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Article

Humanities and Social Sciences in Relation to Sustainable Development Goals and STEM Education

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Abstract: This article explores the question: How can the humanities and social sciences become key elements for the implementation of quality STEM (Science, Technology, Engineering, and Mathematics) education, providing students with the competencies required for a sustainable development agenda? To answer this question, the article seeks to (1) understand the elements that are common in STEM education, Education for Sustainable Development (ESD), and Humanities, Arts, and Social Sciences, (2) analyze these relationships in higher education, and (3) evaluate how to integrate them in a classroom. The article presents the experience of a course that explicitly seeks to integrate humanities and social sciences in a STEM-oriented institution of higher education. This discussion will be complemented by the analysis of survey data from two semesters, taken at the beginning and at the end of a course. This will help to discuss how the students shaped their perceptions about these topics and to what extent these perceptions were or were not changed by the course. Finally, the article proposes that the specific analysis of sustainable development goals (SDGs) and their targets are educational tools to help achieve interdisciplinarity in the classroom, but only if we help the students to see the relationship of these SDGs to their own lives and with their own careers.

Keywords: STEM; HASS; education for sustainable development; STI; sustainable development; interdisciplinarity; higher education

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1. Introduction

This article explores the question: How could the humanities and social sciences become key elements for the implementation of quality STEM education that provides students with the competencies required for a sustainable development agenda in line with the UN's sustainable development goals?

Specifically, the article seeks to (1) understand the elements that are common in STEM (Science, Technology, Engineering, and Mathematics) education, Education for Sustainable Development (ESD), and the Humanities, Arts, and Social Sciences (HASS) disciplines; (2) analyze these relationships in higher-education settings when dealing with a global sustainability challenge and its impact at the dimension of local everyday life; and, (3) evaluate how to integrate these principles in the actual classroom in order to achieve real interdisciplinarity between STEM and HASS in favor of ESD.

In order to achieve these objectives, this article presents the experience of a course that explicitly seeks to integrate humanities and social sciences in a STEM-oriented institution of higher education. This course is part of an interdisciplinary and project-oriented track that explicitly uses the framework of SDGs to encourage students to search for links between global challenges and social development objectives with local realities and their own life experiences. The course puts forward the idea that complex problems need to be thought of from a sustainable development perspective based in the relationship between STEM and HASS. This discussion will be complemented with the analysis of survey data from two semesters, 2021-1 and 2021-2. These surveys were taken at the beginning and at the end of the course and will help to discuss how the perception of the students about these topics were shaped and whether their perceptions were or were not changed by the course.

The idea of STEM education is centered around the necessity of recognizing that interdisciplinary education should occur permanently in all contexts and with a deep understanding of reality (life long, life wide, life deep) [1] (p. 1). STEM education in higher education needs the approach of Education for Sustainable Development in order to understand the relationship between knowledge and everyday life. Likewise, policies towards sustainable development goals require STEM education to educate professionals with sustainable development competencies and sensitivities.

Arguably, understanding the relationship between knowledge and the complexities of people´s everyday lives is where the inclusion of topics and methods from the social sciences and humanities become necessary. Although the need for the inclusion of humanities and social sciences in STEM education has been well established [2–4], in practice, this idea is more of a politically correct statement than an actual policy [3] (p. 11). The lack of a common conceptualization about how to integrate the disciplines [5] (p. 598), [6] (p. 11) makes it difficult to actually integrate them in the classroom or in other educational environments. The problem can be seen as an operational one.

Finally, this article proposes that in order to overcome this operational problem, it is necessary to give emphasis to the relationship between knowledge and the complexities of people's everyday lives, incorporating HASS research methodologies and information in order to bring global problems into the local arena and the realities of the students´ lives. In this line, this article seeks to go further than politically correct statements by proposing ideas of how to accomplish the implementation of a high-quality STEM education that serves the UN Sustainable Development Goals.

1.1. STEM Education for Sustainable Development: Interdisciplinarity for Real Life

STEM education puts special emphasis on the need to integrate technology and engineering principles such as design processes (applied knowledge) with basic science and math (discipline-based knowledge) in order to enhance problem solving and innovation [7] (p. X), [8] (p. 997). Therefore, STEM education is not only ascribed to scientific and technological knowledge, it also involves a particular approach to education where learning to apply the acquired knowledge to real life situations is as central as the disciplinary knowledge acquired [7]. Although the term of STEM education is applied to different ideas using different criteria [1], [5] (p. 597), [9] (p. 20), it is true in nearly all cases that STEM education involves the recognition of the necessity to integrate the four disciplines (science, technology, engineering, and mathematics) in an interdisciplinary process to address real world problems [5] (p. 598), [6] (p. 10), [9,10].

The real-world problem dimension establishes the need to understand that the subjects of STEM disciplines are not isolated from the rest of the social processes surrounding them [1,4,8]. Therefore, it needs to be understood from a contextual and/or systemic approach, which is only possible when STEM education occurs permanently in all contexts and with a deep understanding of reality (life long, life wide, life deep) [1] (p. 1). STEM education needs to promote ways of connecting the day-to-day of community with the teaching and practice of science [1] (p. 3), [9] (p. 23). STEM education is associated with teaching students to look for Why? When? Where? How? Who? [1] (p. 2–3).

In that sense, STEM education shares many similarities with the proposals at the core of Education for Sustainable Development (ESD). ESD believes in the necessity of education to be involved in the search for societal transformations through the education and empowerment of people to take responsibility for sustainable development challenges [10]. Thus, it is necessary that education integrates all types of learning through hands-on, project-oriented activities that give a strong connection between what is learned and what is lived [11] (p. 2–3), a concept similar to the "life long, life wide, and life deep" idea that was discussed above for STEM education.

In the people-oriented vision of education promoted by ESD, all of the problematics or challenges such as poverty, violence, health, environment, etc., are interconnected in the everyday lives of people. There is a necessity to face these sustainable development challenges from a contextual perspective that includes active interaction with the diversity of society. In this diversity, the role of the social sciences and humanities is of vital importance to understand inherently complex problems and their solutions.

1.2. The Changing Relationship between STEM Subjects and Humanities and Social Sciences in Education

If, as stated above, STEM education implies that students look for answer to the Why? When? Where? How? Who? of problems, we can argue that these are exactly the kind of questions that the social sciences and humanities train students to answer. Without humanities and social sciences disciplines, the recognition of actors and motivations will be poor, generic, and based on prejudgments, focusing on the concrete and evident and limiting the definition of the problem to only a few dimensions. It is restrictive to think that we can develop scientific understanding within the limits of STEM [2] (p. 62–63) [4] (p. 12) [8] (p. 997) [12] (p. 2) [13].

The necessity of the participation of HASS disciplines in STEM education has been well established [2–4,14] [12] (p. 7), but in practice, this idea is no more than wishful thinking, rather than something commonplace [3]. In higher education institutions, despite institutional attempts to the contrary, STEM subjects and HASS methods are still thought of as opposite sides of a dichotomy. There is a failure to integrate them into a single approach to complex problems, with real implications in the daily lives of people. This happens, in part, due to the resistance of professionals from both sides and, in part, because of institutional barriers [15] (p. 10).

There are a variety of attitudes about the relationship between HASS and STEM in education [15] (p. 3) [13]. From a perspective of how HASS should be integrated in STEM education, we can see three main attitudes (following loosely [15], Table 1):

1. HASS disciplines are seen as attendants of the STEM disciplines, where HASS should provide tools to enhance the performance of the STEM disciplines. The HASS contribution is seen as a provider of soft skills, such as how to write or speak in public.
2. HASS could be thought of as the provider of cautionary tales, a critique to STEM disciplines and methods in order to keep them real. HASS disciplines challenge and put STEM disciplines to the test. In this view, HASS gives the students a different perspective and critical thinking to see limitations, but they are not part of the conceptualization of the problem or the solution.
3. A third more interdisciplinary view seeks to include a mix of themes, contents, and methods from both HASS and STEM. In this case, the integration should start from the first approach to the problem, recognizing that any complex problem is part of the world, and the world itself is interdisciplinary [15] (p. 10); thus, it is necessary to set common objectives and goals [12].

For this article, the third idea is the most desirable, but it presents us with a challenge: How can we actually integrate and operate this mutual understanding in educational environments? It has been pointed out that this integration is easily accomplished on the big scale of major global problems. Students and academics are able to identify the benefits of interdisciplinarity with HASS in social global development issues and operate using them (20). The challenge is to make explicit this benefit through the progression between the different scales and dimensions of a social problem [12] (p. 7) [14] (p. 2–3), particularly in locally grounded problematics.

Table 1. The attitudes toward HASS in STEM education and its implication in higher education. Based in [15].

Attitude of HASS toward STEM	Dominant Discipline	Competencies	Function/Goal	Impact	Toward Student
HASS Subaltern to STEM	STEM dominant methods and topics	Soft skills	HASS as a tool for STEM education	HASS adds value to STEM	Helps student to find a job
HASS Critique of STEM	HASS dominant methods, STEM dominant topics	Critical thinking	HASS challenges STEM to improve	Hass proves STEM as subjective and relative	Creates an ethical professional
HASS Partner of STEM	Mix topics and methods from HASS and STEM	Interdisciplinarity	Mutually enhance understanding of HASS and STEM	Innovation, integrating HASS and STEM	A well-integrated professional with real world problem-solving skills

2. Material and Methods

2.1. Case Study: The Interdisciplinary Track, an Academic Track That Starts with Global Challenges and Sustainable Development Goals

The University of Engineering and Technology-UTEC in Peru has as an explicit goal to train professionals capable of adapting to an always changing world, generating positive impacts in society through innovation and solutions to complex problems [16]. In line with this general goal, the university developed a track of courses with project-based goals, called Interdisciplinary Projects, that promote the design and conceptualization of practical solutions with social impact. This track of courses was developed in parallel to transversal classes like general sciences, humanities, and the STEM disciplines themselves. In the latest version of this curricula, this course track explicitly incorporated more concern with human and social issues, integrating concepts and methodologies such as "design thinking," "system theory," and coupled human–environment system (CHANS) [17], transforming it from a project-based course to a more design-oriented track [18] (p. 21). This track follows a progression from:

- Interdisciplinary Project 1: a heavy-methodology course that tackles major sustainable development challenges and how to link them with local problems.
- Interdisciplinary Project 2: provides students with knowledge and practice in methodologies from engineering, ethnography, and social sciences, project management, and computing skills.
- Interdisciplinary Project 3: students develop protypes or other types of solutions for a specific problem derived from the general issue.
- In this particular article, we focus on the first course that tackles global sustainable development issues, bringing them to the local level using tools and methodologies of the social sciences and humanities.

2.1.1. Interdisciplinary Project 1 Course

This course is a freshman year class that explicitly seeks to integrate the framework of SDGs to STEM education using humanities and social sciences so that students can openly search the links between global development challenges and local realities (Figure 1). The course puts forward the idea of the necessity to think about complex problems from a sustainable development perspective based on the relationship between STEM and HASS. Starting with a reflection about the evolution of the relationship between science and technology with society, the class presents global issues such as health, education, poverty, environment, and diversity as the center of innovation in recent years [19]. The class uses the SDGs and its targets to help narrow down global developmental issues to the local level. The students identify meaningful actors or stakeholders and complete an initial ethnography with them. Then, students propose a problem tree composed of a central problem (concrete, specific, and local) and at least two levels of causes and effects. This problem tree is not only the students´ first approach at grasping the intrinsic complexity of a problem, but also allows them to understand how societal challenges of a global dimension operate at specific local levels.

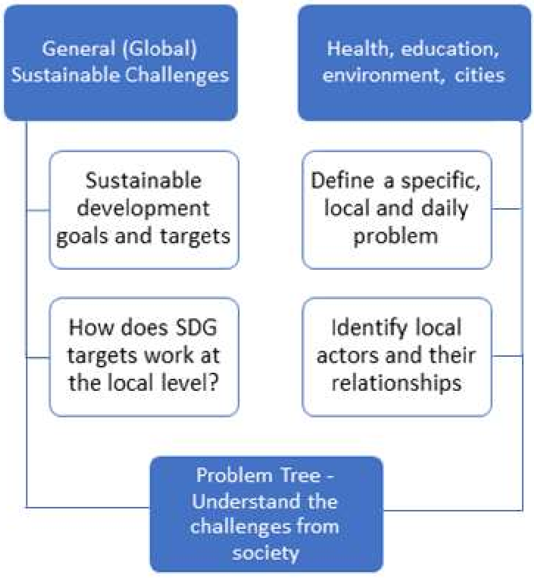

Figure 1. The process for understanding general sustainable challenges and their relationships to local-level actors using a problem tree.

2.1.2. Competencies and Performance Criteria

The Interdisciplinary Project 1 [20] competencies are aligned with ICACIT (https://www.icacit.org.pe/web/en/ accessed on 1 February 2022), an international accreditor.

- Conduct studies of complex engineering problems using basic knowledge in research and research methods including analysis.
- Conduct studies of complex engineering problems using basic knowledge in research and research methods including the interpretation of information and the synthesis of information to produce valid conclusions.
- Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- Understand professional and ethical responsibilities.
- Effectively lead diverse teams.
- Define a project and identify the stakeholders.

2.1.3. Learning Outcomes

- Identify the constituent factors of a problem of global dimension.
- Identify causal or non-causal relationships between multiple factors to develop a research problem.
- Determine a research problem through the analysis and evaluation of multiple dimensions including the ethical and moral constituents of a social challenge.
- Identify the complexity of global problems and be aware of the importance of addressing them from an interdisciplinary perspective (people-centered).
- Organize and assume, within the work group investigation, the delivery of at least one of the deliverables requested throughout the cycle.
- Carry out an ethnographic approach that allows students to identify the relevant actors within the problem, incorporating their perspectives in the definition of a research problem.

2.1.4. Topics and Structure

The course is divided into plenary sessions and practice sessions (Table 2):

1. Theory Sessions: These sessions follow a lecture format with class participation, looking to analyze the complexity of challenges of a global nature. The students are expected to understand the complexity of multidimensional problems.
2. Practice Sessions: Under the format of active sessions, instructors will guide students in the application of qualitative tools and the data analysis of complex problems.

Table 2. The themes of the theory and practice sessions.

Theory Topics	Practice Topics
1. STI (science, technology, and innovation): approaches and perspectives	1. One SDG and its tasks, in depth
2. STI in context of global societal and sustainability challenges	2. Research ethics and reliable sources
3. SDGS and 2030 agenda	3. How to work in groups
4. Poverty: definitions and approaches	4. Choose a theme/objective for the final project
5. Education: problems and possibilities; education in peru	5. Mapping stakeholders and relevant actors
6. Public health; health challenges in peru	6. Intro to ethnography methodology
7. Environmental conservation and sustainability	7. How to conduct an interview
8. Cities and sustainability	8. How to build a problem tree
9. Diversity and inclusion	

2.2. Survey

Survey Characteristics

The survey was originally drawn up to establish an informal baseline about students´ perceptions of interdisciplinarity, sustainable development, and the interaction with humanities and social sciences, and, as a communicational device, to promote student reflection on course topics from the start. It is an eight-question survey administered at the beginning of the course; the questions are basic and direct in nature. It was not designed as a precision tool to measure results.

The survey explores two related issues: (1) perceptions of the need for interdisciplinarity, especially the need for humanities and social sciences, and, (2) perceptions about the relationship between their careers and problems of social and environmental development (Table 3).

Table 3. Survey questions.

Interdisciplinary Project 1—Exploratory Survey	
1. Are the humanities and social sciences important for an engineer? (a) Yes (b) No (c) It depends	5. Technology Solution vs. Social Solution (a) A false dichotomy. (b) Technology must serve society. (c) Social solutions are abstract and diffuse; technological ones are concrete. (d) Technology is itself a social solution.
2. What is a complex problem? (a) A problem that encompasses different solutions based on complex technologies. (b) Problems that, due to their social origin, are inherently complex. (c) Difficult, hard science problems.	6. Interdisciplinarity is: (a) Looking for solutions from different scientific perspectives. (b) Understanding the problem from different scientific and humanistic perspectives. (c) Sharing a common goal despite having different disciplines and methodologies. (d) An ideal; only applicable to some cases.

Table 3. *Cont.*

Interdisciplinary Project 1—Exploratory Survey	
3. Science should look at universal social challenges like poverty, violence, etc. to decide the research agenda. (a) Science does not have to look at these social challenges; science finds its place naturally. (b) Science naturally generates social development. (c) Agreed, it is important to have clear guidelines for social development. (d) Social development is not the work or concern of a scientist.	7. Studying HASS courses mainly serves me: (a) To be interdisciplinary. (b) To acquire soft skills. (c) To understand my socio-economic context. (d) To write well and with technical efficiency. (e) Not really at all; I already saw many of these things at school. (f) To take better advantage of the specific knowledge of my career, understanding the origin of problems.
4. How would you define innovation? (a) Creating something technological and new based on market requirements. (b) Taking science one step further; pushing the limits. (c) Finding new ways to solve problems. (d) Interdisciplinarity that listens to society to determine new directions.	8. Are you interested in studying HASS courses? (a) Yes (b) Not much (c) No

Since 2021-1, the same survey has been used to help us explore at what level the course is accomplishing the task of integrating humanities into STEM education and at what level students' perceptions about these issues are changed by the class, therefore favoring a receptivity to SDGs. We also began to administer the survey at the end of the course as well.

3. Survey Results

The survey outcomes from two semesters, 2021-1 and 2021-2 (Figures 2–5), are present next:

1. The survey outcomes show some consistency in the results, both by semesters and between the beginning and ending of the semesters. The percentage distribution of answers by question does not show significative variation in most of the questions, with the exception of questions 3–5, which we will discuss later.
2. The survey shows evidence that students have a high value of humanities and social sciences in their answers. For example, question 1 that specifically asks about the value of humanities shows, that at the beginning of the semester, 89.1% in 2021-1 and 94.38% in 2021-2 provided a positive response to the importance of HASS for an engineer, and a positive response of 88.25% and 96.1%, respectively, at the end of the course. This small variation is not really significant, and the initial high percentage left little room for improvement between the start and the end of the semester.
3. There is an important percentage of students that manifest strong visons towards the disciplinary views of science. For example, in question 3, when asked about the role of global social challenges in thinking about science, 9.02% in 2021-1 and 10.95% in 2021-2 thought that science does not need to look at these social challenges (option a), and 29.51% in 2021-1 and 23.20% in 2021-2 thought that science naturally generates development (option b). Although the data shows a small decrease in these answers by the end of the semester, with an increase of 9–10 percentage points each semester for option c (that agreed on the importance of social challenges in determining research agendas), these changes are not really significant, and the data suggests the existence of a group of students that are not likely to change their views about science in short term.
4. The biggest variation between the start and the end of the semester was identified in question 4. The variation was similar in both semesters. This question asks for responses about innovation, and the choice of option d (to establish the necessity for listening to society to determine the direction of the innovation) grew between

the start of the semester and the end of the semester in both semesters, from 10.24% to 28.06% in 2021-1, and from 18. 59% to 38.30% in 2021-2. This change in almost 20 percentage points was in detriment of option a, that benefits the technological dimension of innovation, but especially in detriment of option b, that benefits science-based visions of innovation, from 24.62% to 15.11% in 2021-1, and 22.19% to 8.87% in 2021-2. This change is highly significant (Figures 6 and 7), and is evidence that this change is likely reflecting a transformation in the students' visions about innovation.

5. Question 5 explores how students see the relationship between technical and social solutions. Exploring their understanding of interdisciplinarity option d (technology is itself a social solution) shows some regression between the start and the end of the semester, from 28.75% to 19.66% in 2021-1, and from 33.86% to 24.11% in 2021-2. In 2021-1, the difference was more or less distributed between the other options, but in 2021-2, most of the variation could be seen in an increase of option c (social solutions are abstract and diffuse, technological ones are concrete). This increase in option c between the start of the semester and the end of the course is significant if we assume a confidence level of 90% or lower (Figure 8). This is evidence that the student has a superficial understanding of interdisciplinarity. This is the only question that shows some relative differences between 2021-1 and 2021-2.

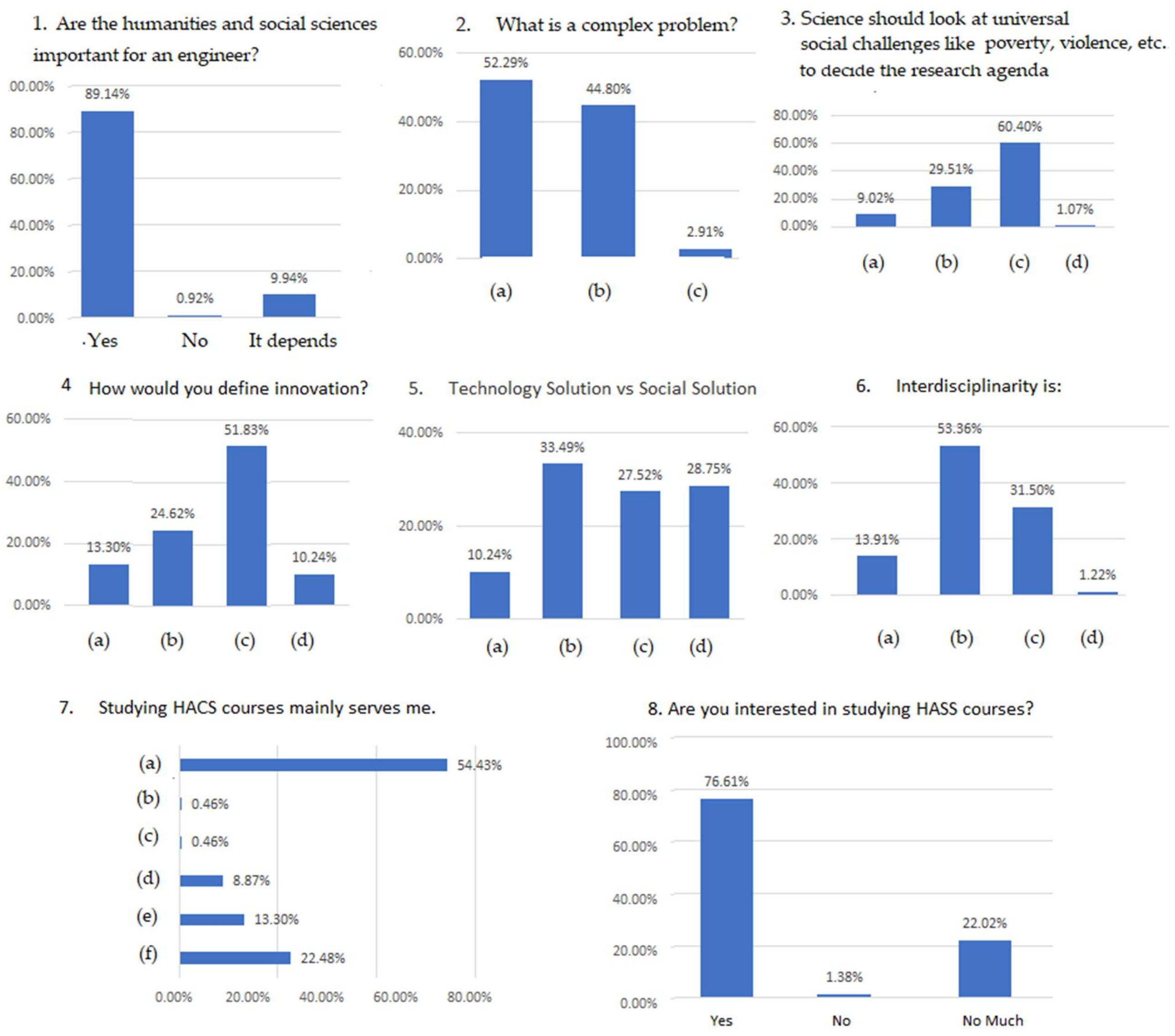

Figure 2. The survey results from 2021-1 by question, start of semester.

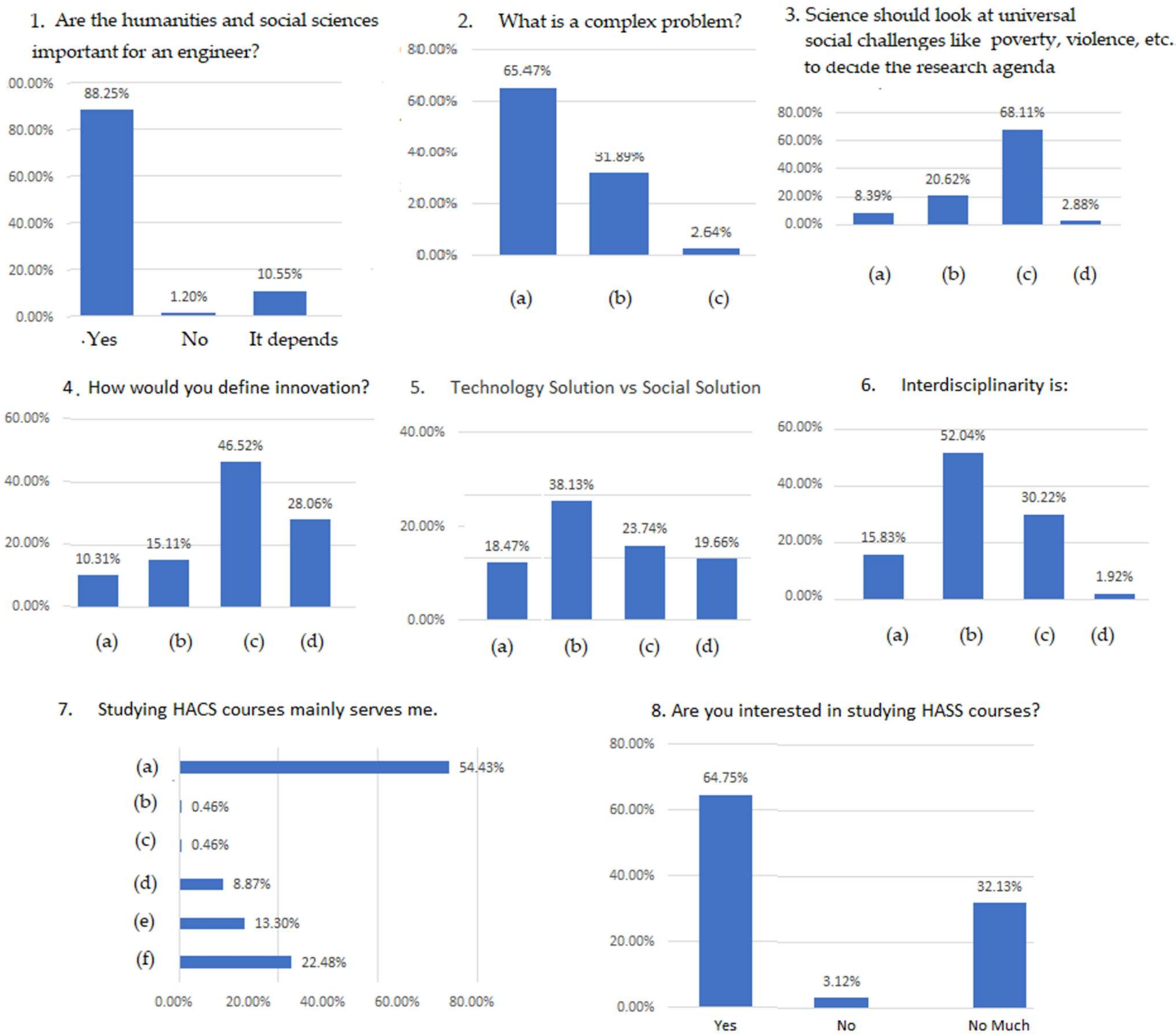

Figure 3. The survey results from 2021-1 by question, end of semester.

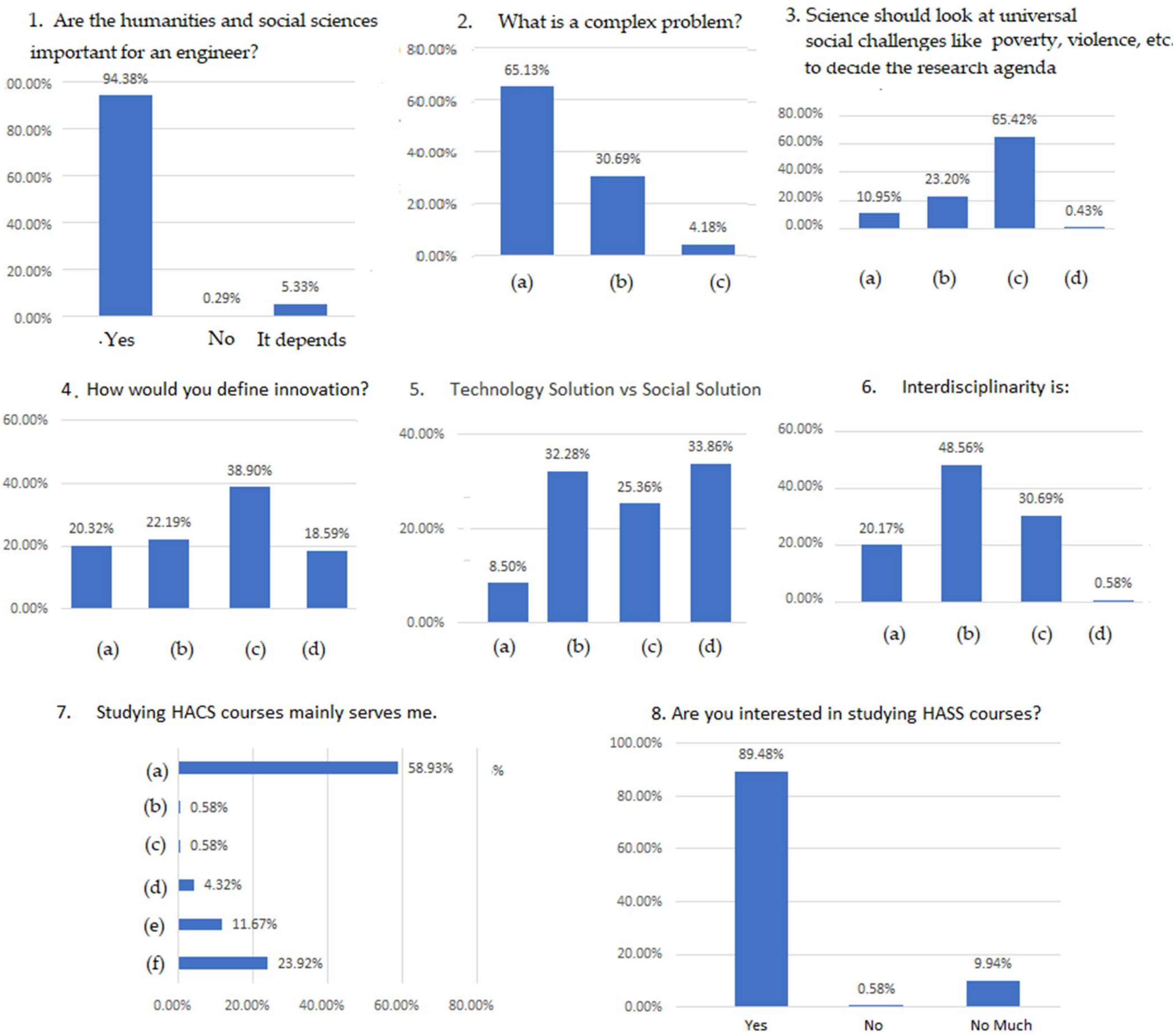

Figure 4. The survey results from 2021-2 by question, start of semester.

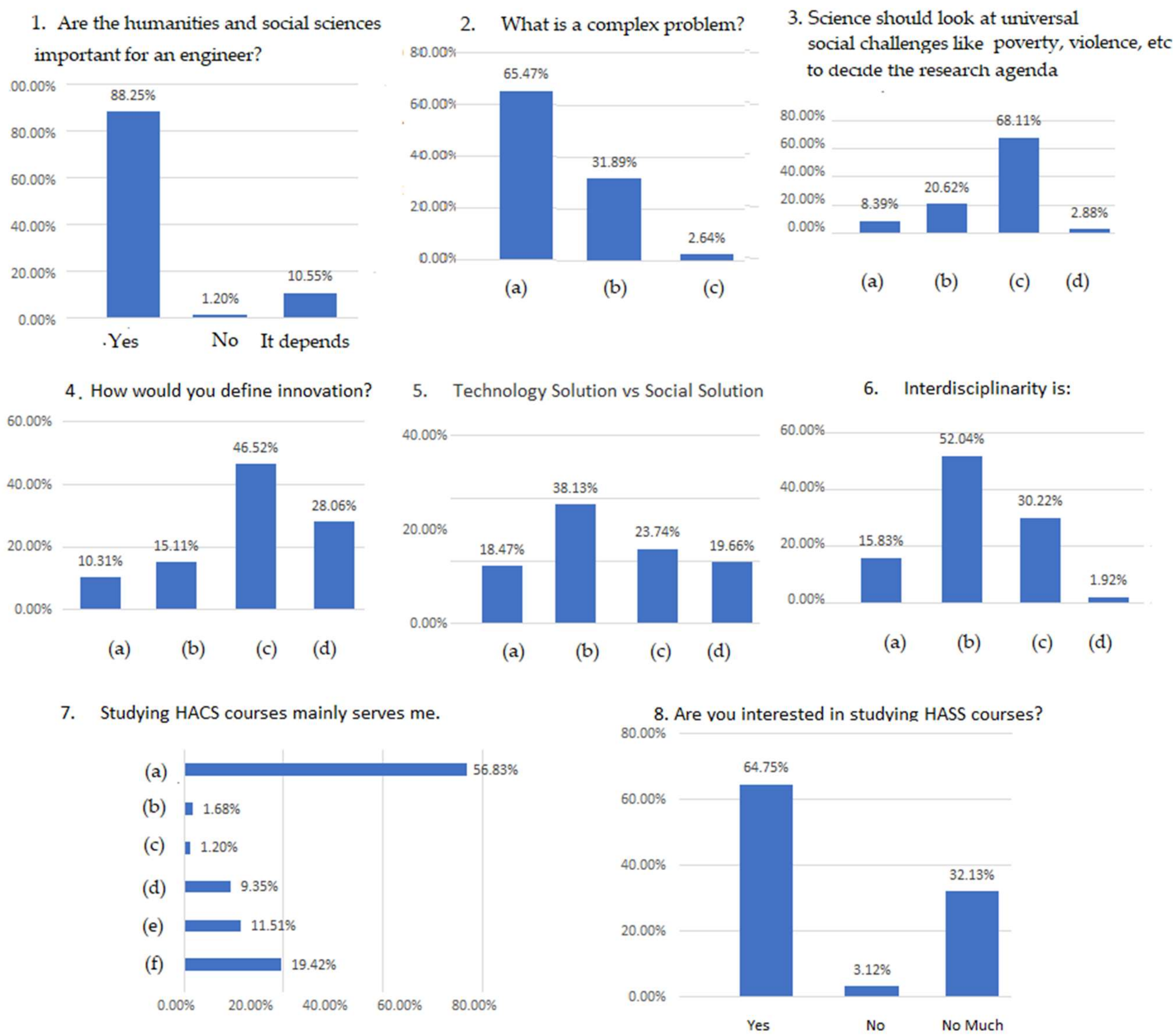

Figure 5. The survey results from 2021-2 by question, end of semester.

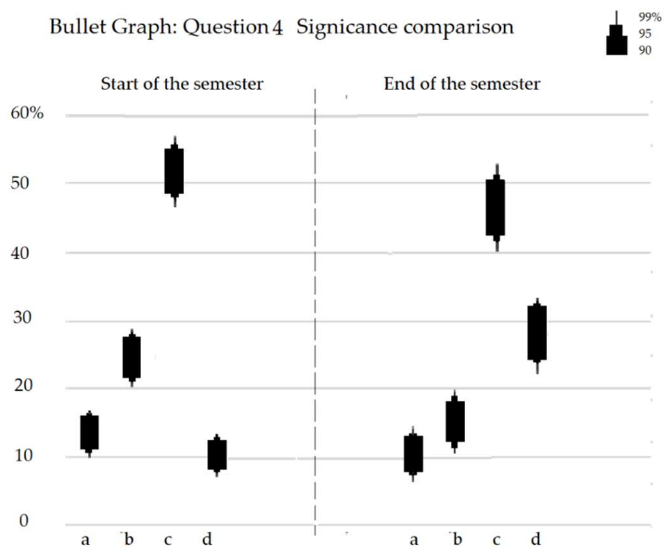

Figure 6. A bullet graph showing the significance of the answers to question 4, 2021-1.

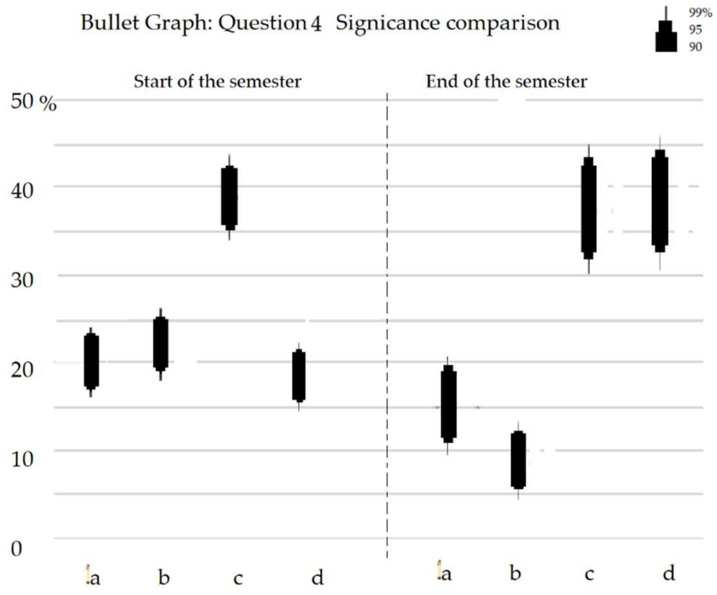

Figure 7. A bullet graph showing the significance of the answers to question 4, 2021-2.

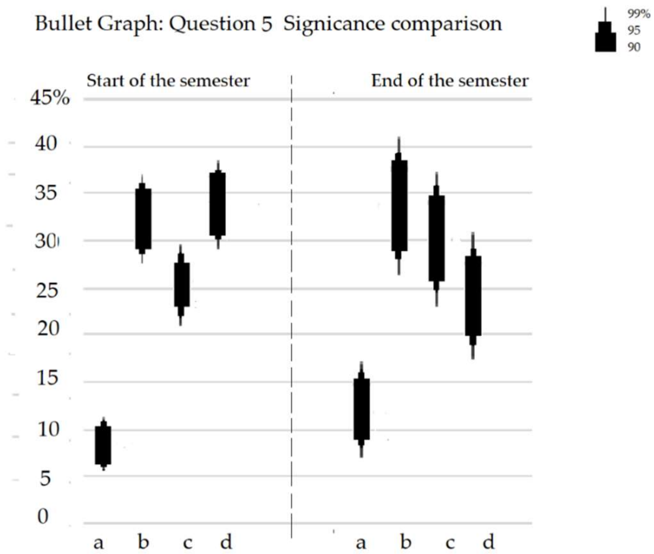

Figure 8. A bullet graph showing the significance of the answers to question 5, 2021-2.

4. Discussion

How can the humanities and social sciences become key elements for the implementation of quality STEM education that provides students with the competencies required for a sustainable development agenda in line with the UN´s sustainable development goals?

In order to become a key element, the humanities and social sciences need to allow students to identify the need for a systematic or contextual approach to study the problem or to think of and design possible solutions. This systematic approach includes a necessary approximation to the problem from the human disciplines and social sciences. Without that, communicating what the HASS disciplines bring to the table and understanding that interdisciplinarity is not even possible for the four STEM disciplines.

It is necessary to give emphasis to the relationship between knowledge and the complexities of peoples´ everyday lives, incorporating HASS research methodologies and information in order to bring the global problem to the local arena and to the realities of the students´ lives.

Without this training during a student´s formative years, science and technology will remain separate from society and fail to produce real social and technological innovation.

Although operationally, it is still challenging to implement a true interdisciplinarity in the classroom, this paper makes the case for an approximation to teach science careers from an education for sustainable development perspective using humanities as a cornerstone for understanding the diversity and complexity of a problem as an efficient way to train interdisciplinary professionals.

The survey also allows us to propose that there is an impact on the students who took the course, making them more conscious of the links between global challenges and social development objectives with local realities and their own life experiences. It is not clear if the course had an impact on how students understand interdisciplinarity or the necessity of the social sciences and humanities. Although this lack of clarity could be the result of the survey's limitations, it is not surprising, given the direct form of some questions in which the answers linked with the acceptance of the humanities and/or interdisciplinarity had the higher frequencies. However, when we analyze other questions that explore these topics more indirectly, the picture is less positive. Disciplinary or hard sciences-oriented visions of understanding science, development, and innovations survive in a significant number of the students.

Looking at the survey results, the goal of the class to integrate the SDGs framework into STEM education using humanities and social sciences, enabling students to openly search for the links between global development challenges and local realities was only partially accomplished.

5. Conclusions and Limitations

A real integration between HASS disciplines and STEM education cannot be evaluated exclusively by means of a survey centered on the opinions of students. As stated above, this survey was not designed for this type of evaluation. Its original goal was communicational and also intended as an informal introduction to the course. The students are in their first semester at an institution of higher education. Their understanding of these issues is still basic and built from bias and prejudgments of what science is. They have not yet had much exposure to scientific methods, problems, or methodologies. As first-year students, in the case of surveys, we should consider that although anonymous, the students tend to answer what they think is the expected or appropriate answer. Nevertheless, these surveys allow us to discuss some of the topics presented above concerning the relationship between HASS, STEM education, and sustainable developmental challenges from the perspective of the students.

From the beginning, the development of STEM education included interdisciplinarity; this interdisciplinarity is only possible with the help of humanities and social sciences. Since this interdisciplinarity is based on an understanding of the socio-cultural context, the need for HASS methodologies focuses on listening to society. Similarly, the necessity for understanding the general context and listening to societies are at the core of Education for Sustainable Goals. Consequently, this article recognizes that understanding the social context and listening to society are part of the elements that are common between STEM education, HASS, and EDS.

Although this idea has been recognized before, even for first year college-level students, it is also recognized that in higher education, many times, the necessary interdisciplinarity is never accomplished, especially because it is difficult to achieve interdisciplinarity in a classroom (and elsewhere) when the problem is specific and concrete. This article proposes that the specific analysis of SDGs and their targets are educational tools to help achieve this interdisciplinarity in the classroom, but only if we help the students to see the relationship between these SDGs and their own lives and in relationship to their careers, identifying the need for interdisciplinarity from the macro level and bringing it down to a level where the students can relate and operate. In this way, we implement a high-quality STEM education that provides students with the competencies required for a sustainable development agenda in line with the UN´s sustainable development goals.

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Institutional Review Board Statement: Ethical review and approval were waived for this study since no research was conduct affecting directly human subjects. The opinions and information obtained was recorded in such a manner that human subjects cannot be identified, directly or through identifiers linked to the subjects; and, do not implied place the responders at risks of criminal or civil liability, financial harmful, employability, or reputation. The survey was applied in educational context and correspond to the category 2 of Exemption accordingly to 45 CFR 46 104 (d)(2).

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Conflicts of Interest: The author declares no conflict of interest.

References

1. Dierking, L.D.; Falk, J.H. 2020 Vision: Envisioning a new generation of STEM learning research. *Cult. Stud. Sci. Educ.* **2016**, *11*, 1–10. [CrossRef]
2. Otsuki, G.J. Finding the Humanities in STEM: Anthropological Reflections from Working at the Intersection. In *New Directions of STEM Research and Learning in the World Ranking Movement*; Hawkins, J.N., Yamada, A., Yamada, R., Jacob, W.J., Eds.; Palgrave Macmillan Cham: Los Angeles, CA, USA, 2018; pp. 65–78. [CrossRef]
3. Collins, C.S. Not Just a Technical Problem: The Intersections of STEM and Social Science in Addressing Global Poverty. In *New Directions of STEM Research and Learning in the World Ranking Movement*; Hawkins, J.N., Yamada, A., Yamada, R., Jacob, W.J., Eds.; Palgrave Macmillan Cham: Los Angeles, CA, USA, 2018; pp. 97–110. [CrossRef]
4. Zeidler, D. STEM education: A deficit framework for the twenty first century? A sociocultural socioscientific response. *Cult. Stud. Sci. Educ.* **2016**, *11*, 11–26. [CrossRef]
5. Aguilera, D.; Lupiañez, J.L.; Vilchez-Gonzalez, J.M.; Perales-Palacios, F.J. In Search of a Long-Awaited Consensus on Disciplinary Integration in STEM Education. *Mathematics* **2021**, *9*, 597. [CrossRef]
6. Mohr-Schroeder, M.J.; Cavalcanti, M.; Blyman, K. STEM education: Understanding the changing landscape. In *A Practice-Based Model of STEM Teaching*; Sahin, A., Ed.; Brill Sense: Rotterdam, The Netherlands, 2015; pp. 3–14. [CrossRef]
7. Bybee, R.W. *The Case for STEM Education: Challenges and Opportunities*; National Science Teachers Association, NSTA Press: Arlington, VA, USA, 2013.
8. Bybee, R.W. What Is STEAM Education? *Science* **2010**, *329*, 996. [CrossRef] [PubMed]
9. Sanders, M. STEM, STEM Education, STEMmania. *Technol. Teach.* **2009**, *68*, 20–26.
10. Hsiao, P.-W.; Su, C.-H. A Study on the Impact of STEAM Education for Sustainable Development Courses and Its Effects on Student Motivation and Learning. *Sustainability* **2021**, *13*, 3772. [CrossRef]
11. UNESCO [United Nations Educational, Scientific and Cultural Organization]. *Framework for the Implementation of Education for Sustainable Development (ESD) Beyond 2019*; UNESCO: Paris, France, 2019.
12. Das, K.; Paital, B. Future call for policy making to speed up interdisciplinarity between natural and social sciences and humanities in countries such as India. *Heliyon* **2021**, *7*, e06484. [CrossRef] [PubMed]
13. Josa, I.; Aguado, A. Social sciences and humanities in the education of civil engineers. *J. Clean. Prod.* **2021**, *311*, 127–489. [CrossRef]
14. Davis, K.; Joshi, S.; Czerwionka, L.; Montalvo, F.; Rios-Rojas, G.; Tort, J.; Martson William, J.; Nauman, E. Integrating the Humanities with Engineering through a Global Case Study Course. *J. Int. Eng. Educ.* **2021**, *3*, 4.
15. Gleason, D.W. The Humanities meet STEM: Five approaches for humanists. *Arts Humanit. High. Educ.* **2018**, *19*, 186–206. [CrossRef]
16. Universidad de Ingeniería y Tecnología. Available online: https://www.utec.edu.pe/ (accessed on 13 June 2021).
17. An, L. Modeling human decisions in coupled human and natural systems: Review of agent-based models. *Ecol. Model.* **2012**, *229*, 25–36. [CrossRef]
18. Zhang, X.; Ma, Y.; Jiang, Z.; Chandrasekaran, S.; Wang, Y.; Fonkoua Fofou, R. Application of Design-Based Learning and Outcome-Based Education in Basic Industrial Engineering Teaching: A New Teaching Method. *Sustainability* **2021**, *13*, 2632. [CrossRef]
19. Vasen, F. ¿Estamos ante un "giro poscompetitivo" en la política de ciencia, tecnología e innovación? *Sociologias* **2016**, *18*, 242–268. [CrossRef]
20. Universidad de Ingeniería y Tecnología. *Silabo Proyectos Interdisciplinarios I*; Universidad de Ingeniería y Tecnología: Lima, Perú, 2021.