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THE NEW ECOLOGICAL PARADIGM AND ATTITUDES TOWARDS SUSTAINABLE BUSINESS PRACTICES – A MEXICAN CASE STUDY

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ABSTRACT: This study investigates the impact of teaching programmes on perceptions of sustainable development among students. The researchers argue that existing educational programmes must provide a comprehensive approach to mitigating collapse risk. To address this issue, the study developed a teaching programme to be delivered by experienced educators and experts, consisting of lectures, seminars, exercises, research projects, and related activities. The programme aimed to raise awareness of sustainable development and deepen understanding of the complexity of the subject. The results showed that the teaching programme increased students' appreciation of the importance of complexity and the non-linear impacts of Black Swans in the sustainability discourse without changing their adherence to the New Ecological Paradigm. The study highlights the need for education to enable students to deal with problems characterised by complexity, uncertainty, and low probability, as well as high-impact events that pose a non-linear threat to sustainable development.

KEYWORDS: teacher intervention, sustainable development, collapse, new ecological paradigm

Introduction

The sustainability of societies is challenged by environmental degradation and depletion of natural resources (Bartelmus, 1994). To deal with this challenge, education has an important role (Fua et al., 2018) in developing attitudes and skills which support sustainable development perspectives (Stern, 2006; Peña Miguel et al., 2020). Integration of sustainability issues incurricula is often focused on innovation and practices which support a transition to sustainable development (Blanco-Portela et al., 2017; Findler et al., 2019) and provide students with a comprehensive understanding of the interconnection between economic growth, social well-being, and environmental impact (Sousa et al., 2020). Higher education institutions can also serve as models for sustainable practices that inspirea more comprehensive societal transformation.

In today's complex and interconnected world, it is increasingly important to understand and identify the vulnerabilities that can lead to the collapse of organisations or systems (see Taleb, 2007; Taleb, 2012; Mandelbrot & Hudson, 2008). However, current educational and training programs often need a comprehensive and systematic approach to teaching these skills. This omission presents a significant challenge in the prevention of collapse scenarios. To build resilience and ensure the sustainability of organisations and systems, individuals and organisations should be educated on identifying, assessing, and mitigating the risk of collapse (Gainey, 2020). In this context, following the work of Lambrechts et al. (2018) and Platje et al. (2019), education for sustainable development needs to enable students to appreciate and deal with problems (Rittel & Webber, 1973; Levin et al., 2012) which are characterised by complexity and uncertainty (Lambrechts & van Petegem, 2016) and where small probability, high impact events pose a non-linear threat to sustainable development (Kahneman, 2011; Taleb, 2012).

The research presented in this paper attempts to reorient knowledge of sustainable development onto the basics of preventing collapse scenarios by identifying vulnerabilities in organisations or systems (see Taleb, 2007; Taleb, 2012; Mandelbrot & Hudson, 2008). The research was conducted in a teaching context to identify whether teaching can impactfour determinants of the capability to identify and assess vulnerabilities. These determinants are (1) Functional stupidity, i.e. the capacity to change the"rules of the game" and redefine goals in organizations and systems (Alvesson & Spicer, 2012, 2016); (2) the New Ecological Paradigm (NEP) (Dunlap et al., 2000; Dunlap & van Liere, 1978; Dunlap, 2008; Hawcroft & Milfont, 2010) assessing development of pro-environmental attitudes (Noe & Snow, 1990); (3) Attitudes towards Business Sustainability Practices (Ng & Burke, 2010), providing a profile of future decision-makers, their willingness to go beyond short-term win-win solutions and consider "beyond the business case" (Dyllick & Hockerts, 2002) options for supporting solutions for sustainability; (4) awareness of increasing complexity and the applicationof sys-

tem thinking in order not only to appreciate increasing vulnerabilities in an increasing interconnected global world, but also to enable assessment of the rebound effects of actions that lead to outcomes counter to the intended goals (Meadows, 1998; Sterman, 2000).

This research aims to assess the impact of teaching programmes on students' worldviews and their perception of vulnerability and complexity in the sustainability discourse. It provides a case study where, in line with Lozano et al. (2017), new pedagogical methods are used to introduce sustainable development issues and system thinking into the curriculum.

Review of literature

Sustainable development has become an essential issue at higher education institutions (e.g. Kohl et al., 2022; Elmassah et al., 2022; Leal, 2017; van Weenen, 2000). They may contribute to sustainability by promoting sustainable behaviour and overcoming factors that hinder sustainable practices (Leal et al., 2019). Moreover, education on the subject is one of the aims of the 2030 Agenda for Sustainable Development of the United Nations (United Nations, 2015; Rajabifard et al., 2021; Leal et al., 2015). Higher education institutions should trigger and direct changes in achieving Sustainable Development Goals (e.g., van Weenen, 2000). They may do this by leading a wide range of activities aimed towards the realisation of these goals (e.g. Alcántara-Rubio et al., 2022; Adhikari & Shah, 2021; Hansen et al., 2021; Zepeda Quintana et al., 2019; Platje et al., 2022c) and by addressing global challenges such as climate change, poverty, and inequality (Berchin et al., 2018). From the point of view of the social role of higher education institutions, two areas of change are essential: research aimed at better understanding and knowledge creation on sustainable development and reorientation of existing educational courses to include more information on the subject (Kohl et al., 2022).

Much of the discourse on the role of higher education institutions points to a desire to engage in policy through research, teaching and operations (Annan-Diab & Molinari, 2017), to develop innovative solutions (Menon & Suresh, 2020) and to the development and implementation of sustainable practices (Leal et al., 2019) not only for external stakeholders but also by implementing "practice what you preach" policies on campuses (de la Poza et al., 2021). However, current educational and training programs often lack a comprehensive and systematic approach to teaching the required skills to face today's complex and interconnected challenges of sustainable development (Allen et al., 2014; Zepeda Quintana et al., 2019) because sustainable development as a topic usually is 'bolted onto' existing curricula (van Dam, 2019).

Helping students understand complexity and creating capabilities to prevent collapse scenarios is essential for building resilience and ensuring the sustainability of organisations and systems. By fostering an appreciation for the intercon-

nected nature of systems and the multiple interrelated factors that contribute to collapse, students can develop the critical thinking skills needed to identify, assess, and mitigate risk (Littledyke, 2008). Students who have a solid understanding of complexity will be better equipped to deal with the complex and rapidly changing challenges that arise in today's world, such as climate change, economic instability, and social unrest (Funtowicz & Ravetz, 1993; Heinrich & Kupers, 2018). Ultimately, this kind of education empowers individuals and organisations to make informed decisions, take proactive steps to prevent collapse scenarios and promote sustainable development (Adger, 2006).

To appreciate complexity, it is necessary to question the current status quo regarding economic, social and environmental paradigms. The mainstream idea in economic sciences that the world is a smooth place where markets are soft and events that can ruin the economy or the environment tend not to exist should be assessed critically (e.g., Mandelbrot & Hudson, 2008; Servigne & Stevens, 2020). To critically think about economics and one's actions (Stevenson et al., 2017) requires a willingness to look beyond short-term gainsand go beyond myopic self-interest for the sake of a more sustainable future (Alsaati et al., 2020; Hamón et al., 2020).

Critical thinking, however, is not commonly appreciated in business environments (Ehrensal, 1999). When times are good, the focus on profit and other short-term goals may be rational (Platje et al., 2022a; Kilbourne et al., 2002). Individuals and organisations focus on short-term, my opic goals and neither reflect on nor justify their goals or activities. After all, when profit is not threatened, why bother with "minor issues" that absorb time that could be used for more productive purposes (see Taleb, 2007; Taleb, 2012)? Information transfer and processing are hampered, while time to deal with any challenge or decision is typically short. This focus helps maintain social relationships and power dynamics (Alvesson & Spicer, 2016; Paulsen, 2017). However, this myopic focus prevents substantive reasoning and thinking about the broader consequences of decisions (Alvesson & Spicer, 2012; Alvesson & Spicer, 2016). Individuals or organisations, therefore, can act seemingly irrationally, but that serves the purpose of maintaining the status quo (Alvesson & Spicer, 2012). The consequent failure to consider alternative perspectives thus creates long-term threats to organisational viability. It also does not stimulate learning from mistakes but leads to cover-up of "almost mistakes". This increases cognitive load and reduces the time for more profound thoughts (see Kahneman, 2011). The consequent ignorance and lack of information on potentially disastrous events create structural vulnerabilities in the system. This 'functionally stupid' organisational behaviour is widely discussed in economics, psychology, and administrative sciences (Fagerberg et al., 2020; Butler, 2016).

People think in cause-consequence paradigms (Kahneman, 2011; Beck, 2018; Taleb, 2012; Sterman, 2000). This linear thinking creates a preference for simple solutions without recognising how rebound effects may lead to outcomes

contrary to the aim of the solution (Sterman, 2000). An example is how building roads to solve traffic jamsincreases jamming (Braess, 1968; Sterman, 2000). Thinking beyond simple solutions is related to understanding complexity and the importance of system thinking. Complexity and system thinking are two interrelated fields of study that have gained significant attention in recent years. Complexity refers to the property of systems composed of many interacting elements and exhibit emergent behaviour, thus making them difficult to predict and control (Gros, 2013).

On the other hand, system thinking is a holistic approach to problem-solving that considers the interconnections and feedback loops within a system and recognises that small changes in one part of the system can significantly impact elsewhere (Meadows, 2008). The combination of complexity and system thinking provides a powerful tool for understanding and addressing complex problems in various fields, including natural sciences, social sciences, and engineering (Bousquet & Curtis, 2011; Jackson, 2019). This combinatory approach has been applied to study complex systems ranging from ecosystems (Loreau et al., 2002) to economies (Kauffman, 1993), to organisations (Stacey, 2017), to complex human systems such as health (Carey et al., 2015) and education (Rooy, 2010). System thinking can help to identify the underlying causes of problems and promote more effective and sustainable win-win solutions (Reynolds et al., 2012).

Sustainable business practices tend to focus beyond short-term win-win solutions, improving a company's financial performance, competitive position, etc., while protecting the environment (Hawken, 1993; Porter & Kramer, 2006). This focus may support a company's reputation and marketing strategies (Loock & Phillips, 2020; Shabbir et al., 2020). Companies that effectively communicate their commitment to sustainability and demonstrate the benefits of their sustainable practices are more likely to gain support from consumers and other stakeholders (Carroll, 1991) while also becoming more attractive to students with a positive attitude towards sustainable business practices. Sustainable business practices require thinking beyond short-term myopic goals and simple win-win solutions for sustainable development (Dyllick & Hockert, 2002; Carroll & Shabana, 2010). Conversely, this means that this attitude is essential for businesses in selecting managers for jobs related to corporate social responsibility (Ng & Burke, 2010). These findings highlight the importance of considering internal and external factors in evaluating attitudes towards sustainable business practices (Elkington & Rowlands, 1999).

Attitudes towards sustainable business practices vary depending on various factors such as age, education, cultural background, and personal values (Banerjee et al., 2008). Due to increased awareness and concern for environmental issues (Lakhan & LaValle, 2002), younger people tend to have more positive attitudes towards sustainable business practices than older people (Banerjee et al., 2008). Individuals with higher levels of education and a personal commitment to environmentalism tend to have more favourable attitudes towards sustainable

business practices (Morsing & Schultz, 2006). This supports the importance of sustaining and developing these attitudes in education.

Underlying these sustainable practices and attitudes is a shift in how people view their relationship with the environment, moving from a traditional anthropocentric view to an eco-centric one (Dunlap & van Liere, 1978). This shift increases one's appreciation of ecosystem vulnerabilities and critical opinions on technofix solutions to environmental problems. Adherence to this so-called New Ecological Paradigm is assumed to be related to pro-environmental behaviour. Firstly, individuals with New Ecological Paradigm beliefs tend to view the environment in a holistic and interconnected way rather than as a collection of separate resources to be used for human benefit (Dunlap & van Liere, 1978). They tend to see the environment as an asset that should be protected for future generations and the well-being of all living organisms (Kollmuss & Agyeman, 2002). Secondly, these individuals feel a sense of personal responsibility for the state of the environment (Stern et al., 1999). They may see themselves as part of a more extensive ecological system and feel that they must act in ways that promote environmental sustainability (Stern et al., 1995). Thirdly, adherence to the New Ecological Paradigm is assumed to be related to pro-environmental behaviour because individuals who adhere to New Ecological Paradigm principles tend to have a more positive attitude towards the environment and the natural world (Kollmuss & Agyeman, 2002), seeing the environment as a source of beauty, inspiration and wonder and feeling a sense of connection to the natural world (Stern et al., 1995).

The "pro-ecological" worldview of the New Ecological Paradigm consists of general beliefs that are supposed to determine more specific environmental values and have extensively been used for environmental education (Anderson, 2012; Lundmark, 2007). Several institutions of higher education have taken the initiative to integrate New Ecological Paradigm principles into their curricula, operations, and policies by incorporating sustainability concepts into coursework (McKenzie-Mohr & Smith, 2000), implementing green campus initiatives (Coy et al., 2013) and engaging students in environmental activism and advocacy (Gillham, 2008). Overall, using the New Ecological Paradigm may be necessary for promoting sustainability and fostering a culture of environmental responsibility where educational and policy activities by higher education institutions can inspire future generations to adopt a more eco-centric worldview (Harraway et al., 2012).

Research methods

To obtain relevant information about students' perception of sustainable development and the conditions for effective teaching in sustainable development, a teaching programme was modified during a course on "sustainability in engineering". This was done in the spring of 2019 for all the programs from the

engineering faculty of a university in Mexico. The study employed a pre and post-test methodology to evaluate the impact of these modifications on students' perceptions. To guarantee anonymity, students received an individual code for the pre-and post-programme modification questionnaire; Participation was voluntary. Of the 546 students participating in the course, 270 participated in the survey. For the assessment of students' worldviews and perception of vulnerability and complexity in the sustainability discourse, four existing constructs were measured in the study: (1) functional stupidity, (2) complexity and system thinking, (3) Attitudes Towards Sustainable Business Practices, and (4) adherence to the New Ecological Paradigm (Annex 1).

For this study, Functional Stupidity was measured as (FS1) 'reflexivity and justification' and (FS2) 'substantive reasoning' (Platje et al., 2022a). Complexity and system thinking were measured as 'Appreciation of Complexity' to contrast it with peoples' tendency to apply simple cause-consequence reasoning (see Kahneman, 2011). The questions on FS and Complexity were the topic of earlier studies (Platje et al., 2019; Platje et al., 2022b). All questions were consulted with university experts and translated into Spanish and backward, and a pilot study was conducted the year before this survey was carried out.

The personal value systems, cultural orientations, and supportive leadership styles for sustainable business are measured by Attitudes Towards Sustainable Business Practices (Ng & Burke, 2010). The 15-item New Ecological Paradigm scale measured the underlying worldview (Dunlap et al., 2000) consisting of 5 dimensions: [1] the reality of limits to growth, [2] anti-anthropocentrism, [3] the fragility of nature's balance, [4] rejection of exceptionalism and [5] the possibility of an eco-crisis or ecological catastrophe. Its authors have validated both scales (Dunlap et al., 2000; Dunlap & van Liere, 1978; Dunlap, 2008; Ng & Burke, 2010).

After eliminating incomplete questionnaires and the questionnaires from students who only filled out the pre- or post-intervention questionnaire, 208 questionnaires remained for analysis. Single indicators were created for each variable by calculating the average across scale items. When necessary, the scale was inverted to complete one hand, as in the case of the New Ecological Paradigm (the questions making up each variable are presented in Annex 1).

The teaching programme modifications consisted of lectures and discussions to raise awareness and understanding of sustainable development delivered by experienced educators and experts in the field. The participants were actively engaged in the sessions, participating in group discussions and activities to promote critical thinking and reflection. The different groups taking classes were taught during weekdays for 3 hours per week over 18 weeks, with the subject being divided into four blocks, covering ten main topics.

During the class, a mixed approach (theoretical and practical) was applied in addition to presentations by the lecturer. The students carried out exercises, research projects, and activities outside the classroom focused on generating the

basic skills and abilities to apply the knowledge learned in class to sustainability projects in their professional lives. The lectures and presentations given by the instructors covered a wide range of topics within the sustainability scope. Table 1 below presents the relationship between the theoretical notions and the course topics.

The research hypotheses tested in this research were:
- H1. The modified program increases reflexivity and helps identify justifications (i.e., reduces Functional Stupidity (FS1)).
- H2. The modified programme supports substantive reasoning development (i.e., reduces Functional Stupidity (FS2)).
- H3. The modified programme increases understanding and appreciation of complexity.
- H4. The modified programme strengthens adherence to the New Ecological Paradigm.
- H5. The modified programme results in a more positive attitude about Sustainable Business Practices.

All hypotheses were tested using a two-tailed dependent t-test with a confidence level of $p \leq 0.01$. STATISTICA software was used for the statistical analysis.

Table 1. Relationship between elements analysed in the questionnaire and the topics provided in the subject

Block	Topic	FS1	NEP	ATSBP	FS2	COM
Block 1: Research, engineering, and sustainability	1. Introduction to sustainability		X	X		X
	2. History of sustainable development		X			
	3. Sustainable development, Limits to Growth and Agenda 21	X		X		X
	4. Population, Economy, and Sustainable Development Goals	X	X	X		X
Block 2: Dissemination and awareness	5. Education for sustainable development		X		X	
	6. Energy efficiency and sustainability			X	X	X
	7. Environmental management systems and Sustainability management systems			X	X	
Block 3: Production systems and life cycle	8. Industrial ecology and product life cycle			X	X	X
	9. Cleaner production and pollution prevention			X	X	
	10. Industrial Safety and Hygiene and Civil Protection	X		X		
Block 4: Biannual event	11. Practical and fieldwork	-	-	-	-	-

FS1 = Functional Stupidity (reflexivity, justification); NEP = New Ecological Paradigm; ATSBP = Attitude Towards Sustainable Business Practices; FS2 = Functional Stupidity (substantive reasoning); COM – Complexity

Results

In Table 2, the results of the surveys are presented. A higher score on the individual variables (indicating an improved understanding of sustainable development) could be positive. Reflexivity and justification (FS1), as well as substantive reasoning (FS2) (the last identifying the perceptions towards non-linear effects of Black Swans), were at a medium level. While FS1 does not change, the post-programme modification questionnaire shows that students' appreciation of the importance of Black Swans and their non-linear impact tended to increase. This is related to system thinking, appreciating increasing complexity in a globalising world, where innovations can lead to different rebound effects with outcomes contrary to the aim of the invention. The increase of the mean from 3.10 to 3.65 can be interpreted as a change from a relatively neutral perception of complexity to an appreciation of the importance of this topic in the sustainability discourse.

Table 2. Research outcome

Scale	Likert-item scale	Hypothesis	Result	Mean (pre)	Mean (post)	t	p
FS1 (reflexivity, justification)	1-5	H1. Teaching intervention increases reflexivity and justification.	Rejected	3.83	3.85	0.513	.61
FS2 (substantive reasoning)	1-5	H2. Teaching intervention substantive reasoning.	Confirmed	3.70	4.01	7.015	< .001
Complexity (system thinking)	1-5	H3. Teaching intervention supports appreciation of complexity.	Confirmed	3.10	3.65	13.504	< .001
NEP (New Ecological Paradigm)	1-5	H4. Teaching intervention strengthens adherence to the New Ecological Paradigm.	Rejected	3.76	3.72	-1.406	.06
ATSBP (Attitude Towards Sustainable Business Practices)	1-7	H5. Teaching intervention makes the Attitude Towards Sustainable Business Practices more positive.	Confirmed	5.87	5.92	3.632	<.001

Adherence to the New Ecological Paradigm before the programme modification could be considered to be medium-high (a mean of 5.87 in the pre-modification test on a scale from 1 to 7); however, the increase after the programme (mean of 5.92 in the post-modification test) is significant and helps bolster the conclusion that the student profile seemed to be suitable for companies engaged in corporate social responsibility. Analysis of the individual responses shows that one of the four items on this topic accounted for this: "I believe environmental sustainability business practices will help organisations achieve their goals and

obtain (financial) benefits". While appreciation of going beyond short-term win-win situations remained at the same high level, this "business case for sustainable development" gained appreciation. This may result from the fact that engineers tend to focus on technological solutions for different types of problems that may be attractive from the business point of view.

Hypothesis H1 posited that the modified teaching program would increase appreciation of reflexivity and justification, thereby reducing Functional Stupidity. This hypothesis was rejected based on our study findings.

Hypothesis H2 suggested that the modified program supports the development of substantive reasoning, there by reducing Functional Stupidity (FS2). The study's findings affirm this hypothesis, indicating a significant enhancement in the students' understanding of the need for deep, critical thinking and understanding of complex issues.

Hypothesis H3 posited that the modified program increases understanding and appreciation of complexity. This hypothesis was confirmed by the study results, demonstrating an increased awareness among students of the complex, dynamic aspects of sustainable development. The findings underscore the program's success in enriching students' comprehension of ecological, economic, and social interdependencies.

Hypothesis H4 asserted that the modified program strengthens adherence to the New Ecological Paradigm (NEP). Contrary to this assumption, the hypothesis was rejected as the study did not observe a significant increase in adherence to NEP principles. This outcome may indicate that fostering a deeper understanding and commitment to NEP values requires more nuanced and engaging educational strategies, like with FS1.

Hypothesis H5 proposed that the modified program produces a more positive attitude towards Sustainable Business Practices. Although the mood was already positive, the study confirmed this hypothesis, showing that participants exhibited a more favourable stance toward business practices aligned with sustainable development principles. This reflects the program's effectiveness in shaping pro-environmental attitudes and enhancing awareness of the necessity to integrate sustainability into business operations.

Discussion

The rejection of hypotheses 1 and 4, that the teaching intervention increases the appreciation for reflexivity and justification and the appreciation for the NEP, has a few implications. These results confirm an earlier study on the impact of a teaching intervention in Poland (Platje et al., 2019, 2022b). The level of appreciation of reflective thinking was already high before the teaching intervention. Enhancement of reflective thinking may be considered in future program development. This may be more important than a change in pro-environmental atti-

tudes embraced in the NEP. Adherence to the NEP was already high, and the Attitudes to Sustainable Business practices were quite positive. Worldviews are often deeply ingrained in the way of thinking and are difficult to change (Beck, 2018). People need at least two to five new observations to change their view (Edwards, 1982). While the transformative impact of environmental education may be significant in the face of different challenges in sustainable development (Ruiz-Mallén et al., 2022), one needs to be careful when trying to change ways of thinking, as this may go different ways. According to neuroscientists, worldviews are often a mix of contradictory views, which prevent fundamentalistic thinking and enable change of ideas (Beck, 2018). Human behaviour and ways of thinking are influenced by various cultural, genetic, and neurological factors (Sapolsky, 2023). Appreciation of complexity (Sterman, 2000) and non-linearity (Lambrechts et al., 2018) and understanding cognitive biases (Ha, 2016) may be more relevant than changing mindsets. The confirmation of hypothesis 2 that the teaching intervention impacts the appreciation of substantive reasoning may indicate that the existing program possesses the potential for more intensively developing analytical skills and fostering a substantial reasoning approach for addressing sustainability challenges. The findings, showing a significant increase in students' appreciation of complexity, confirm the effect of an earlier study by some authors on the impact of a teaching intervention (Platje et al., 2019). However, as Olsson et al. (2022) argue, practical education for sustainable development issues takes time.

Of course, the results need to be interpreted with care, as they concern a case study in a specific environment. This study was meant to develop furtherearlier studies (Platje et al., 2019, 2022b), and future studies are required to measure the impact of teaching interventions for sustainable development.

Conclusions

The teaching interventions implemented in the sustainability in engineering course effectively shaped students' perceptions of vulnerability and complexity in the sustainability discourse. The observed positive shifts in appreciation for complexity and strengthened adherence to environmentally sustainable practices highlight the potential of educational interventions to mould future professionals with a robust understanding of and commitment to sustainable development.

The results of this case study provide valuable insights into the effectiveness of the programme modification in enhancing students' perceptions regarding vulnerabilities, system thinking, worldviews and cognitive processes, which areessential for information processing and gaining knowledge. While worldviews as such are unlikely to change in a short time (confirming similar research of Platje et al. (2019)), the greater appreciation of vulnerabilities and non-linear

collapse scenarios may be an essential step towards creating the basis for more sustainable societies or organisationsand thus help prevent collapse scenarios.

Much of the discourse on sustainability in higher education is focused on intervention and innovation. The results of the current study suggest that it may be more essential to redirect the address to what not to do and what to abstain from (Taleb, 2012), thus preventing rebound effects in complex systems which would lead to outcomes opposite of the ones intended as understanding collapse scenarios is part of avoiding such methods becoming a reality.

The contribution of the authors

Conception and literature review, D.S.Z.Q., J.P., A.B., Y.v.D. and M.W.; analysis of data, M.C.; acquisition of data, D.S.Z.Q.; interpretation of data and proofreading, D.S.Z.Q., J.P., A.B., M.C., Y.v.D. and M.W.

Estimated contribution shares: D.S.Z.Q. – 25%, J.P. – 25%, A.B. – 10%, M.C. – 15%, Y.v.D. – 15%, M.W. – 10%.

The authors have read and agreed to the published version of the manuscript.

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ANNEX

Table 1. Survey questions

Scale	No. of items	Cron-bach's α	Questions
FS1 (reflexivity, justification) 5 items	5-point Likert-item scale (from totally unproblematic to very problematic).	.711	1. Mistakes are not discussed. 2. It is impossible to doubt or criticize management decisions. 3. Changes in the rules are not openly discussed. 4. Management does not provide reasons and explanations for their decisions. 5. People do not provide feedback to other people.
FS2 (substantive reasoning) 4 items	5-point Likert-item scale (questions 1 and 2 – from totally unproblematic to very problematic; questions 3 and 4 from totally disagree to totally agree).	.352	1. Threats to the companies' existence which are difficult to quantify are ignored. 2. Low probability threats are ignored. 3. An organization should take unlikely disasters into consideration in crisis management. 4. Organizations can neglect low probability threats in their risk management.
Complexity (system thinking) 4 items	5-point Likert-item scale (from totally disagree to totally agree).	.100	1. The world increases in complexity so fast, that increase in knowledge cannot keep up. 16. Innovations making management more complex. 41. It is not a problem when the innovations of an organization make the management more complex.
NEP (New Ecological Paradigm) 15 items	5-point Likert-item scale (from totally disagree to totally agree). New ecological paradigm scale items (+) agreement means a pro-new ecological paradigm attitude. Questions are numbered according to the original scale.		The fragility of nature's balance 3. When humans interfere with nature it often produces disastrous consequences (+). 8. The balance of nature is strong enough to cope with the impacts of modern industrial nations (–). 13. The balance of nature is very delicate and easily upset (+). Possibility of an ecocrisis 5. Humans are severely abusing the environment (+). 10. The so-called "ecological crisis" facing humankind has been greatly exaggerated (–). 15. If things continue their present course, we will soon experience a major ecological catastrophe (+). Rejection of exemptionalism 4. Human ingenuity will ensure that we do not make the Earth unlivable (–). 9. Despite their special abilities' humans are still subject to the laws of nature (+). 14. Humans will eventually learn enough about how nature works to be able to control it (-). Limits to growth (ecological worldview) 1. We are approaching the limit of the number of people the Earth can support (+). 6. The Earth has plenty of natural resources if we just learn how to develop them (–). 11. The Earth is like a spaceship with very limited room and resources (+).

Scale	No. of items	Cronbach's α	Questions
NEP (New Ecological Paradigm) 15 items		.579	Anti-anthropocentrism 2. Humans have the right to modify the natural environment to suits their needs (−). 7. Plants and animals have as much right as human to exist (+). 12. Humans are meant to rule over the rest of nature (−) (Q28).
ATSBP* (Attitudes Towards Sustainable Business Practices Four items	7-point Likert-Item scale (from totally disagree to totally agree).	.464	1. I believe environmental sustainability business practices will help organizations achieve their goals and obtain (financial) benefits. 2. I believe environmental sustainability business practice is the "right thing" to do, regardless of its pragmatic utility (benefits) to the organization. 3. Environmental concerns should be important to executives when companies develop and implement their strategies. 4. A company's effort to reduce its environmental impact should go beyond what the law requires even if profits might be reduced.

Source: see text; *questions by courtesy of the scale authors (FS1, FS2, complexity – authors' own elaboration)

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NOWY PARADYGMAT EKOLOGICZNY I POSTAWY WOBEC PRAKTYK ZRÓWNOWAŻONEGO BIZNESU – PRZYKŁAD MEKSYKU

STRESZCZENIE: Celem badania była ocena wpływu interwencji dydaktycznych na postrzeganie zrównoważonego rozwoju przez studentów. Dotychczasowe badania wskazują, że realizowane programy kształcenia nie prowadzą do nabywania przez studentów odpowiedniego, kompleksowego podejścia do ograniczania ryzyka katastrofy. W badaniu zastosowano interwencję dydaktyczną w formie wykładów, dyskusji, ćwiczeń, projektów badawczych i działań prowadzonych przez doświadczonych nauczycieli i ekspertów. Interwencje miały na celu podniesienie świadomości i zrozumienia natury zrównoważonego rozwoju i jego złożoności. Wyniki pokazały, że program nauczania zwiększył uznanie uczniów dla znaczenia złożoności i nieliniowego wpływu Czarnych Łabędzi w dyskursie na temat zrównoważonego rozwoju, bez zmiany ich przywiązania do Nowego Paradygmatu Ekologicznego. Badanie podkreśla potrzebę edukacji umożliwiającej studentom radzenie sobie z problemami charakteryzującymi się złożonością i niepewnością oraz zdarzeniami o małym prawdopodobieństwie i dużym wpływie, które stanowią nieliniowe zagrożenie dla zrównoważonego rozwoju.

SŁOWA KLUCZOWE: interwencja dydaktyczna, zrównoważony rozwój, katastrofa, nowy paradygmat ekologiczny