

In Activity Two, "Water Game" (Baker, 2009) was played. This aims to simulate the exponential spread of HIV through unprotected promiscuous sex.

In Activity Three, student teachers were divided into groups of 4 and Jigsaw-II method (Slavin, 1980) was employed. For resources, facilitator provided each group with (i) "HIV Preventive Education: Information Kit for School Teachers" (UNESCO Bangkok, 2008), (ii) "Building knowledge about HIV and AIDS: An interactive course for educators" (UNESCO and Japanese Funds-in-Trust, undated), and (iii) an Internet-accessed computer.

In employing the Jigsaw-II method, the following steps were taken: - (a) In their respective HOME GROUPS, students cursorily browse the 'entire' section, before concentrating on their respective areas of expertise, namely HIV; AIDS & HIV Transmission Modes; Diagnosis & Non-Transmission Modes of HIV; and Cure & Social Discrimination; (b) Students go into EXPERT GROUPS, discussing and mastering the content, using provided questions as a guide for breadth and depth of discussion; (c) Students return to their respective HOME GROUPS, taking turn to report to their team mates; and (d) Students take individual QUIZ (e.g., a post-test).

*Application Phase:* Student teachers were asked to develop a brochure/pamphlet that provides school-going students with the information regarding the HIV and AIDS are, and the way in which HIV/AIDS can be prevented.

*Review Phase:* Student teachers reflected on their newly constructed knowledge, identifying how it differs from their pre-instructional views. Example: - "What are three new things about HIV/AIDS which I didn't know before this workshop, but I now knew?"

## Results

### Quantitative Analysis

**Table 1** Results Obtained from t-Test for Paired Samples

Pretest			Posttest			t	p	$\Delta^+$
N	Mean	SD	N	Mean	SD			
56	15.84	1.83	56	17.04	1.60	5.02	.000	+0.66

As shown in Table 1, the t-test for paired samples yielded a t of 5.02 which was statistically significant ( $p < .001$ ) and a “medium” (Cohen, 1988) effect size of +0.66 that was educationally significant. The mean score obtained in the post-test (17.04) was statistically significantly higher than the mean score obtained for the pre-test (15.84). Therefore, the posttest mean score for the group of 56 student teachers shows an appreciably higher degree of knowledge in HIV/AIDS than did their pre-test mean score.

It is understandable for critics to be sceptical of the results presented on the basis of possible initial (pre-intervention) and post-intervention differences between groups and between gender which may give rise to disguised group or gender effect rather than treatment effect. As such, two further analyses are performed to dispel the suspicion and to draw a firmer conclusion.

The first analysis of which the results are shown in Table 2, aims to determine if there are any statistical differences in pre-test mean scores as well as in post-test mean scores between the two intervention groups. The result of the first analysis indicates that there is no significant difference ( $t = 0.29$ ,  $p = .77 > .05$ ) between the pre-test mean scores (Group 1 = 15.76; Group 2 = 15.90). Equally, that there is no significant difference ( $t = 0.02$ ,  $p = .99 > .05$ ) between the post-test mean scores (Group 1 = 17.04; Group 2 = 17.03).

**Table 2** Results Obtained from Independent Samples t-Test for Pre-test and Post-test by Group

	Group 1			Group 2			t	p
	N	Mean	SD	N	Mean	SD		
Pretest	25	15.76	1.69	31	15.90	1.95	0.29	.77
Posttest	25	17.04	1.86	31	17.03	1.38	0.02	.99

The second analysis of which the results are shown in Table 3, aims to determine if there are any significant differences in pre-test and post-test mean scores between the male and female student teachers. The results indicate that there are no significant differences in pre-test mean scores (Male = 15.70, Female = 15.87;  $t = 0.26$ ,  $p = .79 > .05$ ) and in post-test mean scores (Male = 17.50, Female = 16.93;  $t = 1.02$ ,  $p = .31 > .05$ ).

**Table 3** Results Obtained from Independent Samples t-Test for Pre-test and Post-test by Gender

	Group 1			Group 2			t	p
	N	Mean	SD	N	Mean	SD		
Pretest	10	15.70	1.64	46	15.87	1.88	0.26	.79
Posttest	10	17.50	1.43	46	16.93	1.62	1.02	.31

Therefore, these two further analyses (i.e., the first and second analyses) confirmed the earlier finding that the 56 student teachers from the two intervention groups have acquired a markedly higher level of knowledge in HIV/AIDS as the results of the HIV/AIDS Preventive Education Programme, and this is not due to any disguised pre- or post-intervention group or gender effect.

**Qualitative Analysis**

When the student teachers were asked to write down what they now knew which they did not know prior to the HIV/AIDS Preventive Education, the analyses indicated the emergence of the following three themes:-

*Modes of Transmission:*

Many student teachers were ignorant of the ways in which HIV was transmitted. While they were generally aware that HIV was transmitted via unprotected sex, many were not aware that HIV could also be transmitted through exchanges of blood and blood products, and through parent-to-child. This intervention programme has, undoubtedly, “opened their eyes” as indicated by the following direct quotes in which ST denotes student teacher while the number corresponds to the number assigned to each student teacher:

*Before the lesson, I didn't know that HIV can be transmitted via breast milk.*  
 (ST40)

*Before this, I thought mosquito is one of the causes that transmitted the virus. Now I know that mosquito/insect bite does not transmit the HIV virus.*  
 (ST55)

*Now I know that sharing eating utensils with someone who is HIV+ cannot transmit the virus.*  
 (ST38)

*But now I know that I won't be infected if I share my eating utensils with HIV/AIDS people.*  
 (ST28)



*At first, I thought HIV can be transmitted via blood only, but it seems to me now that HIV can also be transmitted via other bodily fluid.*

(ST27)

*Differences between HIV and AIDS:*

Although the scientific facts show that HIV is a virus which basically attacks and destroys the immune system in human beings and that a person is considered to have AIDS when s/he begins developing opportunistic infections such as *Pneumocitis Pneumonia*, *Karposi Sarcoma*, and *Tuberculosis*, due to weakened immune system, many students had the misconception that HIV and AIDS were the same thing/concept prior to the intervention programme. This is supported by the following open-ended responses from the student teachers:-

*Before the lesson, I thought HIV and AIDS are the same. Now I can distinguish between HIV and AIDS.*

(ST33)

*Before this, I thought HIV is a disease, but now, I know that it (HIV) is a virus and not a disease. This virus will cause the AIDS disease.*

(ST30)

*HIV Status by Look:*

Many student teachers verbalised in the class discussion that, prior to the HIV/AIDS Preventive Education, they could spot or identify an HIV-infected person without much difficulty just by his/her “skinny” and/or “flirtatious” look. In short, the student teachers have a stereotypical and/or biased mind-set of an HIV-infected person. However, after the programme, they now knew that such a status could not be determined by a person’s look.

*Now I know that we cannot notice the HIV-infected person by looking at the person.*

(ST52)

There are two additional points worth mentioning. Firstly, the samples of the student teachers’ work indicate that they were able to design interesting and captivating educational pamphlets for HIV/AIDS awareness and preventive programmes. Secondly, it is also gratifying to note from the student teachers’ self-rating that while only 34 (60.7%) of the 56 student teachers were willing to teach with other teachers living with HIV (Item 7) before the HIV/AIDS Preventive Education Programme, the number has increased to 45 (80.4%) at the end of the Programme. This suggests that the HIV/AIDS Preventive Education Programme does not only increase student teachers’ knowledge in HIV/AIDS, but it has also impacted positively on their affective domain in terms of their world-views of working side-by-side with other colleagues with HIV.

## **Conclusion, discussion and implications**

Despite the limitations in sampling and intervention duration, the HIV/AIDS Preventive Education has positively and significantly impacted on the cognitive (i.e., in terms of knowledge gained on HIV/AIDS) and affective (i.e., in terms of student teachers' acceptability of, and willingness to work alongside HIV-infected colleagues) domains of the 56 Semester-Five student teachers at the Faculty of Science and Technology, UPSI. This may be attributed to the combined use of the Five-Phase Constructivist Model (Needham & Hill, 1987) and Jigsaw-II (Slavin, 1980). However, a literature search failed to locate any previous studies on HIV/AIDS Preventive Education that employ such pedagogical approach with which these findings could be directly compared. Hence, this explains the novelty and distinctiveness of this research project in terms of using HIV/AIDS as the context for simulating the combined used of Five-Phase Constructivist Model and Jigsaw-II in science teacher education.

The findings of this study were derived from semester-5 student teachers at the Faculty of Science and Technology, UPSI and there was no comparison group involved, hence its limited generalisability. Further studies investigating similar impact of HIV/AIDS Preventive Education using a comparison group and a more representative sample at the University are recommended in order to examine the validity of such generalization.

While the materials (i.e., pamphlets and brochures) generated by the student teachers seem to be interesting, informative and educationally relevant, these have yet to be tested and validated with students to determine their effectiveness and for further adoption/adaptation by other school teachers. As such, it is strongly recommended that these materials could be tested, validated and refined. Additionally, upon the completion of this HIV/AIDS Preventive Education, student teachers should be assigned to develop lesson ideas on HIV/AIDS, or HIV/AIDS-infused science lesson ideas suitable for secondary students that are based on principled instruction which could then be tested, validated, refined, and compiled. This will not only ensure a better grounded pedagogical competence among the student teachers in terms of classroom practice, but it will also extend the science teaching resources. Meanwhile, similar HIV/AIDS Preventive Education programme could also be extended beyond student teachers, to school students in the quest to address Sustainable Development, particularly in the area of health promotion.

Finally, the helpful publications by the UNESCO which were thoughtfully used in this research project should be extensively capitalised, widely disseminated, and locally adapted. In the case of teacher education at UPSI, the ways in which HIV/AIDS Preventive Education could be judiciously infused into the teacher curriculum, should be given due consideration as part of reorienting teacher education to address sustainability.

## **Acknowledgement**

I would like to put on record, my sincerest appreciation to the UNESCO Bangkok for providing me with the research grant [Contract No.: FC09-070 (SAP.3240217699)]. Equally, I would like to express my gratitude to the student teachers who followed through

the education course on “Strategies for Teaching and Learning Science” (officially coded as TSP 2023) during the Semester 1 of the Academic Year 2009/2010 and were involved in the research project. Their cooperativeness had made this research possible.

## References

- Baker, S. (2009). *A HIV/AIDS Training of Trainers Manual*. Thailand: UNESCO Bangkok.
- Bogdan, R.C. & Biklen, S.K. (2003). *Qualitative research in education: An introductory to theory and methods*. Boston: Pearson Education Group, Inc.
- Colburn, A. (2007). The prepared practitioner. *The Science Teacher*, 74(7), 10.
- De Vaus, D.A. (2001). *Surveys in social research*. Fourth Edition. London: Routledge.
- Denzin, N.K., & Lincoln, Y.S. (2000). *Handbook of qualitative research*. Second Edition. Thousand Oaks, California: Sage Publications, Inc.
- Gay, L.R., Mills, G.E., & Airasian, P. (2009). *Educational research: Competencies for analysis and applications*. Ninth Edition. New Jersey: Pearson Education International.
- Gay, L.R., & Airasian, P. (2000). *Educational research*. Sixth Edition. Ohio: Prentice Hall.
- McKeown, R. (2002). *Education for Sustainable Development Toolkit*. Knoxville, Tennessee: University of Tennessee. [Retrieved January 08, 2010, from <http://www.esdtoolkit.org>]
- Needham, R., & Hill, P. (1987). *Children's Learning in Science Project: Teaching strategies for developing understanding in science*. Leeds: Centre for Studies in Science and Mathematics Education, University of Leeds.
- Nunnally, J. O. (1978). *Psychometric theory*. New York: McGraw Hill.
- Salina, Khalid. (2009). More women getting HIV. *The Sunday Star*, 29 November.
- Slavin, R.E. (1980). *Using student team learning*. Baltimore: John Hopkins Team Learning Project.
- UNAIDS. (2006). *Report on the Global AIDS Epidemics: A UNAIDS 10th Anniversary Special Edition*. Geneva: UNAIDS.
- UNAIDS/WHO. (2007). *2007 AIDS Epidemic Update*. Geneva: UNAIDS
- United Nations Conference on the Environment and Development, (UNCED). (1992). Agenda 21. New York: United Nations Department of Public Information.
- UNESCO. (2004). *United Nations Decade of Education for Sustainable Development 2005-2014: Draft international implementation scheme*. Paris: UNESCO.
- UNESCO.(2005). Draft International Implementation Strategy for the DESD. (Retrieved August 10, 2006, from the World Wide Web: <http://unesdoc.unesco.org/images/0014/001403/140372e.pdf>)
- UNESCO Bangkok. (2008). *HIV Preventive Education: Information Kit for School Teachers*. Thailand: UNESCO Bangkok.
- UNESCO & Japanese Funds-in-Trust. (undated). *Building knowledge about HIV and AIDS: An interactive course for educators*. Paris: UNESCO.
- World Commission on Environment and Development. (1987). *Our Common Future*. Oxford: Oxford University Press.