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ICBA

International Conference In Border Area

Bismillahirrohmanirohim
Assalamualaikum Warahmatullahi Wabarakatuh

35 hamdulillahrabbi'l alamin, the 1st International Conference's proceedings on "the Development in Border Area to Achieve The Sustainable Development Goals in Industrial Revolution Era" collect 19 papers presented virtually on 2-3 September 2020. Fakultas Hukum Universitas Borneo Tarakan hosted the conference. 10 conference's particular feature was discussing various issues in the border area. We express our 10 deep gratitude to the organizing committee, keynote speakers, and reviewers for their high dedication and continuing hard work along with the series of conference events until this proceeding publication. Special acknowledgment goes to the rector and the vice-rectors of Universitas Borneo Tarakan for their reliable support for this conference. We also thank all the participants and authors for taking the excellent opportunity to discuss and publishing their papers. A large number of people have to be appreciated for their contributions to the success of the first ICBA 2020 and, finally, this proceeding publication. Hopefully, these proceedings will give the reader prominent information from different perspectives concerning the Border Area development.

Thank you and Wassalam

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Proceeding Template

Let's Visualise It: Observing Students' Perceptions Through Making Comics About Socioscientific Issues In Border Area of North Borneo

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Abstract

Socioscientific issues in the border areas of North Kalimantan became debatable issues both among scientists and social practitioners. Biology education students as the young generation who explore issues from both perspectives (science and social) need to give their views on this issue. However, the obstacle faced by students is their lack of ability to express their opinions through writing and orally. Based on this, an activity was held on how to convey their perception of this problem through visuals media, especially comics. This research used a case study to find out students' perceptions regarding the types of socioscientific issues and the solutions they offer to these problems. The results obtained in this study were 57.5% of students choosing social problems in the environmental field, 12.5% in the food sector, 10% related to biopiracy problems, 15% related to fisheries and 5% related to biotechnology.

Keywords: *Socioscientific issues, Comics.*

1. INTRODUCTION

Biology learning is not only about learning science concepts but also learning to connect science with social problems. Students, especially biology education students as millennial agents, need to understand and build scientific concepts holistically so that the scientific concepts obtained in learning can be applied to solve problems in society. To start with this, students need to be initiated to analyze the socio-scientific issues that occur in their environment. Socioscientific issues will help them to improve their understanding of science, besides that this is also able to guide students to understand problems in a multi-perspective way.^{1,2,3}

Socioscientific issues are problems that arise because of the interrelation between science and society.⁴ Sometimes these issues are controversial, sometimes true from a scientific point of view and sometimes they can be wrong from a social point of view, and vice versa. Based on this, students are expected to be able to provide good and appropriate solutions from a scientific and social point of view. Besides, students also need to use evidence and reason for this evidence. Introducing students to socio-scientific issues is very important to shape their critical thinking. This is because the use of socio-scientific issues in learning from a pedagogical context can develop cross-disciplinary knowledge, values in society, and personal experiences.⁵

¹S. Lin and J. Mintzes, "Learning Argumentation Skills Through Instruction in Socioscientific Issues: The effect of Ability Level". *International Journal of Science and Mathematics Education* (2010): 993-1017

²J. Nielsen, "Arguing from Nature: The Role of 'nature' in Students' Argumentations on Socio-scientific Issues". *International Journal of Science Education* 35 no. 5 (2012): 723-744.

³N.Christenson, S. Rundgren, and D. Zeidler, Relationship of Discipline Background to Upper Secondary Students' Argumentation Socioscientific Issues. *Research Science Education* (2014), DOI:10.1007/s11165-013-9394-6.

⁴D. L. Zeidler, T. D. Sadler, M.L. Simmons, & E.V. Howes, "Beyond STS: A research-based framework for socioscientific issues education". *Science Education*, 89 no. 3 (2005): 357-377

⁵T. D. Sadler. "Informal reasoning regarding socioscientific issues: A critical review of research". *Journal of Research in Science Teaching*, 41 no. 5 (2004): 513-536.

Introducing socioscientific issues (SSI) to students in a lesson is not easy because generally the learning process only focuses on studying one field of science. They will find it difficult to develop other disciplines and combine their fields of knowledge with other disciplines. Presenting SSI in a lesson needs to be packaged in interesting learning, and the issues presented are related to students or according to the area where the student lives.⁶ Based on some of these considerations, it is necessary to raise socio-scientific issues in border areas, especially in North Kalimantan. North Kalimantan is the youngest province and also located on the border with neighboring countries is certainly an area that has a lot of issues. Issues in the North Kalimantan are over several main issues, namely: the issue of national boundary defense and border area security, institutional issues, community economic issues, education issues, infrastructure issues, and regional potential issues.⁷ These issues will later give birth to socio-scientific issues. For example, the issue of national borders raises the issue of biopiracy. For example, cases of illegal fishing in Sebatik by Filipino foreigners.⁸

One aspect that needs to be considered in introducing socio-scientific issues is attractiveness in learning design. The attractiveness of design must also be following the scientific literacy vision so that it will support students' scientific literacy. There are 2 visions of scientific literacy. The first vision covers scientific processes, practices, and basic principles. Furthermore, Second vision is a consideration of other contexts related to real life, such as social, cultural, political and ethical issues.⁹ An interesting learning design to introduce SSI to students requires the availability of attractive media in the classroom. The media chosen in this research is comics. The selection of comics as a medium has many considerations, among these considerations, the most important consideration is the increase in student motivation and literacy. Visual representations and text in comics can interact with students, which in turn has an impact on increasing student motivation in the classroom. Comics are also able to expand the meaning of content, and directly improve interpretation or synthesis skills. Besides, the connection between visual and text can expand students' understanding.¹⁰

Based on these things, socioscientific issue-based instruction will be designed in social biology courses at the Biology education program of the University of Borneo Tarakan. However, some problems were found during the pre-implementation observation process of research activities. The problem found is the lack of students' writing and opinion skills. Therefore, students are assigned to describe the results of their observations and analysis related to problems using comic strips. Comic strips are very useful for highlighting important points so that students who are still lacking in writing skills can still express their ideas. The comic strips that are made will later be presented by students in class and responded to by other students.

2. METHOD

a. Learning approaches

The implementation of learning used socioscientific issues-based instruction (SSI-based instruction) which consists of three core aspects, namely design elements, student experiences, and teacher attributes.¹¹ These three elements integrated into the context of classrooms, schools/communities, and state policies.

The picture of the SSI-base instruction framework is depicted in Figure 1. The core aspects which consist of 3 parts are placed centrally. Furthermore, the classroom is represented as concentric circles. After that, there is another big circle representing important factors such as school, community, state context, and national policy.

⁵ L. Ke, T.D. Sadler, L. Zangori, & P.J. Friedrichsen, "Students' perceptions of socio-scientific issue-based learning and their appropriation of epistemic tools for systems thinking". *International Journal of Science Education* (2015): 1-23.

⁷ L. Rosliana, D. Sartika, T.N. Aziza, F.H. Wismu, R. Amarullah, K. Hidayah, W.L. Arieyasmietia, M. Kusumaningrum, L.E. Rhamdani, M. Sari, M. Darto, & W. Mariani, "Kajian Manajemen Perbatasan di Kalimantan: Fokus Inovasi Pendidikan di Wilayah Perbatasan". Pusat Kajian dan Pendidikan dan Pelatihan Aparatur III. Lembaga Administrasi Negara, 2015

⁸ Tribun Kaltim, "Bongkar Kasus Ilegal Fishing di Perairan Sebatik, Polairud Polda Kaltara Tangkap WNA Filipina" (online). <https://kaltim.24news.com/>. Accessed 3rd March 2020

⁹ D. Roberts, "Scientific literacy / science literacy". In S. Abell & N. Lederman (Eds.), *Handbook of research on science education*. Mahwah, NJ: Lawrence Erlbaum Associates, 2007: 729-780

¹⁰ C. McVicker, *Teaching and learning to read withprofessorgarfield.com* Paper presented at the annual meeting of the College Reading Association, Savannah, GA. 2005.

¹¹ M.L. Presley, A.J. Sickel, N. Muslu, D. Merle-Johnson, S.B. Witzig, K. Izci, and T.D. Sadler, "A Framework for Socio-Scientific Issues Based Education". *Science Educator* 22, no. 1 (2013): 26-32.

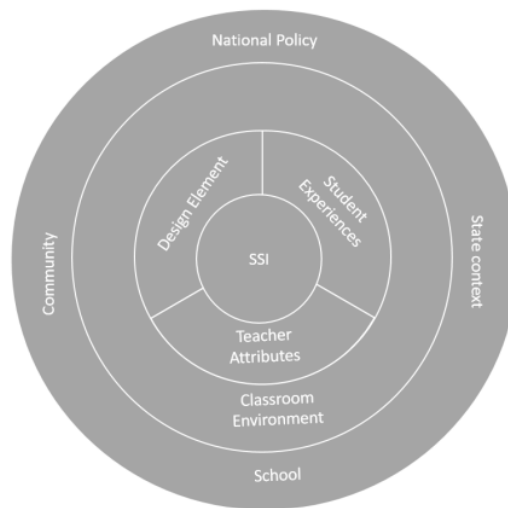


Fig 1. A Framework of SSI-Based Instruction

1) Design Element

The first core aspect of SSI-based Instruction is the design element, it contains four important features, namely building instructions on interesting problems, presenting problems, providing scaffolding for high-level practice (reasoning, decision making, argumentation activities), and integrating experiences.¹²

Instruction development is the initial activity of connecting social problems with science. Most of the curriculum in higher education does not focus on socioscientific issues in the curriculum. The curriculum emphasizes more on specific concepts from each field of science. If the instructions have been built, the next step is to present the problem in learning media.

The third feature in the design element is the provision of scaffolding for high-level practice. The scaffolding in question is an activity to build student knowledge related to socioscientific issues. The scaffolding used in the activity is argumentation, reasoning, and decision making. Scaffolding is useful for developing student argumentation skills.^{13 14 15} The final feature of the design element is experiential interaction, where students are allowed to integrate what they have learned into issue-based learning with the knowledge they have previously acquired.

2) Student Experiences

Student experiences together with design elements are interrelated aspects where students are expected to be actively involved in SSI-based learning. Student experiences that students need to face in SSI learning are facing scientific ideas and theories related to a problem being considered. After that students are expected to be able to collect and analyze data and evidence related to the problem. After that students are expected to be able to provide social negotiations in the form of offering solutions to problem-solving.¹⁶

¹²ibid

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¹³C. Quintana, C. "A scaffolding design framework for software to support science inquiry". *Journal of The Learning Sciences* 13 (2004): 337-386.

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¹⁴T. Tali, Y. Kali, S. Magid, and J. Madhok, "Enhancing the authenticity of a web-based module for teaching simple inheritance. In T. Sadler (Ed.), *Socioscientific issues in the classroom: Teaching, learning and research* (pp 11-38). New York: Springer, 2011 : 11-38

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¹⁵J.L. Eastwood, W.M. Schlegel, and K.L. Cook, Effects of an interdisciplinary program on students' reasoning with socioscientific issues and perceptions of their learning experiences. In T. Sadler (Ed.), *Socioscientific issues in the classroom: Teaching, learning and research*. New York: Springer, 2011: 89-126

¹⁶Presley op cit

3) Teacher Attributes

Teacher attributes to support SSI-based instruction which includes: familiarity with socioscientific issues (knowing science content and awareness of social considerations related to these issues), willingness to position themselves as contributors to knowledge, and skills in dealing with uncertainty in the classroom.¹⁷

4) Classroom Environment

The classroom environment makes the second layer of the SSI framework this aspect greatly influences aspects of the first layer (i.e., design elements, learning experience, and teacher attributes). The classroom environment is needed in SSI-based learning because the class accommodates teachers and students in collaborating and interacting with the socio-cultural issues raised. The teacher as a facilitator is expected to be able to provide input both in the learning process and outside guidance.¹⁸

5) Other factors

Other factors form the third layer of SSI-based instructions. This aspect affects the aspects of the first and second circles. Influence from schools, communities, and state and national policies may influence SSI-based instruction. Important features of this aspect include:

- a) Support and encouragement for teachers to implement Instruction-based SSI
- b) Access to SSI based materials.
- c) Curriculum flexibility that allows teachers to apply SSI-based instruction in the classroom
- d) Existence and local awareness by the community regarding socio-scientific issues
- e) The connection between SSI based instructions and national level curriculum objectives.¹⁹

b. Comic Development

In the learning process, lecturer showed a comic book that contains one of the social science issues in the North Borneo, as well as a step to initiate students in getting to know socioscientific issues. After reading the comic, students were asked to argue about the contents of the comics.

After the process of initiating issues by the lecturer. The lecture assigned students to look for one of the socio-scientific issues in North Kalimantan. Then, the lecture asked the students to develop their selected socio-scientific issue topic into comics. The comics that are developed is a maximum of 2 pages containing several things, namely: a description of the problem (including data), the case that occurred, and the solutions offered. The comic developed is a comic strip or comic page, where one page can contain several panels or a full panel.

3. RESULTS AND DISCUSSION

The application of SSI-based instruction in learning started with introductions by teachers to students related to examples of sociocultural issues in North Kalimantan. The teacher introduced several social science issues related to drug abuse using comic media. In the comics used by the teacher in the learning process, several important points were emphasized in the content in these comics. For example, related to data on drug users, the dangers of drugs, and stories related to drugs. The comics that have been used by the teacher are shown in Figure 2.

Then in the next stage, students were invited to develop their own comics with the theme of socio-scientific issues in the border area of North Kalimantan. Based on the results of the identification of the topics chosen by the students, 57.5% of students chose topics about environmental problems, 12.5% of students chose topics of the food sector, 10% of students chose biopiracy issues, 15% of students chose fisheries, and 5% chose topics of biotechnology (Figure 3).

¹⁷ibid

¹⁸ibid

¹⁹ibid



Fig 2. The comic used by the teacher to initiate SSI-based instruction

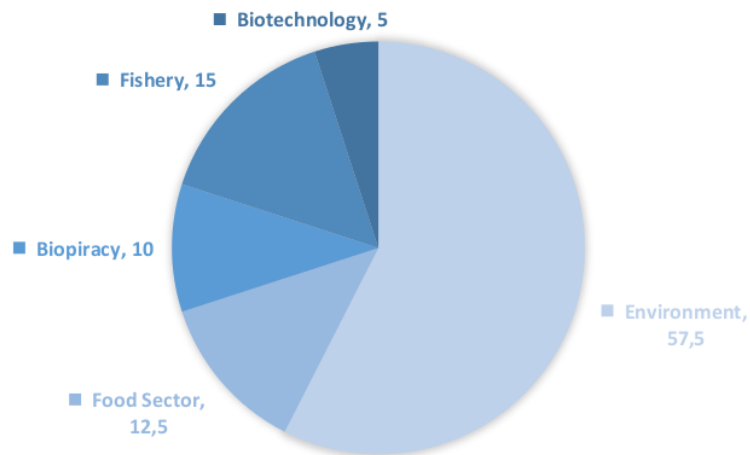


Fig 3. Percentage of SSI Topics selected by students

a. Environmental Problem

Most of the comics developed by students related to environmental problems related to waste problems in coastal areas. One example of a comic related to environmental problems in coastal areas that have been created by students is shown in Figure 4. The topic in the comic shows the cultivation of seaweed as one of the livelihoods in the North Borneo. On the other hand, seaweed farming has a very disturbing impact, namely the accumulation of plastic bottle waste. Plastic bottles are one of the items used in seaweed cultivation, where plastic bottles are used as a tool to make floating seaweeds.²⁰

Students in the developed comic described data related to world seaweed production from Food and Agriculture Organization (FAO) in 2018, where Indonesia is a contributor to 40% of the seaweed industry in the world. Besides, the students also explained that the genus of seaweed that is widely cultivated in Indonesia, namely *Eucheima spp.* and *Gracilaria spp.*²¹

Then, students provided data regarding the impact of seaweed farming on the accumulation of plastic bottle waste. Students make observations in Pantai Amal (coastal area in Tarakan, North Borneo) and identify related types of waste. In the bar table presented by the students in the comic, it was found that at least 50% was a type of plastic bottle waste. The students chose the location because there are so many seaweed farms in this area.

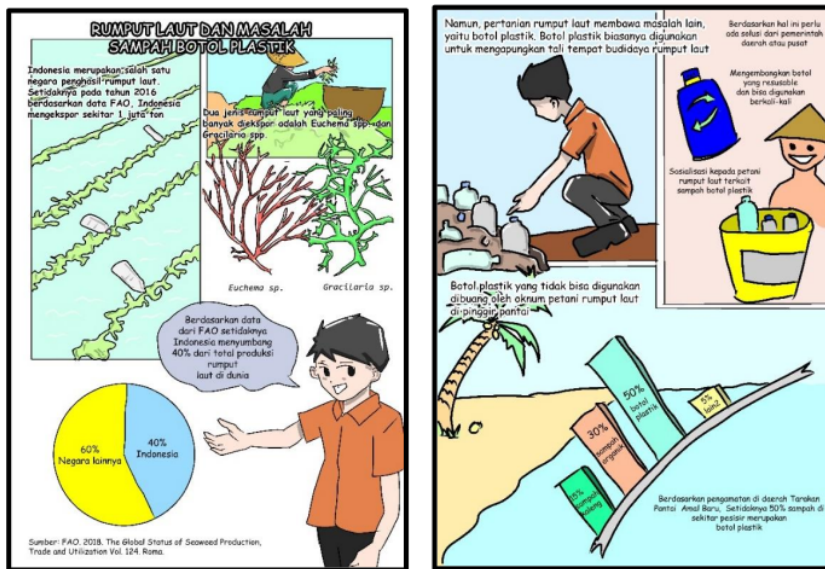


Fig 4. Comic on the topic of environmental issues

In the comics, the students explained 2 solutions, which needed to collaborate with the local government regarding minimizing plastic bottle waste from seaweed farming. The first solution described by the students was making reusable bottles so that seaweed farmers could use the bottles many times over a long time. The second way is by conducting dissemination to seaweed farmers, so that awareness will arise to love the coastal environment and instill the habit of disposing of plastic bottles in the trash. Both of these methods are the most effective from the student's point of view because the first way is an approach by replacing a plastic bottle that breaks quickly with another bottle that has high resistance. Meanwhile, the second method is an educational approach and character development which will have an impact on forming good habits of seaweed farmers.

²⁰Tim Perikanan WWF Indonesia, *Seri Panduan Perikanan Skala Kecil Budidaya Rumput Laut - Kotoni (Kappaphycus alvarezii) Jacol (Kappaphycus striatum) dan Spinosum (Eucheuma denticulatum)*. WWF-Indonesia, 2014.

²¹FAO. *The Global Status of Seaweed Production, Trade and Utilization Vol. 124*. Roma, 2018.

b. Food Sector

The topic of food issues mostly leads to the staple food used by Indonesians, namely rice. The case of rice scarcity or increase in rice prices in Indonesia is a problem that sometimes occurs at several moments, for example before holidays or holidays. Enjoying rice for some Indonesians is also a culture that is very difficult to get rid of (Nurdin & Kartini 2017).

On problems in the field of food, the topic raised by students was related to the increase in rice prices that had occurred in Tarakan in 2018 (Figure 5). In the first panel, the two characters in the comic had a conversation on the topic of rice distribution in Indonesia, where most of the rice supplies from Tarakan came from outside the region, such as the island of Java and other regions. In addition, the absence of rice farming in Tarakan is also a problem. Then, on the last page, students provide several solutions through 2 solutions, namely: liming land in Tarakan which is acidic and has a sandy clay texture so that in the future Tarakan will have its own rice farm. The second solution is food diversification. Changing the culture of eating rice is indeed difficult, but the socialization of food diversification is the right step so that people want to consume other sources of carbohydrates or other foods. Food diversification is a very interesting idea because this solution is able to create a society that can adapt if there is a type of food that is scarce in the area (Sumaryanto, 2019).

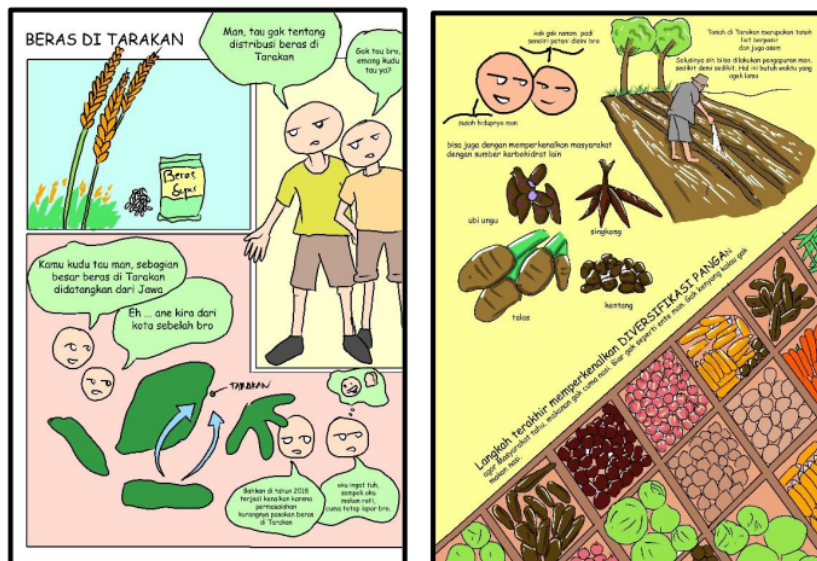


Fig 5. Comic on the topic of the food sector

c. Fishery

The issues chosen by students regarding the topic of fisheries are quite diverse. For example, the destruction of coral reefs by fishermen, the use of illegal fishing gear, and other topics. However, what will be discussed and become a new issue recently is the use of illegal fishing gear by several large fishermen namely trawl. The use of this tool has a great effect both on marine ecosystems and also from a social perspective. From a social perspective, the use of trawl can be detrimental to small fishermen because their fish catch is reduced.

²²B.V. Nurdin, and Y. Kartini "Belum Makan Kalau Belum Makan Nasi: Perspektif Sosial Budaya Dalam Pembangunan Ketahanan Pangan". *Sosiologi: Jurnal Ilmiah Kajian Ilmu Sosial dan Budaya* 19, no. 1. (2017): 15-21

²³Sumaryanto, "Diversification as One of the Food Pillars" Paper presented at the Seminar Commemorating World Food Day, 2009.

The use of trawl has been prohibited under Law No. 45 of 2009 concerning fisheries, in which the law describes the prohibition of fishing to³⁷ that interfere and damage the sustainability of fish resources.²⁴ Besides, in 2015, the Minister of Marine Affairs and Fisheries issued a Ministerial Regulation No.2 of 2015 concerning the prohibition of using trawl.²⁵

In the comic that was made by the students, several facts were explained, that in some areas the big fishermen changed the size of the trawl to be smaller or known as mini trawl (Figure 6). This change in size helps these individuals continue to use the trawl, and not break the rules. This occurs because there is no standard trawl (size and shape) so that the elements can easily escape the prohibition regulations. These violations also occurred in several regions in Indonesia.^{26 27}



Fig 6. Comic on the topic of fishery

Several solutions were elaborated by the students, especially related to the active role of the government in eradicating violations of trawling. The solutions formulated by students include providing solutions and tolerating the time limit for using trawl so that no fishermen are disadvantaged. Besides, cooperation between local governments and law enforcement officials is necessary to catch fishermen who violate the prohibition on trawling.

²⁴Law No. 45 of 2009, Law on fisheries

²⁵Indonesia Ministerial regulation No.2 of 2015 (Minister of Marine Affairs and Fisheries)

²⁶A. Arisandi. Inkonsistensi Kebijakan Penggunaan Jaring Trawl (Studi Kasus Penggunaan Jaring Trawl oleh Nelayan Wilayah Perairan Gresik). *JKMP (Jurnal Kebijaksanaan dan Manajemen Publik)* 4, no. 1 (2016): 1-18.

²⁷B. Nababan, and Wiyono, E. S. "Fishermen's Perception and Compliance to Support Sustainable Capture Fisheries in Tanjungbalai Asahan, North Sumatra". *Marine Fisheries: Journal of Marine Fisheries Technology and Management* 8, no. 2 (2017): 163-174.

d. Biopiracy

On the topic of biopiracy, the theme chosen by the students was illegal fishing. Although this topic is closely related to fisheries, the thing that is highlighted is the piracy of natural resources. In the comics made by students, it was explained related to illegal fishing cases in 2017 and 2018 (Figure 7). Based on data from the Ministry of Maritime Affairs and Fisheries, there were at least 633 illegal fishing vessels from January 2017 - October 2018.²⁸



Fig 7. Comic on the topic of biopiracy

The solution proposed by students to deal with this is the government's assertiveness towards the perpetrators. Several things have been done by Indonesia in dealing with this matter. For example, a boat that perpetrates illegal fishing is blown up. Another solution is a cooperation between the government and security forces, especially in border areas which are very vulnerable to illegal fishing activities.

e. Biotechnology

The topic discussed in biotechnology by students is Genetic Modified Organisms (GMO). Living things whose genetic material has been manipulated artificially in the laboratory through genetic engineering are called transgenic living things or genetically modified organisms (GMO) which have superior properties compared to their original living things.^{29 30} The most important part that was highlighted by the students was related to transgenic plants. The development of transgenic plants as one of the GMO developments is to overcome various food shortage problems faced by the world's population that cannot be solved conventionally, because of the rapid population growth.^{31 32 33} However, in its development to date, GMOs still cause pros and cons, both in countries where GMOs are developed and in countries that use GMO products.

²⁸ Kementerian Kelautan dan Perikanan Republik Indonesia. "Hingga November 2018, Pemerintah Tangani 134 Kasus Illegal Fishing" (online). <https://kkp.go.id/>. Accessed 3rd March 2020

²⁹ D. Lotter, "The Genetic Engineering of Food and the Failure of Science – Part 1: The Development of a Flawed Euphemism". *Int. J. Soc. of Agr. & Food* 16, no. 1 (2008): 31–49.

³⁰ C.D. Marinho, F.J.O. Martins, A.T. Amaral Júnior, L.S.A. Gonçalves, S.C.S. Amaral, and M. P. de Mello, "Use of transgenic seeds in Brazilian agriculture and concentration of agricultural production to large agribusinesses". *Genet. Mol. Res.* 11, no. 2 (2012): 1861-1880.

³¹ L. Amin, A. A. Azlan, M. H. Gausmian, J. Ahmad., A. L. Samian, M. S. Haron, dan N. M. Sidek, "Ethical perception of modern biotechnology with special focus on genetically modified food among Muslims in Malaysia. *AsPac J. Mol. Biol. Biotechnol.* 18, no. 19 (2010): 359-367.

³² H. Azadi and H. Peter, "Genetically modified and organic crops in developing countries: A review of options for food security". *Biotechnology Advances* 28, (2010): 160–168.

³³ Mahrus. "Kontroversi Produk Rekayasa Genetika". *Jurnal Biologi Tropis* 14, no. 2 (2014): 108-119



Fig 8. Comic on the topic of biotechnology

An issue that was highlighted by students regarding transgenic plants was the loss of wild type from plants because most of the plants circulating in the market were GMO products (Figure 8). Although commercialization is widely supported internationally, the issue of genetic diversity due to GMOs has also become a concern of many scientists in the world.^{34,35,36} The market prefers GMO results to wild type. Therefore, the GMO monopoly in the market will greatly reduce the variety of existing products.

The solutions offered by students are very good, where the government needs to work with farmers who are still developing organic products. This collaboration will later be useful in marketing organic products in the market. This is very important because people will be able to choose the variety of products on the market. In addition, the students also gave suggestions for wisely consuming GMO products. People need to know the benefits and risks of consuming GMO products, related to allergies or other effects.

4. CONCLUSION AND POLICY RECOMMENDATIONS

²³ Based on the results of the development of comics by students on the implementation of SSI-based learning, it was found that out of 40 students chose 5 types of topics related to sociocultural issues. The issues were chosen were: environmental problems, food, fisheries, biopiracy, and biotechnology. The percentage of topics selected by students is as follows 57.5% of students chose a topic about environmental problems, 12.5% of students chose a topic of the food sector, 10% of students chose a topic of biopiracy, 15% of students chose fisheries, and 5% chose a topic of biotechnology.

The solutions offered by students vary according to the chosen socioscientific issue. However, most of the ³⁹ solutions described by students mostly needed government assistance, both central and local. Therefore, the results of this study are expected to be able to provide an overview of the government regarding socio-scientific issues that are still being polemic, especially in border areas. The government is expected to take part in solving these issues through various types of approaches, either through solutions described by students in comics, or other solutions.

³⁴K. Koch, "Food safety battle: organic vs. biotech". *Congressional Quarterly Researcher* 9, no. 33 (1998): 761–84.

³⁵R. Pedreschi, M. Hertog, K.S. Lilley, and B. Nicolai. "Proteomics for the food industry: opportunities and challenges". *Crit Rev Food Sci N* 12 50, no. 7 (2010): 680- 692.

³⁶M. Cantley. "European Attitudes on the Regulation of Modern Biotechnology and their consequences". *GM Crops and Food: Biotechnology in Agriculture and the Food Chain* 3, No. 1 (2012): 40-47.

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