

Strengths, Weaknesses, Opportunities and Threats (SWOT) Analysis: A template for addressing the social dimension in the study of socio-scientific issues

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ABSTRACT

Recent research has stressed the particularities and importance behind the social component in the study of socio-scientific issues (SSIs). However, teachers face difficulties when they have to develop pedagogical plans for dealing with the social dimension of SSIs, which mainly relate to the lack of relevant materials and the need to provide students with decision-making heuristics. The objective of the current paper is to respond to these calls by presenting the template of ‘Strengths and Weaknesses, Opportunities and Threats’ (SWOT) analysis as a tool for addressing the social component in the study of SSIs. A pilot implementation of the template is presented, which involved pre-service primary teachers and concentrated on bear conservation in three NATURA 2000 sites in Central Greece. Implications for environmental education and education for sustainability are examined, including the contrast between the instrumental and emancipatory approaches in environmental education and a procedural conceptualization of sustainability.

KEY WORDS (in alphabetical order): *Social heterogeneity; Socio-scientific issues; Stakeholders; Sustainability; SWOT analysis*

Introduction

Socio-scientific issues (SSIs) usually appear in the form of social dilemmas, which are characterized by a predominant linkage to science (Sadler 2004). Many SSIs reveal a focus on environment/nature and these are most frequently dealt with in environmental education and education for sustainability (Klosterman et al. 2012; Laws et al. 2004; Robottom 2012; Tomas and Ritchie 2012; Van Weelie and Wals 2002). Despite the fact that the study of SSIs has to be built on a solid scientific knowledge base (Lewis and Leach 2006; Robottom 2012), there

is a series of ethical questions that arise in SSIs due to multifaceted interactions between science and society (Hovardas and Korfiatis 2011; Sadler 2004;). Therefore, among the core learning goals in studying SSIs is the learners’ ability to form reasoned judgments which integrate multiple knowledge claims, stakeholder positions and moral implications (Bell 2004; Boerwinkel et al. 2014; Carleton-Hug and Hug 2010; Lundblad et al. 2012; Sadler and Zeidler 2004; Zemplén 2007).

Recent research has stressed the particularities as well as the importance of the social

component in the study of SSIs. Taking the social context into account is seen as a prerequisite for a comprehensive exploration of SSIs (Robottom 2012). The social framing of SSIs unravels their constructedness within particular communities of interest and the appropriation of scientific knowledge to serve interests of social groups engaged in SSIs (Simonneaux and Simonneaux 2009a). In this direction, Robottom (2012) argued that the scientific dimension in addressing SSIs within environmental education or education for sustainability discourses will always remain insufficient as long as the social embeddedness of SSIs is not properly approached. SSIs can provide a vehicle for unraveling the heterogeneity of the multiple, diverging or converging, perspectives present in a society (Bell 2004; Dobson 2003; Klosterman et al. 2012; Wals et al. 2008) and for promoting tolerance for all possible outcomes of a radically indeterminate democratic deliberation process, which may result in either reaching consensus or a respectful disagreement (Bell 2004; Jickling and Wals 2008). Such an approach to the study of SSIs is expected to foster public involvement in environmental governance (Ferkany and Whyte 2012; Simonneaux and Simonneaux 2009b).

Previous research has shown that teachers face difficulties when they have to develop pedagogical plans for teaching SSIs, which mainly refer to the social dimension of SSIs (Ekborg et al. 2013; Lee and Witz 2009). Educators highlighted the unavailability of relevant materials as one of the prime obstacles hindering a comprehensive appreciation of the social implications of SSIs (Kara 2012). There is also a need to provide students with decision-

making heuristics, which could structure and scaffold inquiry in the social dimension of SSIs (Lee 2007; Levinson 2006), especially the heterogeneity of the social field in dealing with SSIs (Acar et al. 2010). The objective of the current paper is to respond to these calls by presenting the template of ‘Strengths and Weaknesses, Opportunities and Threats’ (SWOT) analysis as a tool to address the social component in the study of SSIs.

The social dimension in the study of socio-scientific issues

The prefix ‘socio-’ in SSIs might refer to a variety of topics, for instance, nature of science (Lederman et al. 2014), the contingent character of scientific knowledge and uncertainty in science (Schinkel 2009; Wals et al. 2008). Another aspect of the social dimension in SSIs addresses the development of argumentation and decision-making skills in value-based reasoning (Acar et al. 2010; Lee 2007; Wu and Tsai 2007). In this direction, learners have the opportunity to follow the pathways through which the scientific knowledge is selectively used and re-contextualized in order to serve non-scientific ends (Robottom 2012). An additional facet of the social dimension in the study of SSIs refers to inter-group relations in cases of conflict or deliberation concerning natural resources management (Levinson 2006; Simonneaux and Simonneaux 2009a, b). This latter topic focuses on the way different stakeholder groups take position in environmental controversies or change their position in accordance to the social dynamics displayed at play (Hovardas 2013).

A pedagogical strategy which would focus on social heterogeneity and social actor dynamics in SSIs seems able to account for the context-

specificity of sustainability. In this regard, sustainability is to be conceived of as a democratic deliberation process rather than a given end-state of society to be attained (Van Weelie and Wals 2002; Wals and Jickling, 2002; Wals 2010). This conceptualization aims at fostering skills of ‘how to think’ instead of ‘what to think’ in a top-down fashion (Day and Monroe 2000; Dobson 2003; Schinkel 2009). At this point, two contrasting perspectives are distinguished in environmental education and education for sustainability. On the one side, the instrumental perspective (teaching ‘what to think’), which embodies transformative objectives and directs learners’ reasoning and behavior towards pre-determined ways of preferred thought and action (Hailwood 2005; Keene and Blumstein 2010; Mitchell and Mueller 2011; Orr 1994); on the other side, the emancipatory perspective (teaching ‘how to think’), which wishes to respect learners’ autonomy and it abstains from fostering certain values or attitudes and propagating certain types of behavior (Wals et al. 2008; Zemplén 2007).

The study of the social dimension of SSIs within the frame of the emancipatory perspective in environmental education and education for sustainability, rests on *not* imposing certain values, attitudes or behaviors on learners. However, formulating learning goals as well as orchestrating and scaffolding learning activities has to develop on an affirmative background. The question here is how could educators formulate learning goals and structure learning activities without privileging certain values, attitudes or behaviors (see for instance Hovardas and Korfiatis 2012a). Another important question relates to a potential relativism which could be latent in the emancipatory approach: if

we were not to select desired values, attitudes and behaviors as intended outcomes in environmental education and education for sustainability, then we might end up in a situation where ‘anything goes’ or where we would not know what could come after identifying different stakeholder positions. In the next section of the paper we will present and discuss an adjusted version of SWOT analysis which may help us accounting for the aforementioned implications and structuring the social component in the study of SSIs.

SWOT analysis as a template for addressing the social dimension in SSIs

SWOT analysis is frequently used in environmental management as a diagnostic method to identify key factors influencing the success or failure of an organization’s project (Masozera et al. 2006; Geneletti et al. 2007; Lozano and Vallés 2007). The standard application of SWOT analysis is based on a template, which provides the necessary heuristics to examine the future prospects of an organization. This investigation is structured in terms of potential that may promote, or barriers that may hinder, the achievement of the organization’s goals.

A distinction is made between the characteristics of the organization itself and the elements which are attributed to the organization’s environment (Table 1). In this regard, the organization’s potential to accomplish its objectives is judged against both inner (i.e., that pertain to the organization itself) as well as outer (i.e., environmental) aspects that may be mobilized in order to accomplish the goals of the organization. Inner aspects are termed ‘strengths’, while outer aspects are called

‘opportunities’. In an analogous manner, barriers can be found within the organization (termed, ‘weaknesses’) or in the environment surrounding the organization (‘threats’). The result of the SWOT analysis offers insights concerning the trajectory of the organization categorized in ‘strengths’ that should be supported (i.e., inner potential), ‘opportunities’ that have to be sought (i.e., environmental prospects), ‘weaknesses’ that must be overcome (i.e., inner barriers), and ‘threats’ that ought to be alleviated (i.e., environmental hindrances).

Table 1: Template of Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis.

	Aspects that pertain to the organization itself; inner characteristics	Aspects that refer to the environment of the organization
Potential that might promote the organization’s goals	Strengths	Opportunities
Barriers that might hinder the achievement of the organization’s goals	Weaknesses	Threats

SWOT analysis can be easily adapted to serve as a template in addressing the social dimension in the study of SSIs (Table 2). SSIs in environmental education and education for sustainability most often engage a series of social groups that have a stake in the issue at hand. For each stakeholder group, one can identify in-group factors that are decisive for the SSI under study as well as factors that determine inter-group relations among stakeholders. In a

fashion similar to the standard use of SWOT analysis, in-group factors include beliefs, knowledge/skills, intentions, and behaviors which may either enable stakeholders converge and reach consensus in the SSI under study (i.e., ‘strengths’) or lead to divergence or conflict (i.e., ‘weaknesses’). Further, aspects of inter-group relations decisive for consensus involve possible fields of convergence or cooperation between stakeholder groups (i.e., ‘opportunities’), while aspects of inter-group relations that might lead to conflict include possible fields of divergence or competition between stakeholder groups (i.e., ‘threats’).

Table 2. Template of Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis adapted for addressing the social dimension in the study of socio-scientific issues.

	Aspects that pertain to each stakeholder group; in-group factors	Aspects of inter-group relations between stakeholder groups
Potential of increasing convergence between stakeholder groups and reaching solutions	Strengths (Beliefs, knowledge/skills, intentions, and behaviors that can allow stakeholder groups to achieve consensus)	Opportunities (Possible fields of agreement or cooperation between stakeholder groups)
Barriers that might increase divergence between stakeholder groups and lead to conflict	Weaknesses (Beliefs, knowledge/skills, intentions, and behaviors that might prevent stakeholder groups from achieving consensus)	Threats (Possible fields of disagreement or competition between stakeholder groups)

A stakeholder-based SWOT analysis can be used by environmental educators for providing guidance and scaffolding while addressing the social dimension in the study of SSIs. Learners will first need to identify social actors engaged in the SSI under study. Then, ‘strengths’, ‘weaknesses’, ‘opportunities’ and ‘threats’ for each social group will have to be determined. This might be operationalized by means of webquests, interviews and focus group discussions with stakeholder group members or surveys targeting stakeholders. Students will gather information and process this information to complete the SWOT template. In a simulation of inter-group relations and deliberation processes, students can build on ‘strengths’, try to eliminate ‘weaknesses’, exploit ‘opportunities’, and mitigate the effect of ‘threats’ in order to reach potential sustainable solutions. This might take the form of role play or round table discussions. The overall objective will be to unravel and elaborate on the social heterogeneity in social actors’ perspectives on SSIs.

Pilot implementation of SWOT analysis for studying the social dimension in the issue of bear conservation in Central Greece, Prefecture of Thessaly

A pilot implementation of SWOT analysis for studying the social dimension of SSIs concentrated on bear conservation in Central Greece, Prefecture of Thessaly. The bear population in Greece seems to follow the general trend observed throughout Europe, where population sizes of large carnivores have stabilized, or even increased in some cases, and large carnivores re-colonize areas where they have been absent for many decades (Hovardas

and Korfiatis 2012b). Three NATURA 2000 sites in Central Greece include about 30-40 brown bears (*Ursus arctos*), which amount to slightly over 15% of the total bear population in Greece. Brown bears are permanently present in Aspropotamos (GR1440001) and Kerketio Oros-Koziakas (GR1440002), which both include priority bear habitat. Brown bears seem to use Antichasia Ori - Meteora (GR1440003) as a dispersal corridor to move to the east and re-colonize a former bear range. Stabilizing population sizes and the comeback of the brown bear in areas where people have forgotten how to live with the species presents a challenge for rural communities. At the same time, bear conservation projects for dissemination of best practice in terms of damage prevention methods have engaged environmental non-governmental organizations (eNGOs) in the area (see LIFE EX-TRA (2013) for a comprehensive presentation of NATURA 2000 sites and environmental conservation initiatives).

Students at the Department of Primary Education at the University of Thessaly, Greece, undertook the pilot implementation of SWOT analysis as part of an environmental education course. Overall, 12 pre-service primary teachers (at the 5th semester of their studies) participated in this pilot implementation, which took the form of a project (winter semester 2011-2012). Students first developed webquests to identify key stakeholders in bear conservation and delineate stakeholder positions. Stakeholders included stock-breeders, hunters, foresters, and eNGOs (Table 3). Students then used webquest reports to prepare interview schedules for semi-structured interviews with members of stakeholder groups. A number of interviewees were first indicated by local authorities in the

three NATURA 2000 sites while the rest of interviewees were selected by means of a snowball technique. All interviews took place in the towns of Kalampaka and Trikala, the main urban centers in the area. After a training session, pre-service primary teachers conducted and transcribed interviews to determine ‘strengths’, ‘weaknesses’, ‘opportunities’ and ‘threats’ for all stakeholder groups engaged in bear conservation. Only common aspects across all NATURA 2000 sites, i.e. aspects mentioned by all respondents, were incorporated in the template of SWOT analysis. Interviews stopped when all information needed to complete the template was gathered, while students undertook about three to four interviews with members of each stakeholder group, each interview lasting about 30 minutes. When a first draft of the template of the SWOT analysis had been prepared, a focus group discussion was organized to validate the outcome of interviews. Two people from each stakeholder group were invited and discussed the template under the coordination of the author who acted as facilitator. The template is shown, in its final form, in Table 3. The content of the template was used to develop a scenario for a role play and a round table discussion, which were presented to all other students who followed the environmental education course.

As we can read from the first column in Table 3, stock-breeders in the three NATURA 2000 sites acknowledged that electric fences have been effective as a damage prevention method for apiarists elsewhere. This knowledge might prove significant in achieving consensus among stakeholders in bear conservation because electric fences can be endorsed as a damage prevention method by stock-breeders too (refer

to ‘Strengths’ row in Table 3). However, electric fences cannot be used for free-ranging animals. In this case, there is the option of guarding dogs as an alternative damage prevention method. The fact that there is yet no valid way of certifying guarding dogs was highlighted by stock-breeders as an important deficiency, which discouraged them from joining stock-breeder networks that aim at breeding and distributing guarding dogs (row depicting ‘Weaknesses’). A quite interesting finding was that stock-breeders could accept a minimum of damage to their livestock caused by the bear, which outlines a possible line of agreement between stock-breeders and eNGOs (row depicting ‘Opportunities’). However, there exist a substantial number of stock-breeders who do not record damages they suffer because they believe that they would not get any compensation (row depicting ‘threats’). This aspect has been noted as a point of tension between stock-breeders, foresters, and eNGOs.

In an analogous manner, one can follow ‘strengths’, ‘weaknesses’, ‘opportunities’ and ‘threats’ for all other stakeholder groups along the rest of the columns in Table 3. Scenarios that were developed by pre-service primary teachers for role play and round table discussions built on ‘strengths’ and ‘opportunities’ and tried to address ‘weaknesses’ and ‘threats’ in order to promote bear conservation.

Discussion and implications for environmental education and education for sustainability

The template of SWOT analysis can prove a valuable tool in addressing calls for decision-making heuristics, which could structure and scaffold inquiry in the social dimension of SSIs (Acar et al. 2010; Kara 2012; Lee 2007;

Levinson 2006). After being appropriately integrated in educational interventions, the tem-

Table 3. Strengths and Weaknesses, Opportunities and Threats (SWOT) Analysis for brown bear conservation in three NATURA 2000 sites in Central Greece (Aspropotamos – GR1440001; Kerketio Oros-Koziakas – GR1440002; Antichasia Ori - Meteora – GR1440003).

	Stock-breeders	Hunters	Foresters	eNGOs*
Strengths (Beliefs, knowledge/skills, intentions, and behaviors that can allow stakeholder groups to achieve consensus)	Stock-breeders acknowledge that electric fences have been effective as a damage prevention method for apiarists elsewhere	Hunters wish to be involved in nature conservation initiatives	Foresters have valuable experience in nature conservation gained through working in the local area and with the local societies	A democratic mandate for public involvement prevails among members of eNGOs
Weaknesses (Beliefs, knowledge/skills, intentions, and behaviors that might prevent stakeholder groups from achieving consensus)	Stock-breeders know that there is yet no valid way of certifying guarding dogs	The cost of hunting dogs is extremely high and, therefore, any damage to hunting dogs will comprise a significant financial loss for hunters	Financial and organizational barriers create a strong feeling of inability among foresters concerning the fulfillment of their mission	There are a series of objectives formulated by eNGOs that are not adequately adapted to the local context
Opportunities (Possible fields of agreement or cooperation between stakeholder groups)	Stock-breeders can accept a minimum of damage to their livestock caused by the bear	Hunters are willing to support financially networks of breeding and distributing guarding dogs between stock-breeders	Foresters are institutionally responsible for the implementation of a series of nature conservation measures	eNGOs strongly support compensation systems because they might decrease conflicts between stock-breeders and bears
Threats (Possible fields of disagreement or competition between stakeholder groups)	Many stock-breeders do not record damages they suffer because they believe they would not get any compensation	Conflict between stock-breeders and hunters usually escalates by using poisoned baits	Foresters have withdrawn from many nature conservation networks	Negative attitudes towards eNGOs are still present among other social groups

* eNGOs = environmental non-governmental organizations.

plate of SWOT analysis might be used in upper primary education, lower and upper secondary education, and tertiary education. The template can be combined with webquests to introduce students in the social landscape and define social groups that have a stake at SSIs under study. Social research methods, such as interviews, focus group discussions and surveys can be employed to gather data, validate findings, and complete the template. Finally, pedagogical methods such as role play and round table discussions can make use of the template's content to simulate social actor dynamics and explore the potential of reaching consensus among stakeholder groups.

Apart from bear conservation that served as a pilot study in the present paper, the template of SWOT analysis can assist in examining stakeholder group positions and actor dynamics engaged in a wide array of SSIs. Since the template is not case-sensitive, it can be easily modified to account for new case studies by identifying the appropriate stakeholder groups. By tracking and simulating inter-group interactions between social groups involved in SSIs, the overall objective of using the SWOT template is to unravel and elaborate upon the heterogeneity that characterizes the social fabric in dealing with SSIs (Simonneaux and Simonneaux 2009a, b). In this regard, the template of SWOT analysis allows environmental educators to formulate learning goals and orchestrate learning activities on an affirmative basis within the emancipatory perspective, where values, attitudes or behaviors are not to be imposed upon learners (Hovardas 2013).

A final point to be discussed refers to the latent relativism that could be inherent in the

emancipatory approach, which could end up in a situation where learners would just celebrate social heterogeneity and appreciate the validity of any social actor's beliefs, knowledge/skills, intentions, and behaviors. In this regard, we should highlight the fact that the template of SWOT analysis enables the investigation of points where stakeholder groups could diverge or converge and, thereby, enables the potential of seeking consensus and reaching solutions concerning the social component of SSIs. This potential provides a valuable and insightful reference base, which precludes relativism in the sense that 'anything goes' (see for instance Hovardas 2012). Further, such a perspective suggests a procedural conceptualization of sustainability (Van Weelie and Wals 2002; Wals and Jickling 2002; Wals 2010), where the latter has to be experienced as a democratic deliberation process rather than as a pre-given end-state to be sought.

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