Perceptions, Knowledge, and Teaching of Climate Change and Natural Disaster Risk at Honduran Universities

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The objective of the study was to examine perceptions, knowledge, and teaching of climate change and natural disaster risk of 457 faculty members of Honduran universities. In the last 20 years, Honduras has been among the countries with the highest vulnerability due to climate change. The tool RISKPERCEP was used to calculate perception of natural disasters, climate vulnerability, social vulnerability, and disaster response. The results showed that the teachers interviewed evaluated risk with an overall perception of 2.06. They tended to overestimate the variables: imminence, catastrophism, exposure, role of the media, involvement, and history. They underestimated risk for organizational climate, risk comprehension, uncertainty, and familiarity. Overall, 59% of the teachers interviewed did not teach the topics examined here. But they perceived their knowledge was adequate, even though more than 60% of the informers had not received formal training on climate change or natural disaster risk. The results reveal the importance of strengthening the knowledge and applied research of Honduran university professors on climate change and natural disaster risk.

Keywords: climate change, environmental education, risk perception, management

INTRODUCTION

Climate change is defined as "change in climate directly or indirectly attributed to human activity that alters the composition of the global atmosphere and adds to the natural climate variability observed over comparable periods" (IPCC, 2014). Climate change has ceased to be a scientific myth to become one of society's greatest challenges, as it can not only cause disasters, but also amplify their impacts, as is happening in Honduras. The planet is in danger, the scientific community considers this era as a planetary emergency (IPCC, 2013). According to the Intergovernmental Panel on Climate Change (IPCC) for its Spanish acronym), human activity is responsible for global warming, which, since the 1950s has been unprecedented in recent decades to millennia (IPCC, 2013).

The continuing emission of greenhouse gases (GHGs) will cause further warming and alterations in the climate system, resulting in a probability of severe impacts on people and ecosystems (IPCC, 2013, IPCC, 2014). Perceptions of climate change and associated risk depend on people interpretations, which vary by country, geography, and culture (Lee et al., 2015), gender, socioeconomic status (Ibarrarán et al., 2014) and exposure to public and scientific information (Lorenzoni and Pidgeon, 2006). Little research has taken place

in Honduras, a country highly vulnerable to climate change and the risk of natural disasters, to know how the university faculty gets ready to face this issue is preparing for and facing the problem. Risk in this context refers to the likelihood that a climate hazard will turn into become a disaster. Integrated disaster risk management (ISDR IDRM) identifies vulnerabilities to hazards and acts to prevent them or to manage the impact when disaster is unavoidable. In Honduras, the IDRM theory is not transversalized in the study programs of the universities, so that the actions mentioned by Gutiérrez and Sánchez (2018): accept, mitigate, transfer and avoid, flow as general knowledge in the careers.

In recent years, Central America and the Caribbean have experienced extreme weather events. In 1998, Hurricane Mitch caused death and infrastructure damage in Central America, mostly in Honduras. Climate change impacts Honduras due to its geographic location (a corridor between two oceans), level of development (under), and little or no training of the population in disaster prevention and response. According to the Germanwatch Climate Risk Index, Honduras ranked first between 1997 and 2016 along with Haiti and Burma Myanmar among the countries most affected by extreme weather events (Eckstein et al., 2018). Developing countries are known to be most affected by climate change, due to their social and economic vulnerability (Eckstein et al., 2018), less contact with scientific information (Lee et al., 2015) and lower response capacity due to their high individual and collective vulnerability (Ibarrarán et al., 2014).

Efforts to address climate change focus on adaptation and mitigation. Mitigation is mainly targeted towards reducing GHGs or enhancing sinks (IPCC, 2014). There is a global consensus regarding the reduction of emissions, although it is not yet reflected in major actions (Hamin and Gurran, 2009). Adaptation to climate change is the process of adjusting to climate through initiatives that reduce the vulnerability of the environment and people (IPCC, 2013). The lack of climate information, impact and vulnerability studies, knowledge gaps and confusions represent the greatest barriers to achieving adaptation (Hamin, 2009; Meira-Cartea and Arto-Blanco, 2014; Taylor et al., 2014). The IPCC recognizes the role of universities in reducing vulnerability through reduction teaching and training (IPCC, 2014). Environmental education in the university system can influence the new professionals to become involved in social, economic and technological responses related to climate change and disaster risk management (Meira-Cartea and Arto-Blanco, 2014; Solis-Espallargas and Barreto-Tovar 2020; Xavier et al., 2016). Universities play a key role in meeting the 2030 agenda for sustainable development (Olaguez et al., 2019). That role demands multidisciplinary preparation given the growing demand for new professionals with disaster risk management skills (Henderson et al., 2017; Xavier et al., 2016).

Educational vulnerability as part of climate risk analysis and as an assessment of the absence of school programs and cross-cutting thematic axis in the educational curriculum (Xavier et al., 2016) is high in Honduras. In the context of this study, it relates to the absent or scarce academic training of faculty, even though, in several studies, education is the strongest predictor of public awareness of climate change and disaster risk globally (Lee et al., 2015). The risk due to climate disasters in Honduras is considered high (Eckstein et al., 2018), not only because of events frequency, but also because of the scarce preparedness, prevention, and response of the population. In most universities, the teaching of integrated disaster risk management (IDRM) is absent or scattered in few courses in certain careers.

According to the social construction of vulnerability, everyone perceives and manages risk at a personal and global level (Lorenzoni and Pidgeon, 2006). Social, physical, and economic issues influence the degree and type of vulnerability faced by men and women (Soares and Murillo-Licea, 2013), regardless of whether they are university professors or not. The perception of risk varies according to culture, place, country, the scientific conceptualization that the person handles and history of exposure to risk (Taylor et al., 2014). The psychometric paradigm (Prades and Gonzalez, 1999) used for the study of risk perception in this research considers in the assessment factors of individual nature, physical nature of the risk, and risk management. It is clear that a population with cultural patterns of adherence to their place of residence undervalues the risks associated with their environment, since the prediction and management of natural phenomena becomes part of their socio-environmental psychology. This becomes a historical and temporal factor, the former because it represents the community's experience in dealing with adverse environmental factors and the latter because it is framed in certain seasons or times of the year (Muñoz-Duque and Arroyave, 2017). The vulnerability to climate change may increases poverty, which has an impact on

people's response to risk events (Ibarrarán et al., 2014). But it is also clear that training in risk management can help reduce that vulnerability (Xavier, 2016).

Knowledge creation is based on individuals' epistemological beliefs, those beliefs are not always scientifically correct (Beck et al., 2013; Cajigal et al., 2016; Taylor, et al., 2014). In general, there is a perceived limited knowledge of the population regarding the causes and solutions to climate change (Oltra et al., 2009), which includes the segment of university teachers, especially those who do not have any training in the environmental or natural sciences. Several studies confirm a self-perception of teachers with deficiencies in environmental knowledge; limited availability of teaching tools on the subject and little research (Domenech-Casal, 2014; García-Rodeja and Lima, 2012; Saidón and Claverie, 2016). There is also little or confused knowledge of teachers and students concerning climate change and disaster risk management (Cajigal et al., 2016; Dal, et al., 2014; Meira-Cartea and Arto-Blanco, 2014; Saidón and Claverie, 2016). This global view was also perceived by university faculty in Honduras before this study, in part because no major training initiatives related to climate change and IDRM were identified.

The way society adapts to climate change is determined by: "the understanding of values, beliefs, perceptions and norms" (Oltra et al., 2009; Gasparetto, et al., 2018). O'Connor et al. (1999) verified that risk perceptions influence people's behavioral intentions. However, in several studies, most people report difficulty relating the impact of climate change to aspects of their daily lives (Torres et al., 2017). The perception of climate change as a problem without a solution can cause a feeling of disinterest and ineffectiveness at the personal level. Some studies suggest that people react, when what happens in the environment threatens their assets and they believe that their actions contribute to recovering the situation or stopping the threat (Gasparetto, et al., 2018). Seroussi et al., (2019), highlight three categories of learning about socio-environmental issues, such as climate change: the first is knowledge, the second is belief, and the third is attitude. In this sense, universities can contribute with knowledge in the response to how Honduras adapts to climate change.

Most hondurans assumes a risk under a subjective immunity, in which the probability of daily dangers is minimized, avoiding the perception of highly probable risks, as proven in Cuba by Dr. Antonio Torres and others in the last decade. Oltra et al., (2009) helps to understand that assumption of the indifference in the current population with the fact that major impacts may occur in 30, 50 or 100 years. Although global warming is a common term, public awareness to address climate change is considered low (Norton and Leaman, 2004). Skepticism about climate change and associated disaster risk also includes universities because of limited action in teaching, research and operational involvement (Leal, et al., 2019). In the Honduran case, the inclusion of the topic of climate change and disaster risk has been promoted mostly by international development cooperation agencies, and not as an endogenous action from the universities.

The IPCC recognizes a primary role of people and their knowledge in adaptation as part of the risk management process (IPCC, 2014). Increasing environmental awareness and action for climate and disaster prevention requires greater communication and education initiatives (Leal et al., 2019; Lee et al., 2015) directed towards values and attitudes (Parker and Muñoz, 2012). Strengthening environmental education through the curricular inclusion of climate change and disaster risk management is essential (Parker and Muñoz, 2012). The actions of universities are fundamental for the implementation of the 2030 agenda that seeks sustainable development. The involvement of universities as learning, research, innovation, and extension centers must go beyond eco-efficient buildings and green campuses; climate change and disaster risk management should be part of the curricular offerings (Beck et al., 2013; Leal et al., 2019; Reid, A.,(2019). Institutional policies in response to climate change will strengthen the universities' role (Henderson, et al., 2017). Even though the production of climate information in Central America is perceived to be increasing, in Honduras, technical capacity building from universities is insufficient. There is still a certain skepticism among professors regarding the subject reflected in absence of this topic in most of the academic programs, and the creation of networks and alliances between universities, companies and society require strengthening, and sustainability.

The 20 Honduran universities (six public and 14 private) are part of the Interinstitutional Committee of Universities in Environmental Sciences of Honduras (CICA) and the Honduran Network of Universities of Latin America and the Caribbean for Disaster Risk Reduction (REDULAC-RRD). There are pioneering

experiences of curricular review on Climate Change Adaptation (CCA) and IDRM, such as: Zamorano University, National Pedagogical University Francisco Morazán, National Autonomous University of Honduras and Metropolitan University. The support of international cooperation agencies such as the Swiss Agency for Development and Cooperation (SDC) has been central in strengthening the Honduran university academy to initiate actions for adding these topics in the curricula. In 2019, CICA submitted a formal request to the Honduran Directorate of Higher Education for adding of climate change and IDRM as a new undergraduate university core courses.

Despite the initiatives, both topics are perceived to be absent in general education systems in Honduras, with few pilot projects initiatives among few universities. Knowing how Honduran university teachers perceive and teach climate change and disaster risk is key in order to promote a national educational strengthening plan on the subject. This study took as reference a characterization of knowledge and risk perception about climate change in the network of Cuban schools associated with UNESCO (Torres, et al., 2017). The purpose of the research was to analyze the perceptions, knowledge and teaching of climate change and disaster risk management of teachers at the undergraduate level in Honduran universities.

METHODOLOGY

The study involved 457 undergraduate professors from 12 Honduran universities, who voluntarily responded to an online survey. Considering that risk perception is a subjective measure, we sought a program that would allow us to quantify this subjectivity. In other words, it would allow to adapt the qualities of perception to quantities. The computer tool RISKPERCEP version 2.0, provided by Dr. Antonio Torres of the University of Havana, was used for this purpose. The variables analyzed in the study by Torres et al., (2017) provided the basis for the current study (Table 1).

The variables were classified into three types taking as reference the study in Cuba by Torres, et al., (2017): those that relate to the person (Individual), ii) those that relate to the nature of the risk or physical risk (Nature) and iii) those that relate to the management of the risk (Management) . Based on this study, the behavior of the variables is known in advance. For example, the catastrophic potential, the panic generated and the immediacy of the consequences behave in a way that is directly proportional to the perception. Others such as familiarity, capacity of control and reversibility act inversely. The risk comprehension variable shows extreme behavior, indicating that it is underestimated by experts and by non-specialists on the subject.

The RISKPERCEP program calculates an average of the data in each question corresponding to a specific variable. For this purpose, it uses ordinal qualitative values, to which it assigns numerical values of 1, 2 or 3 depending on the response. The questions with closed characteristics comprised responses ordered unidirectionally on three scales. This made it possible to achieve a correlation with the associated risk perception scale of three levels, where 1 means underestimation of the risk, 3 overestimation, and 2 being the adequate estimation. The foregoing applies to questions that evolve directly to the associated perception. When variables evolve differently, the program makes adjustments for its consideration (Torres et al., 2017).

Responses were collected through the Survey Monkey platform, for subsequent analysis using IBM SPSS Statistics and Excel. The survey included 57 questions, including Likert-type and open-ended questions, 41 of which were used to calculate risk perception. The other questions were analyzed descriptively. The RISKPERCEP program calculates a non-statistical estimator called the Weighted Score, which represents a collective tendency towards a group opinion (Torres, et al., 2017). It also estimates the specific dispersions of each variable in relation to its Score value. Within the framework of the analysis methodology, the results of perception by variables are independent of each other. This approach is necessary because, although this dependence is recognized, it is impossible to quantify it without introducing a high degree of subjectivity into the study.

TABLE 1
RISK PERCEPTION VARIABLES ASSOCIATED WITH CLIMATE CHANGE

No.	Variable (CODE)	Behavior	Risk perception ratio	Type
1	Familiarity (FAMI)	Inverse	The greater the familiarity, the lower the risk perception	Individual
2	Risk comprehension (COM)	Extreme	High and/or low knowledge - lower perception	
3	Uncertainty (INCE)	Direct	The greater the uncertainty, the greater the perception	
4	Personal Involvement (INVO)	Direct	The greater the involvement, the greater the perception	
5	Controllability (CONT)	Inverse	The greater the controllability, the lower the perception	
6	Voluntariness (VOLU)	Inverse	The greater the voluntariness, the lower the perception	
7	Catastrophic potential (CATA)	Direct	The greater the potential, the greater the perception	Nature
8	Consequences immediacy (INME)	Direct	The greater the immediacy, the greater the perception	
9	Past accident history (HIST)	Direct	The more past history-the greater the perception	
10	Panic (PANI)	Direct	The greater the panic, the greater the perception	
11	Consequences reversibility (REVE)	Inverse	The higher the reversibility, the lower the perception	
12	Trust in Institutions (INST)	Direct	The greater the confidence, the greater the perception	Management
13	Benefits (BENE)	Inverse	The higher the benefits, the lower the perception	
14	Risk-Benefit Inequity (RI-B)	Direct	The greater the Risk-Benefit Inequity - the greater the perception	
15	Role of the media (PREN)	Direct	The better the role of the media - the greater the perception of risk.	
16	Organizational climate (CLIM)	Direct	The better the organizational climate regarding safety, the higher the perception of safety.	

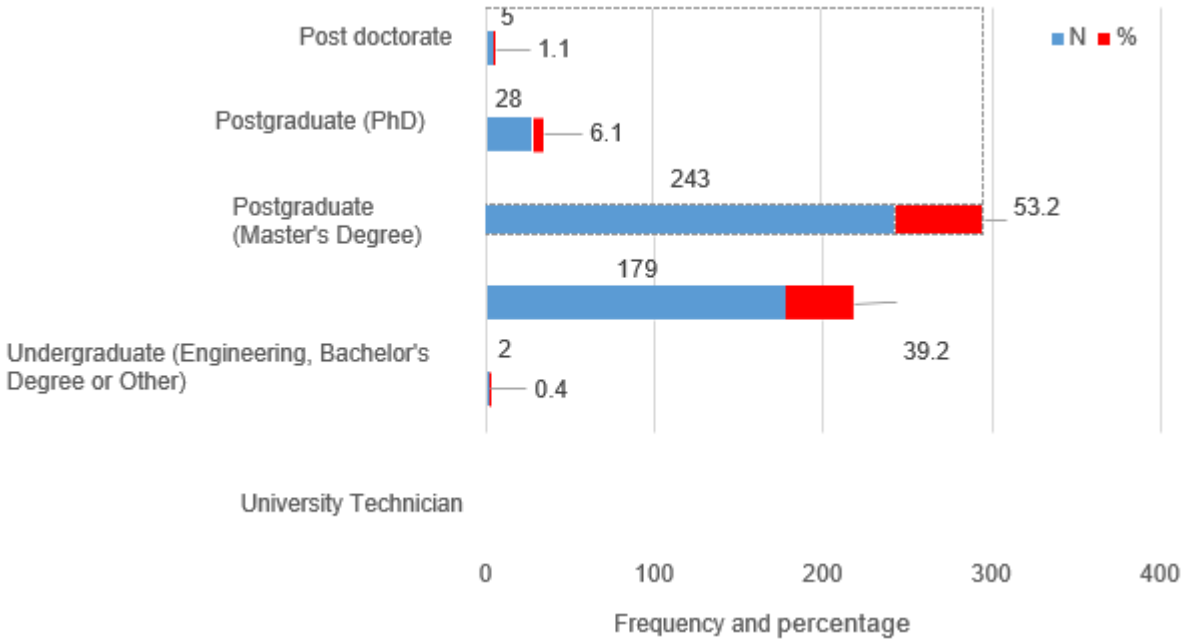
Source: adopted from Torres, et al., (2017).

RESULTS

457 informants responded the online survey. 52% of the informants (238) were male and 48% (219) were female. The informants came from twelve universities, 59% from public universities and 41% from private universities. The average age of the informants was 41 years old, with a minimum age of 24 years

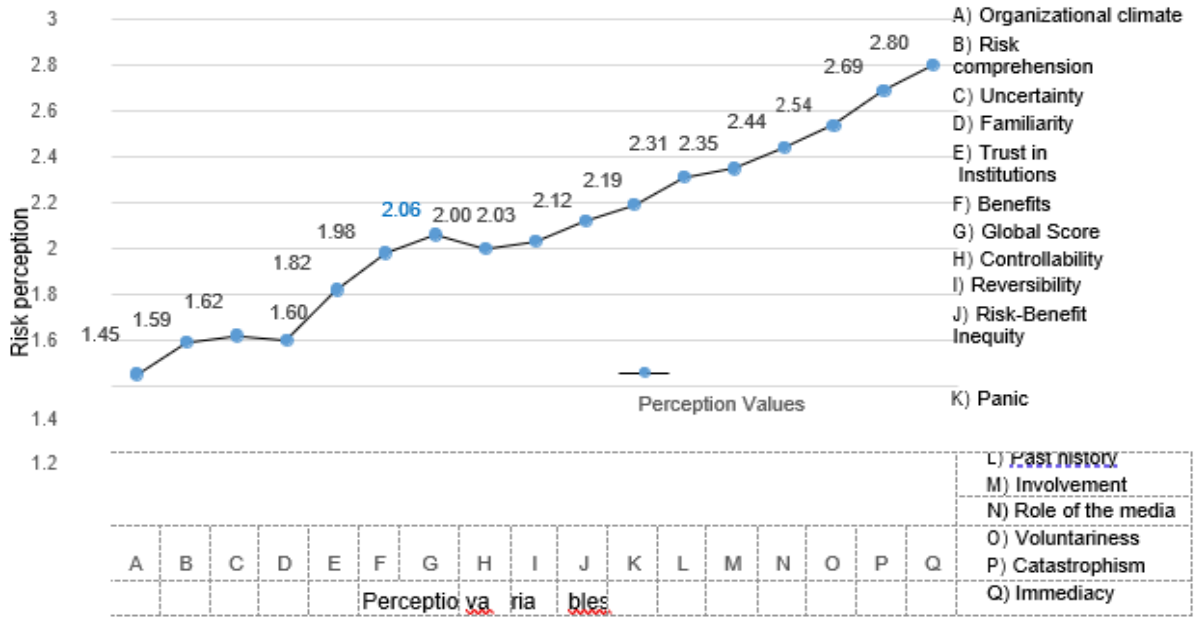
old and a maximum age of 67 years old. The informants had an average of 9.34 years of education, a mode of 2 years, a minimum of 1 year, a maximum of 33 years and a Standard Deviation of 7.55 years. 67% reported having between 10 or less years of teaching experience. 53% of survey respondents had a master's degree, followed by an undergraduate degree, either engineering or a bachelor's degree (39%). Only 6% had a PhD degree. Figure 1 shows the distribution of the informants' educational background.

FIGURE 1
ACADEMIC BACKGROUND OF INFORMANTS



The overall perception of risk for the group studied was 2.06 close to adequate (2.0), with a tendency to overestimate the variables: immediacy, catastrophism, voluntariness, role of the media, involvement and past history. Figure 2 shows the distribution of risk perception profiles. Underestimation was found for the variables: organizational climate, risk comprehension, uncertainty, and familiarity. Climate change knowledge was assessed through the variables uncertainty (INCE), risk comprehension (COMP), and organizational climate (CLIM). With a value of (2.80), teachers recognize that the risks of climate change are manifesting themselves quickly. 90% of teachers perceive that current natural disasters related to climate change will become more frequent in the coming decades and 77% believe that the impacts will manifest themselves in the short term. The majority of survey respondents rated the risks associated with climate change as catastrophic (2.69). With a score of 2.44, teachers negatively recognize the role of the media in providing scientific information on climate change and its consequences. The majority (64%) consider that the information provided to the public is poor or insufficient. Among the perception variables that reached the highest risk underestimation index (lowest estimate) were: Organizational climate (1.45), risk comprehension (1.59), Uncertainty (1.62) and Familiarity (1.60).

FIGURE 2
RISK PROFILE FOR PERCEPTION VARIABLES



In uncertainty (INCE), the perception of teachers regarding the origin of climate change and the phase of science on the subject was analyzed. With a value of 1.62, the underestimation from this point of view reflects an understanding that science's knowledge of the phenomenon is clear and there is confidence in the studies that have been done on the subject. 87% were correct in their response when considering that the origin of climate change is due to human activities and the result of natural climate variability. 21% consider that science is at an early stage of knowledge on the subject. There were 84% who consider that actions to mitigate and/or adapt to climate change should be connected to sustainable development strategies.

In risk comprehension (COMP), most teachers consider their level of preparation and knowledge as low. Similarly, they consider as low their level of preparation on methodologies and organizational aspects regarding the training of students in the subject. 77% of the informants coincide in their response about the concept of sustainable development. There were 19% who interpreted the concept as: "preserving the environment and preserving resources without alterations" and 4% as: "achieving continuous economic growth, without limitations in terms of volume or time, that satisfies the growing needs of human beings".

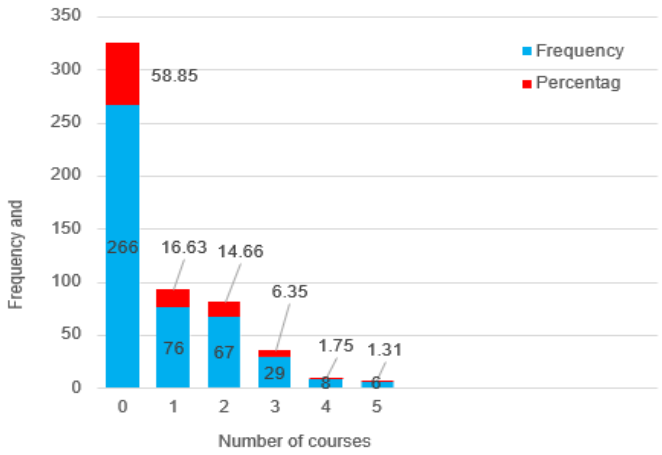
51% perceive their level of preparation and knowledge about climate change as adequate, while 43% consider it low. 54% rated as low or insufficient their preparation and knowledge of methodologies and organizational aspects that should be considered for the development of adaptation and mitigation work with students. In the organizational climate variable (CLIM), 62% of informants consider that the methodological preparation of teachers to address climate change, mitigation, and adaptation issues is low/insufficient (Table 2). This is partly attributed to the lack of interest of university institutions in the subject.

TABLE 2
LEVEL OF KNOWLEDGE AND PREPARATION ON CLIMATE CHANGE

Questions	In your opinion, how is your level of preparation and knowledge on climate change, mitigation, and adaptation issues?				In your opinion, how is your level of preparation and knowledge on climate change, mitigation and adaptation issues?	
Criterion	*Frequency*	*%*	*Frequency*	*%*	*Frequency*	*%*
Low/insufficient	198	43	245	54	285	62
Suitable	235	51	195	43	161	35
High/Rich	24	5	17		11	2
Total	457	100	457		457	100

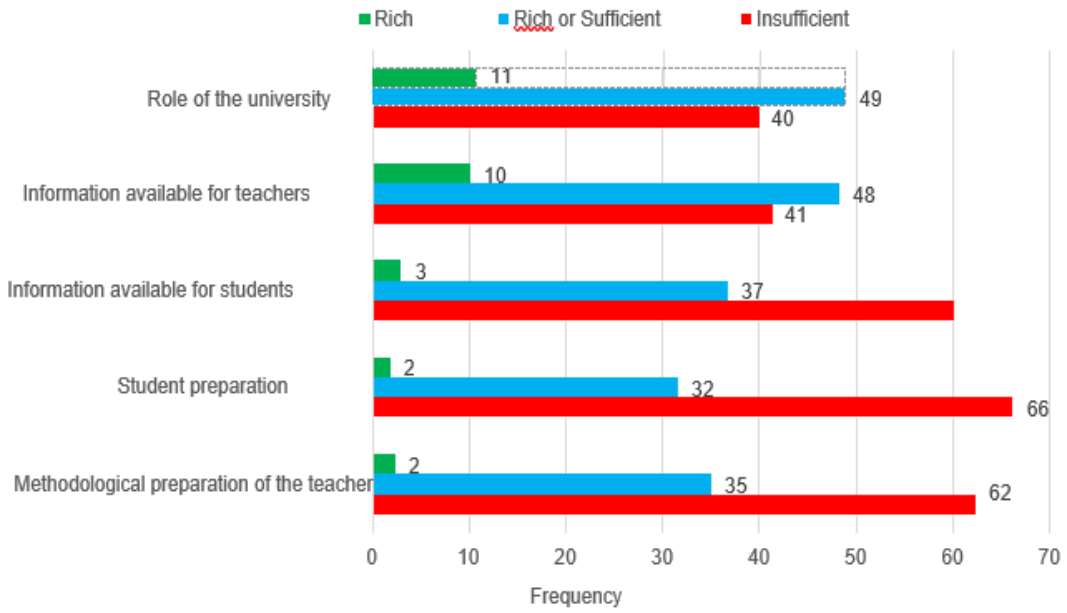
Half of the informants (50%) reported having attended short training events about climate change and 47% about disaster risk management. Training refers to attending short face-to-face courses, online courses, lectures, and forums on the subject. 61% of informants consider themselves up to date regarding the projected impacts of climate change, such as water availability decrease extinction of species, reduction of crop productivity, and the emergence of new diseases. On this subject, 35% reported having heard moderately about the impacts and only 4% did not know about them. There were 24% who reported knowing about other climate change cycles similar to the current one in Earth's history. This last aspect is consistent with the results of similar studies, which report limited knowledge and confusion about the causes and consequences (Oltra et al., 2009). In the study, 84% consider that there is a relationship between natural disasters that have occurred in recent decades, such as hurricanes, floods and/or droughts, and climate change. 41% of the teachers surveyed include climate change and disaster risk management in the courses they teach and 59% do not. Figure 3 shows the distribution of courses in which the subject studied is taught.

FIGURE 3
PERCENTAGE OF TEACHERS WHO INCLUDE CLIMATE CHANGE AND DISASTER RISK MANAGEMENT IN THEIR COURSES.



The professors indicated that when teaching their courses, they covered climate change and disaster risk management briefly, as part of other topics, research works, general presentations, but most of the time, they do not cover it under formal classes with specific content. When asked about the presence of sustainable development, adaptation and mitigation, climate change and environment in the undergraduate curriculum, 59% considered them insufficient. 62% of informants considered the level of teacher preparation as insufficient. 66% of teachers consider that student preparation is mostly insufficient. The information available on the subject for students is considered mostly insufficient by 60%, while 41% of the teachers consider the information available for teachers to be insufficient. Figure 4 shows aspects of the organizational climate and the information and preparation of teachers and students on the subject studied.

FIGURE 4
INFORMATION AND PREPARATION OF STUDENTS AND TEACHERS ON THE SUBJECT MATTER



Regarding academic research on climate change issues, only 17% have advised some research on climate change, while 9% have advised research on climate change and climate-related disaster risk management. Since the professors in the sample teach at the undergraduate level, it is worth mentioning that completing a thesis is not mandatory for the students in all Honduran universities. In the study, only three universities reported thesis work following the scientific method as mandatory: Zamorano University, National University of Forestry Sciences, and National University of Agriculture. The rest of the universities have other requirements, such as social practice reports, monographs, or special projects.

DISCUSSION

The results are in accord with conclusions generated in the Cuban study, which gave rise to this research (Torres et al., 2017) and with other studies (Lorenzoni and Pidgeon, 2006; Parker and Muñoz, 2012; Saidon and Claverie, 2016). Most of the informants in the study have advanced postgraduate studies; around 50% of the sample have received some degree of training in the subjects studied. The whole group is constantly receiving information from the media, aspects that help to understand the results obtained.

The tendency of the group to overestimate risk can be explained in part by their academic background, exposure to media, and participation in specific pilot projects activities promoted by some universities. The

variables with the highest risk overestimation index (PGx) were: Immediacy (2.80), Catastrophism (2.69), Voluntariness (2.54), Role of the Media (2.44) and Involvement (2.35). The results can be explained by the following reasons:

Immediacy

The value of 2.80 for immediacy reflects an improvement in the degree of exposure of informants to information on climate change. According to Lee et al., (2015), worldwide public opinion studies for 2007-2008 reflected that developed countries such as the United States, Europe, and Japan showed above 90% awareness of climate change, contrary to developing countries (Egypt, Bangladesh, Nigeria, and India) where above 65% were not aware. The perceived immediacy has changed over the last decade, as a result of the occurrence of extreme weather events, personal experience, and risk exposure history in weather disaster events (Taylor et al., 2016).

Catastrophism

The classification of events associated with climate change as catastrophic by the group, may be attributable in part to the previous experience with Hurricane Mitch, which was large and highly catastrophic, with deaths and missing persons in Central America. In addition, frequent weather phenomena, such as tropical storms, cause severe damage and deaths due to weak infrastructure, prevention and disaster risk management in the country.

Voluntariness

Voluntariness reflects the degree of the teacher's decision as to whether or not to expose him/herself to risk. The risk is imposed and beyond his/her control. In this case, teachers have no decision to expose themselves to the risk of climate change. They consider that they and their family feel directly affected by climate change and diseases attributed to climate change. The fact that Honduras has been listed for 20 years along with Haiti and Myanmar as the countries with the highest vulnerability to climate change in the world (Eckstein et al., 2018), may explain the overestimation of this variable.

Role of the Media

The media plays a important role in the information teachers receive about climate change. A study in Veracruz found that 43% of teachers interviewed knew relatively little about climate change, while 93% recognized the media as the main source of knowledge. Media information is having an increasing impact on the population (Domenech-Casal, 2014). Media information provides basic information but does not achieve a deeper understanding (Saidón and Claverie, 2016), which is necessary for critical and transformative learning. The erroneous linkage between ozone depletion and climate change, as well as the idea of a lack of scientific consensus, is linked to press reporting (Meira-Cartea and Arto-Blanco, 2014).

Involvement

This variable (2.35), relates to the degree to which the teacher or his/her family feels exposed and/or affected by climate change. The uncertainty in the face of natural disasters and the lack of preparation in risk prevention, as well as exposure to situations such as diseases, heat waves, etc., influence overestimation. The history of exposure to climatic events and disasters also influences the overestimation.

Organizational Climate

Teachers underestimate risk (1.45), recognizing the deficient management of disaster risks associated with climate change by their universities. The presence of topics related to climate change (adaptation and mitigation), disaster risk and sustainable development was considered insufficient. The same applies to the methodological preparation of teachers, the information available to students and teachers, as well as the role of the university in general in carrying out work related to the subject. Higher education public policies can help reduce the disaster risk vulnerability of the population (Ibarrarán, et al., 2014, Henderson et al., 2017). The Honduran university system, is not preparing the growing demand for new professionals under

a multidisciplinary approach that includes climate change and disaster risk management skills (Henderson et al., 2017; Xavier et al., 2016).

Uncertainty

Teachers understand that scientifically the origin of climate change is due to both human activities and natural climate variability. The fact that the main impact occurs 30 or 100 years later may also be a cause of uncertainty (Oltra et al., 2009).

Risk Comprehension

The value of 1.59 reflects little knowledge regarding the topics contained in the questions about climate change. In their global study (Lee et al., 2015) confirm that education was a common factor among countries, especially in the United States and China, in predicting climate change awareness. Several studies in different countries confirm this result, through a self-perception of teachers with poor knowledge, limited availability of teaching tools, and little or no research (Cajigal et al., 2016; Dal, et al., 2014; Domenech-Casal, 2014; García-Rodeja and Lima, 2012; Meira- Cartea and Arto-Blanco, 2014; Saidón and Claverie, 2016).

Familiarity

The value of 1.60 indicates an underestimation of risk due to familiarity. In this case, familiarity is partly explained by the perception of the majority (46%) that they sometimes reside in areas frequently affected by disasters, while 29% never reside in such areas. Hondurans link flooding, landslides, and drought to disasters, the frequency of which has intensified in recent years. 70% of teachers are familiar when hearing news weekly about climate change and its consequences.

The lack of formal or informal training in climate change and risk management issues for teachers will be reflected in the absence of specific courses and content in the classroom (Beck, et al., 2013). Several educators teach and do practices based on their intuition or what they learn from the media (Saidón and Claverie, 2016). Many universities offer the environmental education or environmental science course as an elective course and are mostly offered under the online course. In environmental education or environmental science courses, the topic of climate change may or may not be included. Students do not acquire knowledge, nor tools to find solutions to problems arising from climate change, as it corresponds to a constructivist model (Saidón and Claverie, 2016). This prevents students from being exposed to Basic Science Strategies in Inquiry (BSI), as proposed by (Domenech-Casal 2014) and which would elicit greater interest, meaningful learning, and engagement. Nor does it promote teaching in which knowledge influences beliefs, and this in turn influences pro-climate actions (Seroussi et al., 2019).

CONCLUSIONS

From the results obtained, the following conclusions can be drawn: 1) More than half of the teachers perceive their knowledge as adequate, they did not cover the topics in the courses they teach, and they have not received formal training. In Honduras there is no formal teacher updating program on these topics, so teachers find ways to inform themselves. Very little faculty participation in research was found as well as a perceived adequate to low knowledge of the faculty concerning the subject; 2) Teachers rate the risk in terms close to "adequate", with an overall perception of 2.06; with overestimation of the variables: immediacy, catastrophism, voluntariness, role of the media, involvement and past history, and underestimation of variables such as organizational climate, risk comprehension, uncertainty, and familiarity. This is in part due to low scientific knowledge about climate change, little or no training, lack of knowledge of methodologies and organizational aspects from universities; 3) There is a need to strengthen knowledge about climate change and disaster risk at the undergraduate level so that it could be reflected in classroom teaching, as well as in research and publications, in addition to disaster risk prevention initiatives, and 4) The Honduran university system needs to strengthen the knowledge of teachers and the supply of careers and programs that contribute with greater preponderance in damage

reduction, disaster risk mitigation, and reduction of vulnerability associated with climate change. A training plan for teachers, which allows rethinking curricula and careers and expanding them to include these two areas of knowledge of urgent teaching, research and liaison will help strengthen the Honduran university system in terms of climate change and disaster risk management.

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REFERENCES

Beck, A., Sinatra, G.M., & Lombardi, D. (2012). Leveraging higher-education instructors in the climate literacy effort: factors related to university faculty´s propensity to teach climate change. *International Journal of Climate Change: Impacts and Responses*, *4*(4), 1–17. ISSN: 1835-7156

Bellami, R., & Hulme, M. (2011). Beyond the tipping perception of abrupt climate change and their implications. *Weather, Climate and Society*, *3*(1), 48–60. https://doi.org/10.1175/2011WCAS1081.1

Cajigal, E., Maldonado, A., & González, E. (2016). Construcción de conocimiento y creencias epistemológicas sobre cambio climático en docentes de nivel primaria. De la vulnerabilidad a la resiliencia. *Revista Interamericana de Educación de Adultos*, *38*(2), 52–76. ISSN: 0188-8838

Dal, B., Ozturk, N., & otros cuatro autores. (2014). Perception of climate change: reasons, consequenses, and willigness to act. How aware are they? *International Journal for Cross-Disciplinary Subjects in Education*, *4*(2), 1930–1937. https://doi:10.20533/ijcdse.2042.6364.2014.0268

Domenech-Casal, J. (2014). Contextos de indagación y controversias socio-científicas para la enseñanza del cambio climático. *Enseñanzas de las Ciencias de la Tierra*, *22*(3), 287–296. ISSN: 1132-9157

Eckstein, D., Künzel, V., & Schäfer, L. (2019). *Global climate risk index 2018*. Germanwatch e.V. Bonn, Alemania.

García-Rodeja, I., & Lima, G. (2012). Sobre el cambio climático y el cambio de los modelos de pensamiento de los alumnus. *Enseñanza de las Ciencias*, *30*(3), 195–218. ISSN: 0212-4521

Gasparetto, M.I., Teixeira, D., & Roazzi, A. (2018). Knowledge and beliefs about climate change and the role of the Amazonian forest among university and high school students. *Ecopsychology*, *10*(2), 106–116. https://doi:10.1089/eco.2017.0050

Gutiérrez, Y.E., & Sánchez- Ortiz, A. (2018). Diseño de un modelo de gestión de riesgos basado en ISO 31.000:2012 para los procesos de docencia de pregrado en una universidad chilena. *Formación universitaria*, *11*(4), 15–32. https://doi:10.4067/S0718-50062018000400015

Hamin, E.M., & Gurran, N. (2009). Urban form and climate change: Balancing adaptation and mitigation in the U.S. and Australia. *Habitat International*, *33*, 238–245. doi:10.1016/j.habitatint.2008.10.005

Henderson, J., Bieler, A., & McKenzie, M. (2017). Climate change and the Canadian higher education system: an institutional policy analysis. *Canadian Journal of Higher Education*, *47*(1), 1–26. ISSN: 0316-1218

Ibarrarán, M.E., Reyes, M., & Altamirano, A. (2014). Adaptación al cambio climático como elemento de combate a la pobreza. *Región y Sociedad*, *26*(61), 5–50. ISSN: 1870-3925

IPCC, Pachauri, R.K., & Meyer, L.A. (Eds.). (2014). *Cambio Climático 2014: informe de síntesis*. Contribución de los grupos de trabajo I, II y III al quinto informe de evaluación del Grupo Intergubernamental de Expertos sobre el Cambio Cimático, IPCC, Ginebra, Suiza.

IPCC, Stocker, T.F., Qin, D., & otros 8 (Eds.). (2013). *Resumen para responsables de políticas, Cambio Climático 2013: Bases físicas*. Contribución del grupo de trabajo I al quinto informe de evaluación del Grupo Intergubernamental de Expertos sobre el Cambio Climático, Cambridge University Press, Reino Unido y Estados Unidos.

Leal, W.F., Mifsud, M., & otros cuatro autores. (2019). Climate change scepticism at universities: A global study. *Sustainability*, *11*(2981), 1–13. https://doi:10.3390/su11102981

Lee, T.M., Markowitz, E.M., & otros cuatro autores. (2015).Predictors of public climate change awareness and risk perceptions around the world. *Nature Climate Change*, *5*, 1014–1020. https://doi:10.1038/NCLIMATE2728

Lorenzoni, I., & Pidgeon, N.F. (2006). Public views on climate change: European and USA perspectives. *Climatic Change*, *77*, 73–95. https://doi:10.1007/s10584- 006-9072-z

Meira-Cartea, P.A., & Arto-Blanco, M. (2014). Representaciones del cambio climático en estudiantes universitarios en España: aportes para la educación y la comunicación. *Educar em Revista*, *3*, 15–33. https://doi:10.1590/0104-4060.38041

Muñoz-Duque, L.A., & Arroyave, O. (2017). Percepción del riesgo y apego al lugar en población expuesta a inundación: Un estudio comparative. *Pensamiento Psicológico*, *15*(2), 79–92. https://doi:10.11144/Javerianacali.PPSI15-2.pral

O´Connor, R.E., Bord, R.J., & Fisher, A. (1999). Risk perceptions, general environmental beliefs, and willingness to address climate change. *Risk Analysis*, *19*(3), 461–471. https://doi:10.1023/A:1007004813446

Olaguez, E., & Otros tres autores. (2019). Plan de acción a partir de la percepción en estudiantes de la universidad politécnica de Sinaloa ante el reciclaje de residuos sólidos y la educación Ambiental. *Formación Universitaria*, *12*(3), 3–14. http://dx.doi.org/10.4067/S0718-50062019000300003

Oltra, C., Solá, R., & Otros tres autores. (2009). Cambio climático: Percepciones y discursos públicos. *Prisma Social- Revista de Ciencias Sociales*, *2*, 1–23.

Parker, C., & Muñoz, J. (2012). Elites universitarias y cambio climático. *Ambiente y Sociedade*, *XV*(2), 195–218. https://doi:10.1590/S1414-753X2012000200011

Prades, A., & González, F. (1999). La percepción social del riesgo: Algo más que discrepancia Expertos-Público. *Nucleus*, (26), 1–12. ISSN 0864-084X

Reid, A. (2019). Climate change education and research: possibilities and potentials versus problems and perils? *Environmental Education Research*, *25*(6), 767–790. https://doi.org/10.1080/13504622.2019.1664075

Saidón, M., & Claverie, J. (2016). Percepciones de docentes y directores sobre los factores que promueven u obstaculizan la educación ambiental en escuelas del área metropolitana de Buenos Aires, Argentina. *Ciência & Educação*, *22*(4), 993–1012. https://doi:10.1590/1516-731320160040010

Seroussi, D.E., Rothschild, N., & otros tres autores. (2019). Teachers´ knowledge, beliefs and attitudes about climate change. *International Education Studies*, *12*(8), 33–45. https://doi:10.5539/ies.v12n8p33

Soares, D., & Murillo-Licea, D. (2013). Gestión de riesgo de desastres, género y cambio climático. Percepciones sociales en Yucatán, México. *Cuadernos de Desarrollo Rural*, *10*(72), 181–199. ISSN: 0122-1450

Solís-Espallargas, C., & Barreto-Tovar, C.H. (2020). La Visión de la educación ambiental de estudiantes de maestría en pedagogía en el marco de la catédra de la paz en Colombia. *Formación universitaria*, *13*(2), 153–166. https://dx.doi.org/10.4067/S0718-50062020000200153

Taylor, A.L., Dessai, S., & Bruine de Bruin, W. (2014). Public perception of climate risk and adaptation in the UK: A review of literature. *Climate Risk Management*, *4*(5), 1–16. https://doi.org/10.1016/j.crm.2014.09.001

Torres, A., Garea, B., & otros cuatro autores. (2017). Estudio de percepción de riesgo asociado al cambio climático en el sector educacional. *Revista Cubana de Salud y Trabajo*, *18*(1), 3–13.

Xavier, M., Camolesi, T., & otros cuatro autores. (2016). Adaptation to climate change and integration of disaster risk management in business education: A case study in fundação Getulio Vargas, Brazil. *AD-minister*, *28*, 91–126. https://doi:10.17230/ad-minister.28.5