# Environmental Education through Documentaries: Assessing Learning Outcomes of a General Environmental Studies Course

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**ABSTRACT**

The use of film as supplementary materials in the classroom has become common for higher education teachers of environmental studies. It is, however, rare that film is incorporated as the primary instructional medium. This paper reports a case study on a documentary film-based environmental studies course which sought to engage students in exploring and reflecting on a wide range of locally significant environment issues. While film is the focus of the course, post-film reflective discussion is an integral part in order to help students identify and clarity their thoughts and ideas. A pre and post survey and post-instruction interviews were carried out with two cohorts of university students for the purpose of evaluating this course. The results suggest that, using documentaries to repeatedly expose students to real issues, the course proved to be beneficial to developing students' perspective-taking and critical thinking abilities and sense of relevance, which collectively leads to a more pro-environmental disposition.

**Keywords:** case study, documentary films, environmental education, higher education, course evaluation

## INTRODUCTION

Documentary films are one way of telling stories about environmental problems. They represent these real problems, involving real people rather than professional actors (Godmilow & Shapiro, 1997), and can be powerful in demanding a deeper empathy from the audience. With visual, audial, and narrative experiences, documentaries show a great potential to reach and influence a wide range of people regarding environmental issues (Bahk, 2010). One example is the renowned 2006 documentary "An Inconvenient Truth" that features former US vice-president Al Gore's longstanding commitment to raise public awareness of global warming. Despite much controversy as to whether the science presented in the film is accurate (e.g., Nielsen-Gammon, 2007), it has contributed to informing citizens of the catastrophic effects of greenhouse gases on the environment, and been adopted worldwide by educators for use in their classrooms.

More recently, provoked by a locally produced aerial documentary "Beyond Beauty: Taiwan from above" (2013), Taiwan has experienced an unprecedented level of public discussion and emotion about local and national environmental problems. This film depicts Taiwan landscape completely in aerial photography, and by doing so provides powerful *visual evidence* to those problems that had been known to environmental experts and the public. With minimum narration, this documentary is evidence that visual images are a powerful way to communicate the importance of current environmental concerns.

Several studies have investigated the role of documentaries in different disciplines such as social policy (Shdaimah, 2009), economics (Leet & Houser, 2003), and history (D'sa, 2005). More recently, environmental educators and scholars also began to study the effectiveness of documentaries on achieving desired learning outcomes. Focusing on the documentary "An inconvenient truth," Nolan's (2010) evaluation study showed that after watching the film, participants exhibited more knowledge and concern for global warming. In addition, an increase in their willingness to reduce greenhouse gases through behavioural change was observed, although only

**Contribution of this paper to the literature**

- The present study contributes to fill an existing research gap by looking into an environmental studies course where students were repeatedly exposed to locally significant environmental issues through documentary films.
- This case study was conducted using mixed methods with two cohorts of students, and provided insights into the impact of documentary film-based teaching practice on student learning outcomes and perceived experiences.
- This study is also relevant to science education because environmental issues tend to have bases rooted in science, and issue-based instruction has become important in science education for engaging students in scientific practice and for helping them find links between science and society.

a few participants reported actual actions after a one-month period. Barbas, Paraskevopoulos and Stamou (2009) conducted a study to investigate the contribution of nature documentaries to the environmental sensitivity of students in the context of their simple introduction to teaching (without the teacher's interventions and the students' preparation), and found that students who have watched a nature documentary on insects developed more positive emotional reactions to them compared to students who have not. Another study by Bahk (2010) found that after watching a narrative film (portrayals of environmental issues in dramatized stories), college students grew more favourable attitudes towards the forest preservation than those who watched an unrelated movie. In Reid's study (2012), it is found that participants learned substantially through the reception of a drama-documentary (a combination of factual and fictional content), which explores uses of human cloning in stem cell research, although they did not necessarily develop more positive attitudes toward the topic.

The above studies suggested a great potential of adopting and utilising documentaries in environmental teaching and learning to promote students' knowledge, attitudes, and behavioural disposition. However, these studies are limited by highly specific conditions, such as focusing on a single film or comparing two types of films. The investigated effects are generally immediate and short-term, and by isolating films as an intervention component, it is not clear whether and how students' learning experience and outcome can be further enriched within an educational programme. Moreover, although films, including documentaries, have been widely used by higher education teachers as a source of information and as a teaching tool to support students in learning about the environment and environmental problems, they are primarily included as supplementary materials to the textbook instruction. It is rare that film is used as major instructional materials within an environmental education program to teach about various environmental issues. To the best of our knowledge, no research has explicitly examined classroom practices where documentaries are incorporated as primary instructional medium in combination with lecture, interactivity, and reinforcement that might provide an optimal mix of inputs to generate desired learning outcomes and experiences. By introducing a semester-long course involving showing a series of environmental documentaries, we assume that the study can help explicate long-term effects of films on relevant attitudes and perspectives of the participating students.

## THE PRESENT RESEARCH

In this study, we examined a general environmental studies course, where a number of environmental documentaries were selected to address locally relevant environmental issues, and formed the main topics and contents. The course was designed based on the assumption that presenting a wide range of real issues using these visual, narrative presentations, in combination with classroom lecture/discussion, may provide an optimal mix of inputs to generate the most engagement and commitment as well as generalisation of learnt knowledge and skills. We specially examined the effect of this course on students' environmental beliefs, affect and behavioural intentions. These desired outcomes represent an integral part of environmental literacy defined by North American Association for Environmental Education (NAAEE) (Hollweg et al., 2011). Furthermore, we explored students' perspectives on their learning experiences and responses to the course in order to provide more in-depth data. The use of retrospective qualitative interviews should contribute to the overall effort of understanding not only if this course works, but also by why and how it works.

## OVERVIEW OF THE COURSE AND METHODS

This study was conducted at two different universities in southern Taiwan, one of which is a private medical university (University A) consisting of approximately 7,000 students, and the other a public research university (University B) without medicine-related disciplines, having around 10,000 students. Both universities are highly reputed in the region, and each year attract students from all over the country. The two universities have developed a close relationship and partnership through a number of educational and research collaboration programmes in

the past years. This study was embedded in a teacher exchange programme, where the author and her collaborative instructor developed and taught the introductory environmental studies course, first to one class (Class A) at University A for spring semester 2014. The course was then moderately revised based on the researchers' observation and students' post-instruction feedback, and taught to another class (Class B) at University B for fall semester 2015.

*The design of the course.* The environmental studies course was developed and implemented as a liberal arts course intended for all undergraduate students. It was held two hours a week over a semester. It was designed to endorse the frequent calls in education for context-based learning, collaborative reflection and mass media such as films (Athman & Monroe, 2001; North American Association for Environmental Education, 2004a, 2004b). The emphasis of the course was on using documentary films to help students explore a range of important present-day environmental issues in the national and local context, and learn to think critically and reflectively about these issues. Central to the learning process is perspective taking – to face the multiplicity of visions and ideas, which poses a challenge, even at the university level, because it implies the need to make connections and articulate cognitive processes in real-life contexts (Duatepe-Paksu & Ubuz, 2009; Jacobi, 2005). A list of short documentary films (each 15–20 minutes long) were selected as primary instructional materials; they constituted major topics and content for the course. Each week one film that featured a particular local or national environmental issue was introduced and discussed.

Before a film was presented to the students, we introduced briefly the relevant scientific concepts and background information for the topic illustrated in the film. We also occasionally introduced clips of other short films to enhance students' conceptual understanding of the topic. After viewing the film, students were requested to reflect and respond to a worksheet by working in groups, sharing and comparing their ideas, and discussing the pros and cons before making a judgement or decision in a particular scenario. Some environmental educators have stressed the importance of involving students in reflection, thereby students learn to identify and evaluate the root causes of environmental problems, to challenge bias, to support rational decision-making, and to examine personal and other contributions to change (e.g., Fien, 1993; Sterling, 2001). Reflective practice through group discussions provided students the opportunity to exchange ideas, feelings and experiences, and learn to listen, question, and understand alternative perspectives. As a final assessment we required students to conduct a project in groups which explored a local environmental issue of their interest and to present their work in journalistic reports or short films. The student groups choosing to make short films are provided with support on basic filmmaking techniques and devices.

*Materials.* The films used in the course were selected from an on-going, award-winning TV documentary series produced by Taiwan Public Television Service (roughly equivalent to the NHK in Japan, the BBC in the UK, or PBS in the USA), which has currently more than 700 episodes. This series features exclusively contemporary social and environmental issues in Taiwan. The films used for the course are listed in **Table 1** with their related environmental topics. Several topics deal with questions regarding the impact of economic development on the management of natural resources and common spaces as well as decision-making processes. *Playing Musical Chairs* (2003), for example, highlights the process of selecting an appropriate final repository for nuclear waste in Taiwan by portraying a series of reactions after a small village along the eastern coast was allegedly shortlisted. Many villagers were initially fearful of the negative environmental impact of such development as they relied on fishing as a source of income, but the promise of jobs and educational funds started to divide the villagers into two camps. Another film, *The Shan-Yuen Coastline* (2008), looked into a controversial years-long developmental project of turning a public coastal area into a private luxury resort. This particular issue provoked public concern about privatisation, which led to a series of civic actions to investigate and to protest against the project. The more recent film, *The Lost Sea* (2014), which was shown and discussed towards the end of the course, depicted how people on a small island witnessed and perceived the disappearing of native horseshoe crabs due to an airport construction project.

**Table 1.** The selected short films and their related environmental topics for two classes

| Film (year of release) | Environmental topics | A | B |
|---|---|---|---|
| 1. *Tears of Rainforest* (2010) | Deforestation, biosystem | √ | |
| 2. *Decoding GMOs* (2011) | Biotechnology, environmental ethics | √ | √ |
| 3. *Playing Musical Chairs* (2003) | Nuclear energy and waste | √ | √ |
| 4. *A Petition for the Cows* (2012) | Animal-human relationships, animal ethics | √ | |
| 5. *The Shan-Yuen Coastline* (2008) | Land use and management | √ | |
| 6. *Toxic Plastics* (2010) | Environmental hormone or EDCs | √ | |
| 7. *A Festival of Mackerel* (2013) | Marine biodiversity, overfishing | √ | √ |
| 8. *Terminating GuoGuang* (2011) | Industrial pollution, human health and safety | √ | |
| 9. *Humans and Architecture* (2007) | Green architecture, urban environment | √ | |
| 10. *The Suffocating River* (2010) | River quality and pollution | √ | |
| 11. *After Ah-He Passed Away* (2015) | Animal-human relationships, animal ethics | | √ |
| 12. *New Lifestyle with Water Conservation* (2010) | Environmental action, water conservation | | √ |
| 13. *Another World on the Rooftop* (2008) | Environmental action, urban ecosystems | | √ |
| 14. *Non-GMO Fighter Beans* (2014) | Non-GMO movements, GMO controversies | | √ |
| 15. *The Geothermal Island* (2013) | Renewable energy, environmental futures | | √ |
| 16. *Energy for the Future* (2013) | Environmental action, renewable energy | | √ |
| 17. *The Lost Sea* (2014) | native species, biodiversity, environmental development | | √ |

*Note.* Film titles are translated from Chinese.

Several films were changed for Class B based on researchers' and students' responses to the Class A instruction in order to address more relevant and meaningful issues for the students. For example, two pollution-related topics were replaced by renewable energy and environmental action because students in the post-instruction interview specifically pointed out that they became aware of environmental quality and problems, but needed to know more about actions that can make changes. Of these two films, *Energy for the future* reported a successful renewable energy project in Germany from the bottom up. The Taiwanese film crew visited a small town in southern Germany and conveyed a story of how people there managed to produce more energy than it needs through renewable energy systems.

*Collaborative reflection.* As research has indicated the importance of explicitly provoking student reflection in the learning process, especially when specific places and issues are taught (see Stern, Powell, & Hill, 2014 for a review), we included collaborative reflective activities in the course. The focus is small group discussion for this generally gives students more opportunity to talk. After watching the film, students were asked to reflect on the issue and to complete a group-based worksheet. Some worksheets were action-oriented; for example, students were required to reflect on the meaning of a traditional festival that celebrate mackerel harvest, and to brainstorm ideas of activities that can go beyond food and entertainment and help educate people on the profound relationship between humans and the oceans. There were also worksheets that required students to discuss trade-offs and make a group-based decision; they were, for example, asked what they would do if they were the residents of the village that was chosen to be the permanent nuclear waste repository site as illustrated in the film. After small group discussion, students were asked to present their results to the whole class. The instructor participated as a moderator in this phase with the focus of encouraging students to listen and share rather than offering opinions or drawing specific conclusions.

## EVALUATION OF THE COURSE

As indicated previously, we examined the impact of this documentary film-based environmental studies course on students' environmental attitudes (EA). Data were gathered by (a) a pre and post survey using a Likert scale EA Questionnaire that measures students' beliefs, affect and behavioural intentions about the environment. We also conducted post-instruction interviews with a selective sample of students in order to understand students' perspective on their learning experiences and learning gains. The interviews were conducted 2-3 months after the instruction because the students often left the campus immediately after the semester ended.

### Participants

A total of 34 students from two universities ($n_A = 17$; $n_B = 17$) participated in the study in two different semesters. They covered a wide range of disciplines, and the gender ratio (12 female and 5 male at Class A; 5 female and 12 male at Class B) reflected respectively the university enrolments. All the participating students were informed about the purpose and design of the study, and assured that their decision to not participate in or to withdraw from the study would not in any way affect their assessment mark for the course. For Class A, all of the enrolled students agreed to participate in the study and completed the pre and post survey, whereas 19 among 25 students from

Class B participated, but two were excluded from the analysis, one due to an incomplete returned survey and the other to low attendance. Among these survey participants, four students from Class A and seven students from Class B were invited for post-instruction individual interviews. These students were deliberately chosen to reflect a range of changes based on pre and post survey.

As the course was offered as elective, it was likely to attract students who had been previously interested in the environment and environmental issues. The key differences between these two classes were the classroom disciplines, and some content details in that the course taught with Class B was a moderately revised version after teaching Class A.

## Measures

***Pre and post survey.*** The EA Questionnaire was a 5-point Likert scale (where 1 = *strongly disagree* and 5 = *strongly agree*) and consisted of 30 items divided into three constructs: beliefs (11 items), affect (9 items), and behavioural intention (10 items). This questionnaire was a modified version of EA scale used in our previous study (Liu & Lin, 2015). Items in the beliefs construct were selected from Milfont and Duckitt's (2010) Environmental Attitude Inventory for the purpose of measuring a person's general beliefs about human-environment relations, such as, whether a person believes that priority should be given to preserving nature and natural species and protecting them from human use and alteration. An example item is "The question of the environment is secondary to economic growth." The total beliefs score ranges from 11 to 55. The affect construct measures a person's emotional connectivity to the environment, that is, how emotionally invested or tied a person is to the environment or environmental issues. An example item is "I feel fairly indifferent about the statement: 'the world will be dead in 40 years if we don't' remake the environment'." The total affect score ranges from 9 to 45. The behavioural intention construct measures a person's intention to behave ecologically, that is, what a person says that he or she would be willing to do based on some sort of environmental concern. An example item is "I'd be willing to give my vote to a political candidate who stresses on environmental issues." The total behaviour score ranges from 10 to 50. The higher score on the EA Questionnaire indicates respectively a higher level of pro-environmental beliefs, environmental concern, and intention to behave pro-environmentally. Internal consistency of the questionnaire was high (Cronbach's alpha between 0.80 and 0.88 for the different constructs).

***Post-instruction interviews.*** In an attempt to provide a richer description of the quantitative changes detected by the statistical results, a selective sample of students ($n_A$ = 4, $n_B$ = 7) was recruited for post-instruction individual interviews. These students' selective demographic and score information are illustrated in Appendix I. Each participant was informed of the purpose of the interview and that they could withdraw at any time. The semi-structured protocol was adapted from Hashimoto-Martell, McNeill, and Hoffman's study (2012) and aimed to provide additional insight on students' perspectives regarding their learning experiences and the impact of the course following the interpretation of the quantitative results. Some example questions are: "What do you think you've learned or gained from the course? Has anything about the course been relevant to your daily life? Do you think taking a course like this is important? Why?" Each interview lasted between 30 and 45 minutes. The interviews were audio recorded and transcribed verbatim.

## Analyses

Several methods were used to examine pre and post survey data. A paired-samples *t*-test was conducted to compare students' EA before and after the course. In order to understand how large the difference is, if any, we used Hedges' *g*, a modification of Cohen's *d*, to measure the effect size, as it is more suitable for small samples (Hedges & Hedberg, 2007; Hedges & Olkin, 1985). In order to account for the fact that those students with high scores on the pre-course survey would have little room for increase, normalised change '*c*' (the ratio of the actual gain or loss to the maximum possible gain or loss) was calculated to further evaluate the impact of the course (Marx & Cummings, 2007). The *c* is a revised concept of Hake's (2002) fractional gain, which is frequently used in pre-post test analyses.

$$c = \begin{cases} \dfrac{Post - Pre}{Total - Pre} & \text{if } Post \geq Pre \\ \dfrac{Post - Pre}{Pre} & \text{if } Post < Pre \end{cases}$$

Each student's normalised change score and the average normalised change score in the class were computed for each of the three constructs. Finally, correlation tests were used to explore the associations among change scores.

The transcripts of student interviews were analysed by two researchers using thematic content analysis (Braun & Clarke, 2006), and we focused our analysis on students' opinions and thoughts of the course, from very general to specific topics, and on their perceived impact of the course on their attitudes toward the environment and

environmental issues. Based on case study approach, we synthesised the qualitative and quantitative data and constructed a scenario for each student.

# RESULTS

## Quantitative: The Effectiveness of the Environmental Studies Course on Students EA

Results of paired *t*-test analysis were given in **Table 2**. As a whole, the students made positive changes in their EA by participating in the course, especially in affect construct (t (33) = 3.29, p = 0.002). For class A, the difference in beliefs construct was statistically significant (*t* (16) = 2.23, *p* = 0.04), close to being significant in affect construct (*t* (16) = 2.05, *p* = 0.057) and marginally significant in behaviour construct (*t* (16) = 1.78, *p* = .095). For Class B, a significant difference was observed in affect construct (*t* (16) = 2.55, p = 0.21).

**Table 2.** Paired-samples *t*-test analysis of students' EA in pre and post surveys (*n* = 17)

|  |  | Beliefs | | Affect | | Behaviour | |
|---|---|---|---|---|---|---|---|
|  |  | Mean (SD) | *t* | Mean (SD) | *t* | Mean (SD) | *t* |
| **Class A** | Pre | 42.76 (5.73) | 2.23* | 32.88 (4.57) | 2.05 | 37.76 (4.45) | 1.78 |
| (*n* = 17) | Post | 44.65 (4.55) | (.040) | 34.65 (5.24) | (.057) | 39.41 (4.92) | (.095) |
| **Class B** | Pre | 42.77 (5.66) | -0.95 | 31.94 (4.59) | 2.55* | 39.41 (5.68) | .21 |
| (*n* = 17) | Post | 42.06 (5.48) | (.358) | 34.00 (5.92) | (.021) | 39.53 (5.99) | (.835) |
| **Total** | Pre | 42.76 (5.61) | .98 | 32.41 (4.53) | 3.29** | 38.59 (5.10) | 1.61 |
| (*n* = 34) | Post | 43.35 (5.13) | (.333) | 34.32 (5.51) | (.002) | 39.47 (5.40) | (.117) |

* *p* < .05, ** *p* < .005

The effect size, Hedges' *g*, was computed to estimate the magnitude of the intervention's impact. Hedges' *g* for total students was 0.11, 0.38, and 0.17 respectively for beliefs, affect, and behaviour construct. Based on Cohen's (1988) original conventions, they can be interpreted as small to moderate effects. However, as educational researchers have pointed out, effect sizes must be examined along with prior relevant research in order to place the current findings into an appropriate context (Hedges & Hedberg, 2007). Zelezny's (1999) meta-analysis of EE interventions found that the average effect size (for 8 studies) involving school children was 0.70, while the average effect size (for 10 studies) involving adults (including college students) was 0.27. Lipsey et al. (2012) also found in their meta-analysis that the average effect size for interventions that target whole classroom was only 0.18. The effect sizes reported in our study can thus be considered educationally meaningful, especially regarding the affective outcome.

As analysing the raw change does not account for the observation that students with low scores on the pre survey have more to gain than students with higher scores, the *c* score was computed to normalise students' learning gains or losses. As shown in **Table 3**, the average normalised change score is 0.11 (SD = 0.22) for the beliefs construct, 0.21 (SD = 0.27) for the affect construct, and 0.14 (SD = 0.27) for the behaviour construct. A *c* score of 0.21 indicates an increase of 21% of the maximum possible increase of the score. Correlation tests revealed that the changes in the three constructs were significantly positively associated with one another. High significance levels were found in the correlations between beliefs and behaviour (*r* = 0.45, *p* = 0.008), and between affect and behaviour (r = 0.64, p < 0.001), as shown in **Table 4**.

**Table 3.** Means and standard deviations of students' normalised change scores, *c*, in three constructs

|  | c_beliefs | | c_affect | | c_behaviour | |
|---|---|---|---|---|---|---|
|  | Mean | SD | Mean | SD | Mean | SD |
| Group A | .18 | .22 | .21 | .30 | .19 | .29 |
| Group B | .04 | .20 | .21 | .24 | .10 | .24 |
| Total | .11 | .22 | .21 | .27 | .14 | .27 |

**Table 4.** Correlations between students' normalised changes (*n* = 34)

|  | 1. | 2. | 3. |
|---|---|---|---|
| 1. *c*_beliefs | 1 | .43* | .45** |
| 2. *c*_affect |  | 1 | .64** |
| 3. *c*_behaviour |  |  | 1 |

*p < .05; **p < .01

## Qualitative: Students' Perspectives on the Impact of the Course

The results of the interview and quantitative data from the questionnaire were synthesised into eleven case scenarios for the selected students. Due to space limitation, we provided here three of the cases (Jenny, Daniel and Jim; all pseudonyms) that best describe student perspectives as they demonstrated different changes in the survey results and many assertions were reflective of most cases.

### *Student scenario 1*

Jenny obtained high scores in the pre-instruction survey and demonstrated a sizeable negative change in all three components ($c$ = -0.10, -0.13, and -0.11 respectively in beliefs, affect and behaviour). She was majoring in sports medicine and was in her first year of study when she took the environmental studies course. She chose to enrol in this environmental studies course because she considered it important to be informed about current social issues.

Her responses to the interview questions revealed that she believed that her understanding of the diverse ideas and perspectives involved in environmental issues had improved. She recalled the class about a local issue where a public coastal land was being turning into a private resort development (*The Shan-Yuen Coastline*), and commented that the learning was very fruitful especially during the group discussion. She noted in particular that encountering different, and meanwhile equally thoughtful, ideas and arguments had made her feel the need to think more thoroughly about the issue. Although she expressed that she experienced at times a feeling of frustration when she perceived her own ideas as superficial compared to others, she did feel that she learned much from the session where collaborative reflection took place, and that, as a result, she had become more reflective of her own and other people's ideas, and also of media reports: "when looking at news, (I know) their information can be partial or one-sided." Connected to this, she believed that she became more conscious of the complexity of some environmental issues and would not jump to conclusions easily.

Although Jenny reported to become more perspective-taking and reflective, her pre and post surveys showed a negative change in all three EA constructs. An in-depth analysis of her questionnaire responses revealed that her strong pro-environmental tendency had been loosened after the course. In three beliefs items (e.g., "When humans interfere with nature it often produces disastrous consequences."), three affect items (e.g., "It genuinely infuriates me to think that government does not do more to control environmental problems."), and another three behaviour items (e.g., "I strive to learn as much as possible about environmental issues."), she changed her response from "totally agree" to "agree". Notably, two items (one in beliefs, and the other in affect construct) received a reduced score by two points; in response to the beliefs item: "The question of the environment is secondary to economic growth," she chose "totally disagree" in pre survey, but "neutral" in post survey; to the affect item: "When I think of the ways industries are polluting, I get frustrated and angry," she changed from "agree" to "disagree".

### *Student scenario 2*

Daniel obtained low scores in the pre-instruction survey and demonstrated a sizeable positive change in all three EA constructs ($c$ = 0.3, 0.25, and 0.25 in beliefs, affect, and behaviour respectively). He was majoring in pharmacy and was in his first year when taking the course. The reason for Daniel to take this course was because it was one of the few class options that fit his schedule and interested him. This course interested him because it seemed to provide a forum for communicating with people about some complex issues and he always preferred more interactive activities. He believed that this course had helped him gain better understanding of the controversy involved in many environmental issues, but his positions about these issues had not changed. The learning experiences of collaborative reflection through group and class discussions had been important for him to realise that his ideas may not be well-considered. In recalling a particular incident at class discussion, he commented: "I thought my idea was solid and would be easily accepted. But his [a student in another group] rebuttal (was so strong) we were speechless… It blew my mind." He added that as a result he now tended to consider both sides of a controversy, and think about what are the underlying reasons for different opinions. He also pointed out that this course helped him become a more critical viewer of the media messages.

However, his interview responses indicated that he seemed to hold true that science is the only reliable source of knowledge. As he noted, he would "definitely believe in what science says" provided that "some experiment was conducted and some data were generated." Also, he seemed to hold that environmental and economic objectives are contradictory, and therefore a choice must be made between one and the other. As for him, he would always choose economic growth as priority over the environment. Moreover, he did not perceive a clear relevance of the taught issues to his everyday life, as he noted that, for example, the discussed incidents of serious industry pollution did not take place "in my backyard." Despite his relatively unfavourable attitudes toward the environment, he expressed that he was aware of the environmental problems that affect and are affected by the society, and that he would be interested in learning more about these issues.

An in-depth analysis of his pre- and post-survey items contributing to his attitude change revealed that Daniel's EA tendency shifted generally from a more neutral to a more pro-environmental position. In six belief items (e.g., "Conservation is important even if it lowers people's standard of living."), five affect items (e.g., "It generally infuriates me to think that government does not do more to control environmental problems."), and another five behaviour items (e.g., "I would be willing to learn more about what I can do to improve the local environment."), he took a neutral response in pre survey, but changed to "agree" to a pro-environmental statement (or "disagree" when the item is reversed) in post survey.

### *Student scenario 3*

Jim obtained low to medium scores in the pre-instruction survey and demonstrated only minor changes in the EA constructs (c = -0.07, -0.03, and 0.1 in beliefs, affect, and behaviour respectively). He was majoring in marine science in his four year when taking the course. He chose to enrol in this course because he felt that his learning about environmental issues, such as climate change, was too focused on scientific analysis and discussion, and there is a need to learn some "social aspect of science." To earn course credits toward graduation was another motivation.

Despite minor changes observed in his survey responses, the interview revealed his overall positive attitudes toward the course and the learning experience. Two films were identified by him as his favourite, and interestingly, they provoked very different emotions. One was a success story of renewable energy (*Energy for the future*) that made him believe that there were various strategies and actions that can be adopted by individuals, communities, and governments. Another film depicted how people on a small island witnessed and perceived the disappearing of native horseshoe crabs due to an airport construction project (*The Lost Sea*). Jim expressed that he felt angry and powerless; "It seems that these government officials just don't listen. It's shocking."

This course, according to Jim, helped students look into a number of problems facing contemporary Taiwan that were often neglected, or even distorted, by the media. Jim believed that he became more interested in related information, and at the same time, more critical when viewing media reports. He expressed that in viewing the media, he now tried to examine all possible aspects in order to "eventually find out the *best* viewpoint." Jim believed that he learned to considered different angles when it comes to environmental issues.

Besides being more interested in and more reflective about related issues, Jim also reported small changes in everyday behaviour, such as reducing his own energy and water consumption and choosing a non-GMO product as long as the price difference between this and a GMO product is perceived as reasonable. Before this course, as he recalled, he would make his purchasing choices simply based on price.

## DISCUSSION AND IMPLICATIONS

The central aim of this study was to examine the impact of a general environmental studies course, where documentary films were used as a primary instructional medium. Overall, the participating students developed more positive affective attitudes toward the environment over the course. The statistical analysis also revealed positive correlations between the learning gains in beliefs, affect, and behavioural intention. Although there was no statistically significant improvement for behavioural intention after the course, we observed a strong association between changes in behavioural intention and changes in beliefs as well as in affect. These findings were generally consistent with the earlier research, which showed that changing behaviour is a complex matter (Heimlich & Ardoin, 2008; Kollmuss & Agyeman, 2002), and that affective attitudes, such as connection to the environment, are strong predictors of environmental behaviour, especially via behavioural intention (e.g., Mayer & Frantz, 2004). It also confirms the previous finding that educational instruction focused on specific places and issues, explicitly linking content to students' familiar environments, and provoking student reflection may allow students to step into the issue and recognise their connection to it (see Stern et al., 2014 for a review). This course is unique in that students were provided with the opportunity to step into *a number of locally significant issues* through the use of documentaries instead of highlighting particular issues for investigation and action-based learning. This design might have helped students to move beyond issue-specific learning gains, and to generalise their knowledge and skills to a wider range of issues (Hungerford & Volk, 1990).

Given the statistically results, student interviews provided additional insight into how students themselves perceived their learning experiences and the impact of the course on their thinking and acting about the environment. Interview results indicated that students focused their change on being able to take multiple perspectives and think more reflectively and critically. Students commonly expressed that their understanding of the taught issues had improved in a way that they became aware of, and informed about, the competing ideas and arguments involved in making social-environmental judgments and decisions. In addition, regardless of their EA levels, the students felt that they had learned a lot from exposing to a number of difficult environmental issues, whereby their ideas and arguments were challenged particularly during discussion sessions. The discussion session, which sought to encourage listening and sharing rather than raising consensus, seemed to provide students

with good opportunities to clarify their own and other people's thoughts and feelings towards the specific topic. While becoming more perspective-taking and more reflective and critical seemed to be a major factor of the overall improvement of students' EA, it also led to shifts in EA from favouring complete environmentalism to supporting cautiously pro-environmental statements. Therefore, the actual improvement for high EA scorers (strong environmental advocates) may well be reflected by negative changes (losses) instead of positive changes (gains). This would mean that an effective and worthwhile EE intervention would raise the overall EA level, but likely lower the EA level of the strong environmental advocates. The effect sizes and normalised change scores serve as useful information for future studies to make comparisons and determine threshold levels of effectiveness of relevant EE interventions.

Although the survey results showed that the course had only limited impact on student behavioural change, students expressed in the interviews that there was a continued interest in learning more about local environmental issues, which may likely influence their participation in environment-related activities. A previous study found that both current interest and future intended interest in learning science-related subjects have significant pathway connection with not only future engagement in science-related subject learning but also with learner's environmental awareness and responsibility (Jack, Lin, & Yore, 2014). We believe that the experiences of repeated exposure to present-day environmental issues in the contexts that were familiar and personally relevant to the students had contributed to this development of interest. Documentaries, with its dynamic, issue-based and context-based nature, proved very helpful in actively engaging students and fostering their learning. The overall findings of the study are congruent with contemporary theories and empirical findings in science and environmental education regarding the importance of issue-based and media-based curricula for promoting student engagement and learning outcomes (e.g., McKenzie, Russell, Fawcett, & Timmerman, 2010; Pearson, Dorrian, & Litchfield, 2011; Sadler, 2009), and add to existing work by focusing on using documentaries as major course materials to help students step into a wide range of locally relevant environmental issues.

## CONCLUSION

In sum, the study suggests that experiences of exploring a number of environmental topics through documentaries followed by collaborative reflection are beneficial to developing students' perspective-taking and critical thinking abilities and sense of relevance, which altogether leads to a more pro-environmental attitude. In order to create a more sustainable world, it is highly important to generate among students positive attitudes toward the environment and environmental learning. This study shows that this type of environmental studies course can contribute to this end. However, such courses may only appeal to students who are least in need of them, and those who most need these learning opportunities may never take the courses (McMillan, Wright, & Beazley, 2004). Therefore, universities should encourage all students to enrol in such courses, and continue to provide resources for instructors to improve the quality of EE instruction. Like the studied course, more emphasis should be placed on creating learning situations, in which learners have the opportunity to explore, analyse, and interpret human actions in real-life situations, and treating environmental issues as social-contextual constructions of the people concerned instead of merely ecological problems regarding air, water, and animals (Kyburz-Graber, Hofer, & Wolfensberger, 2006).

Given the exploratory nature of the course analysis, there were some limitations to this research. One limitation is that, as the studied course was elective, some student characteristics may have also played a role. In the self-selection process, as mentioned above, incoming students are likely those who are more interested in the subject, and thus would naturally be more engaged in learning and make better progress. Also, this study was based on responses from two relatively small groups of students at two different universities, and thus limited in the generalization of its findings. Future research is needed with larger sample sizes and a wider battery of measures in order to substantiate how specific characteristics (e.g., media experience) of the instruction, and to what extent, really influence the measured outcomes.

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# APPENDIX I

## Interviewed Students' Selective Demographics, Pre-survey Scores and Normalised Change Scores ($c$)

| Student | Gender | Year | Beliefs | | Affect | | Behaviour | |
|---|---|---|---|---|---|---|---|---|
| | | | Pre-score | $c$ | Pre-score | $c$ | Pre-score | $c$ |
| A1 (Jenny*) | F | 1 | 48 | -0.10 | 38 | -0.13 | 43 | -0.11 |
| A2 | F | 3 | 52 | -0.06 | 41 | 0.25 | 46 | 0 |
| A3 | F | 2 | 35 | 0.3 | 29 | 0.13 | 34 | 0.19 |
| A4 (Daniel) | M | 1 | 35 | 0.3 | 29 | 0.25 | 30 | 0.25 |
| B1 | M | 3 | 50 | -0.16 | 35 | 0.40 | 45 | -0.07 |
| B2 | F | 3 | 45 | -0.07 | 31 | 0.36 | 38 | 0.17 |
| B3 | F | 4 | 44 | -0.02 | 41 | -0.07 | 42 | -0.05 |
| B4 (Jim) | M | 3 | 42 | -0.07 | 30 | -0.03 | 40 | 0.10 |
| B5 | M | 2 | 37 | -0.03 | 24 | 0.10 | 36 | 0.14 |
| B6 | M | 3 | 47 | 0 | 31 | 0.21 | 40 | 0 |
| B7 | M | 4 | 47 | 0.13 | 34 | 0.55 | 45 | 0.60 |

Note.* Students with pseudonyms are those case scenarios presented in the results.