Engaging the adolescents of Indonesia towards ecological citizenship through food chemistry education: a literature review

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**Abstract:** The dominance of the Indonesian population in 2018 by the productive age group (aged 15-64) reaches 67.6% of 265,000,000 people, and adolescents are 25.2% among the productive ages. Adolescence as a period of life will continue to seek new ways to redefine themselves (identity processes) and to explore new ideas and challenges, so it is important to understand how they will influence others and how they will have an impact on their families, communities, and the world at large. This understanding will encourage the adolescents’ rule as the part of political actors to take action (WTTA) influencing the society towards the ecological citizenship. Ecological citizenship concerns rights, entitlements, duties, obligations, and responsibilities to ensure that ecological footprints make a sustainable impact. By this condition, adolescents need community and social support to develop ecological citizenship along the identity processing and coping of their life struggling. The idea of this paper is to offer food chemistry education as an alternative health and nutrition education. Food chemistry education can facilitate the needs of adolescents to achieve the appropriate development into ecological citizenship. This paper aims to discuss how food chemistry education develops Indonesian adolescents as the youth and future generation who will manage the quality of the environment by becoming ecological citizens through their various life struggles. The discussion will be done by literature review.

**Keywords:** Indonesia; ecological citizenship; adolescence; food chemistry education.(ABS)

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1 Introduction

Sakanko and David (2018) validated the Malthusian Theory on Nigerian economy that population growth and food production can move proportionally in the long-run. Indonesian population in 2018 reach 265,000,000 people, and 67.6% is the productive age group which aged 15-64. Among the productive age group, 25.2% is adolescent (aged 10-19). Adolescence is a predictable developmental stages of human capital investment (Bhutta, *et.al.*, 2019) to support the economic growth and achieve the sustainable development simultanously. The investments with the development of human capital, defined as the stock of knowledge, skills, attitudes, health, and other personal characteristics that enable individuals to realise their full potential as productive and responsible members of society.

Adolescence as a period of life will continue to seek new ways to redefine themselves (identity processes) and to explore new ideas and challenges (Neinstein, *et.al.*, 2008), so it is important to understand how they will influence others and how they will have an impact on their families, communities, and the world at large. This understanding will encourage the adolescents’ rule as the part of political actors to take action (WTTA) influencing the society towards the ecological citizenship (Grabs, 2018).

The identity processes of adolescents (commitment, in-depth exploration, and reconsideration of commitment) and political participation are linked to each other (Crocetti, Jahromi, & Meeus, 2012). The link is mediated by social responsibility, such as involving in volunteer activities some time for the good of their community and playing the role in making the world a better place.

On the other hand, ecological citizenship obliges us to rethink the traditions of citizenship in ways that may take us beyond those traditions. The first virtue of ecological citizenship is justice, more specifically, aims at ensuring a just distribution of ecological space. The second is care and compassion or sympathy, either to human or non-human beings (Dobson, 2003). By this condition, adolescents need community and social support to develop ecological citizenship along the identity processing and coping of their life struggling (De Gregorio, 2011).

Crocetti, Jahromi, & Meeus (2012) also found that achieved adolescents showed more involved in volunteer activities, reported higher civic efficacy (Aydinli, Bakar, & Çağrı, 2018), and had stronger aspirations to contribute to their communities. Liska (2015) stated that adolescents have specific needs and health. The system need to take into account their biological, emotional, and social development to support adolescents to attain a productive, healthy, and satisfying life.

To raise the willingness to take action from adolescents, society needs to priority for action include health education, access to health services, immunization, nutrition, and psychological support. The idea of this paper is to offer food chemistry education as an alternative health and nutrition education. Food chemistry education can facilitate the needs of adolescents to achieve the appropriate development into ecological citizenship.

This paper aims to discuss how food chemistry education develops Indonesian adolescents as the youth and future generation, who will manage the quality of the environment by becoming ecological citizens through their various life struggles. The discussion will be done by literature review.

2 Ecological citizenship

Ecological citizenship concerns rights, entitlements, duties, obligations, and responsibilities to ensure that ecological footprints make a sustainable impact (Dobson, 2003). Ecological footprint defined as the expression of the impact of the production and reproduction of individuals' and collectives' daily lives on strangers, near and far, to whom the obligations of ecological citizenship are owed.

Ecological citizenship transforms the community of citizenship, not the moral community. In-depth point of view, Dobson (2003) stated that ecological citizens are most likely to be created through lived experience. Ecological citizenship is characterized as the exercise of ecologically related responsibilities, nationally, internationally, and intergenerationally, rooted in justice, in both the public and private spheres.

Pallet (2016) argued that ecological citizenship is too closely associated with market-based mechanisms for pro-environmental behavior change through emphasizing its responsibilities and virtue, which is sometimes in opposition to market logics. Even though, development of ecological citizenship needs to focus on the processes and political arrangements that produce ecological citizenships and pro-environmental behaviors, and explicit engagement with the roles, capacities, priorities, and powers of the diverse actors who are involved in these processes (Anantharaman, 2014).

*2.1 Engaging adolescents to become ecological citizens*

Engaging adolescents to become ecological citizens can be done by taking action and contribute as the process of civic identity such as volunteering in community service involvement (Oosterhoff, Metzger, & Babskie, 2015), which needs parents’ support and communication to ensure that the involvement link to adolescents’ moral reasoning about community service and the development of civic identity. Even though, the adolescents’ political involvement is influenced by education and behavioral differences in family-level variation.

Raising environmental awareness (Emiru & Waktola, 2017) can engage adolescent to participate in ecological issues, starting from asessing their knowledge to map their ecological conceptual and describe their willingness to pay and take action. Guckian, Hamilton, & De Young (2018) stated that a visual display of meaningful, interconnected concepts that represent an individual’s unique, lived experience, and knowledge of an ecological topic can drive the adolescents’ conceptual mapping.

Ecological citizenship can initially be developed and achieved at school through the student teachers’ perception of sustainability issues. The perceptions are summarized in education for sustainability. The education for sustainability shaped the student teachers’ perception by aspects of ecological citizenship and political solidarity (Lummis, *et.al.*, 2016). Deeper, the shape is informed by the local context, so that the student teachers were moving from a more environmentally-centered conception of sustainability to a definition that included the other pillars of economic and socio-political sustainability (Aydinli, Bakar, & Çağrı, 2018).

Farther, education for sustainability and environment should be able to drive adolescents to be ecologically aware by seeing themselves as the incarnation of the land with the landscape having uniqueness and aesthetics for others to admire, understand, and emulate as the mode of life that makes a sustainable world (Ideland, 2018). Education for sustainability should provide the psychologies of learning to effect the sensitivities, dispositions, and awareness that reach into the soul of the adolescents as affects, emotions, and desires.

Ideland (2018) stated that the citizen needs to be made continually and the school can be the central site for making of a citizen who inhabits the spaces of participation. In school, a person can speak about social and educational theories which can develop modes of life enable freedom, empowerment, participation, and collaboration to make possible the equitable and just societies, as the argument of environmental education and sustainable development.

*2.2 Sustainable society toward ecological citizenship*

Level of participation in sustainable society management toward ecological citizenship depends on decision-making power, labor contribution, cost bearing, and the number of community member involved (Soviana & Kuhl, 2010). For adolescents situation, level of participation to be sustainable society depends on decision-making power, cost bearing, and number of community member involved (Salonen, & Åhlberg, 2013).

Concerning the decision-making power in adolescents, it needs to consider to give them full responsibility for and control over their own future. School can be the central site to develop adolescents’ decision-making power (Fitri, 2019) together with teachers’ and parents’ role synergies by local culture as the stimulation to build up a collective action concept suitable to normal adolescents interest and need (The Indonesian Ministry of Health, 2016).

The financial grants support in developing sustainable society should be focused on adolescents’ community empowering such as assistance in technology, education, practical knowledge and skills, so that they may see a revelation of new perspectives on their lives and on what they can do (Weller, 2007).

Building up culture in adolescents can be embedded in voluntarism. Adolescents as active citizens (Weller, 2007) in their community and school interest to involve in volunteer activities (Crocetti, Jahromi, & Meeus, 2012) and earning additional economic incentives will tend to bring additional attractiveness to participate. When adolescents share a sense identity, hold similar values, trust each other and reciprocally do things for each other, it will be easier to achieve sustainable society toward ecological citizenship.

Peters & Besley (2019) stated that sustainable society participation toward ecological citizenship needs openness to global sciences collaboration as an alternative growing sector of the global knowledge in distributed knowledge and learning systems that encourage innovation-smart processes and leveraging of cross-border international collaborations. Diprose, *et.al.* (2019) argued that the collaboration of global science can be focused on building common cause to implement sustainable consumption.

3 Adolescents

Piaget, & Inhelder (2013) stated that adolescence is the age which adolescents take their place in adult society. Adolescence is the age of personality formation by walking through the stage of life course that are confronted with learning to achieve new forms of intimate relationships, preparing for an occupation, achieving emotional independence of parents, and developing a mature set of values and ethical principals. The peer group plays a major role in facilitating the achievement of adolescents’ development tasks by providing a context in which some of these tasks can accomplished (Ekerdt, 2002).

When an adolescent begins to think about the society in which he is looking for a place, he has to think about his own future activity and about how he himself might transform this society. Adolescents’ social life tend to congregate in peer groups, action groups, political groups, youth movements. This type of social life defines an expansive phase followed by a withdrawal phase as the source of intellectual decentering. The adolescent’s manifestation of egocentrism stems directly from the adoption of adult roles, since the adolescent not only tries to adapt his ego to the social environment but, just as emphatically, tries to adjust the environment to his ego. (Piaget, & Inhelder, 2013).

As young people, adolescence undergoes dramatic changes, seek new ways to redefine themselves and to explore new ideas. It is necessary to understand how they will influence other adolescents and how young people will impact their families, their communities, and the world at large. The first thing we can do is to encourage adolescents to aware of their health because healthy adolescents will give a positive impact on their development tasks achievement, especially in their social life (Neinstein, 2008).

Adolescence is a period of life full of potential and risk at the same time, this is why, to support the achievement of development tasks, adolescents’ two dimensions health, physiological and psychological, need to be facilitate properly. This condition becomes the driven for the multidisciplinary study includes pediatricians, internists, family medicine physicians, gynecologists, nurse practitioners, physician assistants, psychologists, social workers, nurses, health educators, nutritionists, and teachers among many others, to expand the research on adolescent's health (Neinstein, 2008; Emilia, 2009; Davidow, Insel, & Somerville, 2018).

*3.1 Adolescents in Indonesia*

The Indonesian Ministry of Health (2016) defines adolescents as people between 12-25 years old and unmarried who were initially identified by puberty. Indonesia identifies adolescents in two conditions, normal and problematic. Normal adolescents has a better physical condition, intellectual, and intelligence social than a problematic one. Normal adolescents need positive determinants including health through healthy eating style (Davidow, Insel, & Somerville, 2018) by regulating the variants and quantity of food, maintaining and increasing the nutrition intake, which is supported by routine health checks to monitor the adolescents’ health development as the early detection, prevention, and also immediate intervention on the disturbance found.

Normal adolescents should do regular physical exercise to improve their body coordination, support their bone and muscle growth, increase their intelligence, prevent obesity and disease, and minimize distress (severe stress). Non-physical exercise is also important for adolescents to have comprehensive knowledge about their health so they concern for their own health (Emilia, 2009; The Indonesian Ministry of Health, 2016).

Positive determinants also come from the multi-sector synergies including social activities (Scott, Duell, & Steinberg, 2018) such as the home, school, community and cultural environment that influence the everyday adolescents' attitudes and behavior. Home social activities for adolescents are dominated by parenting styles such as character, communication, and understanding (Farhatilwardah, Hastuti, & Krisnatuti, 2019). Normal adolescents can be superior generation by school positive determinants as the central site of moral optimization (Fitri, 2019) which focuses on adolescents' potential or interest and talent.

For sure, social activities at school should be able to increase their interest of reading, especially the empowering books and information, to increase their comprehensive knowledge, improve their analytical and critical thinking, as well as, find out their true interests and talents. The learning process at school must be also expanded to develop nationality as the students’ character (Novitasari, & I Made, 2013). Social activities at home and school which focus on adolescents' potential or interest and talent will drive them to become positive and creative persons.

Social interaction as positive determinants can affect the adolescents' emotional maturity by practicing them in coping with problems or conflicts, cooperating, building good relationships or networking, and providing or getting support from their peers (Scott, Duell, & Steinberg, 2018). Adolescents can extend their social interaction in the formal organization to maintain a strong character and personality. In Indonesia, two of youth formal organization are OSIS (Students’ Council) and Karang Taruna (Youth Organization). Participating in OSIS, adolescents can improve their intellectual and intelligence social (Nez, 2014), meanwhile, Karang Taruna will increase the ability to actualize themselves within society (Hidayah, Pramono, & Nugraha, 2018), so that Karang Taruna and OSIS can become the social forum for increasing adolescents' willingness to take action as part of ecological citizenship.

Normal adolescents achievement needs support from other sectors such as a quality environment, infrastructure including proper building/house, national economic stability. Hidayah, Pramono, & Nugraha (2018) stated that the quality environment and proper building/house create security and comfort for adolescents to behave a positive personality. Meanwhile, national economic stability provides various opportunities for adolescents to do more positive activities within their peers and society.

To achieve normal adolescents, The Indonesian Ministry of Health (2014) implements the guideline of balanced nutritions which is known as GERMAS (Community Health Movement). One of the movement is healthy eating habits by following the guidelines of 3B (Nutritious, Balanced, and Diverse) food consumption. The illustration of GERMAS which is described in 3B 1A (Nutritious, Balanced, and Diverse plus Active) can be seen as Figure 1. Healthy eating habits on adolescents can be supported by comprehensive knowledge about Indonesian food diversity (Simanjuntak, 2017) that will help them to make the best preferences of food based on their physiological needs.

Engaging adolescents to implement healthy lifestyle by doing GERMAS or the guidelines of nutritious, balanced, and diverse plus active in their everyday life, Indonesian Government must be able to raise multi-sector stakeholders synergies in health aspects involve Directorate of Family Health (Dit. Kesga) and BKKBN (National Population and Family Planning Agency). While in the field of non-health, as social aspect, involves KPAI (Indonesian child protection commission), Ministry of Social Affairs, Ministry of Religion, Ministry of Youth and Sports. On environmental aspects can involve the Ministry of National Education, Kemenhum HAM (Ministry of Law and Human Rights), LSI (Indonesian Survey Institute), KemenPAR (Minister For Public Works and Human Settlements), and the Ministry of Communication and Information (The Indonesian Ministry of Health, 2016).

When adolescents of Indonesia, in majority, agree to follow the guidelines of consuming nutritious, balanced, and diverse food plus active in their everyday life, then Indonesia will be able to reach food security simultaneously preserve the ecosystem services to achieve the biodiversity, at least 25%. Hanspach, *et.al.* (2017) stated that food security and biodiversity can be achieved simultaneously.

**Figure 1.** The guidelines of nutritious, balanced, and diverse plus active to achieve a healthy community (The Indonesian Ministry of Health, 2014)



*3.2 Adolescents’ citizenship*

As future responsible citizens (Mameli, Molinari, & Passini, 2019), adolescents development focus needs to be formalized in order to challenge voter apathy, counter alienation, promote active citizenship and provide a unifying element to the government’s policy on social exclusion (Weller, 2007). Adolescents have a problematic relationship with citizenship and within the context of many dominant understandings, the adolescents are predominantly defined as citizens-in-the-making who need to learn how to affectively participate in democracy (Gibbons & Poelker, 2019).

The understandings of adolescents as citizens-in-the-making become the concern of focusing on adolescents’ perceptions, experiences, and opportunities (Evans, 2019) which are socially and spatially structured. The structure can be examined from the reproduction of culture and social life through children (Weller, 2007) because adolescents’ lived experiences are, in part, constructued and structured by the notion of childhood citizenship which also contains a package of rights, duties and obligations that implies equality, justice, and autonomy.

Introducing adolescents’ citizenship can be executed in school which influences the development of political understandings and active citizenship. Participation in decision making within different aspects of everyday life at school will develop experiences to introduce adolescents’ citizenship (Weller, 2007; Nieuwelink, Dekker, & ten Dam, 2019). Adolescents’ citizenship praxis within the classroom by participating in a school council could have a particular relation to the teaching methods favored on adolescents as the subject of citizenship relevancy in their present lives.

Democratic classroom effectively promotes citizenship (Weller, 2007) through the practice of democracy in school (Arnold, 2019). A democratic classroom can be performed in a learning process that highlights the adolescents’ criticism and preferences for the way in which citizenship is presented. Relevant issues of subjects are also discussed in order to emphasize the difficulties inherent in promoting citizenship education, which focuses on creating future responsible citizen (Mameli, Molinari, & Passini, 2019).

4 Food chemistry education

Chemistry learning can role the sustainable future (Matlin, et.al., 2015) by providing the understanding of the physical and chemical properties of atoms and molecules together with practical methods for creating new molecular structures with a useful application which is related to the sustainable development goals. Chemistry, as the platform or central science, can be the underpinning fundamental aspects of a range of established and emerging sciences including biochemistry, molecular and synthetic biology, physics and soft condensed-matter physics, nanoscience. Even, chemistry is the integrated part of major practical advances seen in such fields as agriculture, biotechnology, energy, ecology, the environment, genetics, information technology, materials and medicine, and the dramatic rises in overall human wealth and well-being during the past two decades.

Abad, Alvaro, & Nudelman (2018) resulted that pedagogic unit such as hydrocarbons focused on environmental issues can achieve chemistry learning process for sustainable development goals, using the STES (Science, Technology, Environment, and Society) teaching approach. Mellor, *et.al.* (2018) stated that green chemistry educational game can be strongly attractive as well as motivate the students to consider green chemistry and sustainability concerns as they design hypothetical, chemical products. Simultaneously, the green chemistry educational game can encourage students as the designers of developing a chemical product with respects to function and improved human and environmental health.

As Simanjuntak (2017) resulted, food chemistry education is one of the chemistry learning process in school that can increase adolescents’ comprehensive knowledge about food diversity and improve their awareness of healthy eating habits. Further, food chemistry education can achieve the environmental awareness by practising sustainable consumption for getting healthier food from environmentally agriculture such as organic farming (Simanjuntak, 2006; Mayrowani, 2016).

Learning process of food chemistry education will apply an integrated module that discusses various kinds nutritious food, food processing without decreasing the nutrition benefit, sources of healthier and cleaner food, as well as, how to manage the food processing waste for a sustainable environment (Simanjuntak, 2015). More advanced, the module will implement a simple game to increase the adolescents' willingness to participate in food security aspect as the ecological citizens.

*4.1 Food chemistry education based on Indonesian culture*

The Indonesian culture in this review is mostly discussed based on Lamoureux’s (2003) study, Indonesia: A global studies handbook. Indonesia is the largest archipelago in the world with two thirds is ocean. Indonesia is made up of over 17,000 islands, the landmass is approximately 760,000 square miles and the combined coastline of all the Indonesian islands is approximately 33,900 miles. The Indonesian islands are located above and below the equator, some are situated directly on it. The islands of Indonesia are divided into four regions, i.e. (1) the Greater Sunda Islands they are Sumatera, Java, Bali, Kalimantan, and Sulawesi; (2) the Lesser Sunda Islands they are Lombok, Sumbawa, Sumba, Flores. Komodo, and Timor; (3) numerous smaller islands they are Halmahera, Ternate, Tidore,Seram, and Ambon comprise Maluku; (4) West Papua. The country extends from the Indian Ocean into the South China Sea and on to the Pacific Ocean. Many islands border on or are surrounded by smaller bodies of water, such as the Strait of Malacca, the Java Sea, Banda Sea, Celebes Sea, and the Timor Sea.

The Indonesia’s population is composed of many ethnic groups. The largest of these are the Javanese, Sundanese, Batak, Balinese Acehnese, Minangkabau, Dani, Dayak, Punun, and Bugis. The Indonesians’ religion is Islam, Christian (Protestant and Catholic), Hindu, Buddhist, Tao, and Indigenous religions. The language spoken throughout Indonesia is over 250 different languages and dialects. They are belonging to the Austronesian language family, some sources put the numbers as high as 600. The motto is Unity in Diversity and the national language is Bahasa Indonesia.

Indonesian dishes are made from locally grown and introduced foods from around the world, such as India, South America, Europe, and China. Soybeans are used extensively in Indonesian cooking, and their high nutritional value is a main reason for the good health of many poorer Indonesians. The two popular dishes made from soybeans are *tahu* (tofu) and *tempe*. *Ketcap* (soy sauce), as a flavor enhancer, is also made from soybean and used in flavoring many meat and vegetable dishes.

Harmayani, Santoso, & Gardjito (2019) stated that Indonesia has many traditional dishes made from fermented product, vegetables such as tofu, *tempe*, *ketcap*, *gathot*, and animal such as *bekasan*, *terasi*/*belacan* (shrimp paste). Furthermore, Indonesia also has many traditional dishes based on ethnic diversity all over regions of Indonesia such as Lontong Medan, Soto Betawi, Papeda, etc. (Gardjito, Harmayani, & Santoso, 2019).

Food chemistry education at school can be the central study for developing Indonesian traditional dishes become popular Indonesian signature dish in the world. The main study of food chemistry education can be more improved to develop *rempah-rempah* Indonesian traditional food flavor toward modern functional food and herbal medicine, since these *rempah-rempah* are endemic to the Nusantara regions (Djati, & Christina, 2019).

To support food chemistry education become the central study at school, Sofia, Permanasari, Sholihin, & Supriyanti, (2019) argued that the Indonesian Ministry of Education must ensure the teacher education institution to fulfill the competency standards of chemistry education candidates, mainly, on competency standards related to food chemistry. But, this literature review proposes that food chemistry education at school must be based on adolescents’ learning outcomes to achieve the normal adolescents, as well as, improve the willingness to participate in healthy eating habits towards a sustainable society.

*4.2 Food chemistry education towards sustainable society*

Lamoureux’s (2003) stated that the green revolution around 1970-1980 had given impact on food diversity in Indonesia. Before green revolution, Indonesia has four kinds of carbohydrate they are rice, cassava, corn, and *sago*, but up to this moment, rice becomes the main carbohydrate almost over the regions of Indonesia, including West Papua. Many scientists concern about the impact of green revolution on biodiversity, especially food diversity which will affect food security in Indonesia (Soehadha, 2016).

Based on the phenomena of food diversity in Indonesia after the green revolution, The Indonesian Ministry of Health (2014) had been promoting the consumption of nutritious, balanced, and diverse food plus active to develop food security, as well as, achieve Indonesians’ good health and well-being.

Unfortunately, adolescents, especially who live in the city, have poorer knowledge about staple food diversity in Indonesia so that they made a short list of staple food diversity (Simanjuntak, 2017). Their preferences of staple food, basically, based on its taste and appearance.

Telfer (1996) believed that the role in life of food and eating raised many central questions in moral philosophy, i.e. the extent of our obligation to the needy, the possibility of duties to oneself, and the place of special obligations in morality. Sometimes, people found that eating can be a leisure activity which is the motive of seeking pleasure, the exercise of choice, and leisureness, however, at the same time, some found that eating is a way to survive. This is one condition which explains the most general duty to others concerning food, that the duty to eat healthily oneself, so be fit to perform one’s duties to others.

Good health enables one to perform one’s duties to oneself, which consist of the exercise of autonomy and promotion of self-development in the choice and pursuit of ideals including ideals on food and eating. Petersen (2010) stated that ideals on food and eating could be pursued to protect the earth’s food supply.

Interestingly, Heaven (1996) described that adolescents’ concept of being healthy is living up to one’s potential, being able to function physically, mentally, and socially, as well as, experiencing positive emotional states. This concept is linear with the result of Simanjuntak’s (2017) research that adolescents make a list of staple food preferences based on taste and appearance which explained their experience about food and eating.

Seems that food chemistry education at school must facilitate adolescents’ experience about food and eating to engage them in participating in healthy eating habits and, at once, fulfilling their duties as a sustainable society by a comprehensive knowledge of accessing their food and eating. As Salonen, & Åhlberg (2013) said, sustainable society is citizens who have circumstances where diverse life can flourish now and in the future.

Usually, the transformation starts from a change in personal behavior and leads to policy changes. Means that food chemistry education at school toward sustainable society should improve the adolescents’ awareness by facilitating the willingness to participate and take action in promoting the healthy lifestyle, recycling, healthier and cleaner food consumption such as organic food (Simanjuntak, 2006; Mayrowani, 2016), water-saving, civil society maintaining, favouring eco-labelled products and services, and favoring renewable energy resources.

*4.3 Food chemistry education develops adolescents’ self-determination motivation as sustainable society*

Self-determination theory (SDT) by Ryan & Deci (2017) discusses motivation, development, and wellness as the basic psychological needs. For adolescents, parents’ play a big role in SDT’s approach through their responsiveness to develop adolescents’ basic psychological needs. The approach begins with the assumption of inherent growth processes, including intrinsic motivation, relatedness, internalization, and integration. SDT specifies three critical dimensions of parenting (The Indonesian Ministry of Health, 2016), they are autonomy support, structure, and involvement which are the influencer to adolescents’ internalization and basic needs satisfaction. Sensitivity by parents’ responsiveness and autonomy-supportive are the bases for secure relatedness.

Adolescents can learn and grow by satisfaction on their basic psychological needs when their parents are involved and autonomy-supportive while providing structure. Parents’ provision of supports for their adolescents’ basic needs led to more internalization and autonomous functioning, which in turn was related to greater well-being and less ill-being. Adolescents are more likely to internalize their guidance and values when they are securely attached to parents, but they who feel unrelated and detached from parents will be more oriented toward internalizing the values of peers or extra familial subcultures to which they feel (or wish to feel) attached (Dishman, *et.al*., 2019).

Briefly, Ryan & Deci (2017) described the key elements of three parenting’s dimensions on adolescents. The key elements of parenting’s autonomy support are taking the adolescents’ perspective, offering meaningful choices, encouraging and supporting initiative and voice, minimizing controlling language, and providing meaningful rationales for required or requested behaviors. The key elements of parenting’s structure to adolescents are organizing the adolescents’ environment to support competence (scaffolding), focusing on mastery rather than performance goals, providing guidelines and effectance-relevant information, providing rich feedback that is informational rather than evaluative or controlling, explaining contingencies and sources of control, and setting limits in noncontrolling way. The key elements of parenting’s involvement are devoting time, investing attention and resources, being care and supportive, and showing warmth and concern.

Obviously, meaningful information has a major role in adolescents’ psychological needs by developing intrinsic motivation to learn and assimilate, this is why school should capitalize on students’ intrinsic motivation (Christiansen, *et.al.*, 2019) instead emphasize extrinsic motivators by grades, awards, and social comparison attached to external pressure, controls, and punishment. Intrinsic motivation has significance for student engagement and cognitive growth, and the conditions that support it in classrooms which lead to autonomous motivation such as internalization of values for learning and academic achievement.

Ryan & Deci (2017) suggest school create educational environments to flourish students’ intellectual and social-emotional. If the intellectual and social-emotional increase enjoyment along the learning process, then adolescents will be able to reach a good learning achievement (Li, 2019). In line with Li's (2019) findings, Ivanova & Ivanova (2009) described adolescents’ learning style that needs to be facilitated along the learning process, i.e. making learning fun and more relevant to them and their world, going faster so they can receive information quickly, less step-by-step instruction, more random access, hyperlinked, just-in-time learning experiences, less text and more pictures, sounds and video wherever possible, more opportunities for multitasking, networking and interactivity.

Further, a school must provide autonomy-supportive behaviors lead to needing satisfaction and increased self-determined motivation. The behaviors include offering meaningful choice and allowing adolescents as students to have a say in the decision-making process, minimizing pressure and control, and acknowledging the feelings of others (Sullivan, 2019). Autonomy-supportive behaviors at school, especially, are executed by teachers through implementing the autonomy-supportive teaching strategies that foster more autonomous forms of motivation in students and the higher quality of engagement, performance, and positive experience associated with it. However, teachers need a positive support as motivation for implementing the autonomy-supportive teaching strategies (Ryan & Deci, 2017).

Food chemistry education at school that I propose in this literature review is a kind of problem-based and project-based learning model to increase adolescents’ high order thinking skill and at the same time, to develop their willingness to take action as a part of sustainable society toward ecological citizenship. Food chemistry problem-based and project-based learning model will encourage adolescents to explore their capacity to involve parents, teachers, and peers along the food chemistry learning process.

5 Conclusion

This literature review uses the concept of ecological citizenship by Dobson (2003) that ecological citizenship concerns rights, entitlements, duties, obligations, and responsibilities to ensure that ecological footprints make a sustainable impact. Ecological citizens are most likely to be created through lived experience and characterized as the exercise of ecologically related responsibilities, nationally, internationally, and intergenerationally, rooted in justice, in both the public and private spheres.

Engaging adolescents to be ecological citizens, first, is to achieve normal adolescents by supporting them to participate in performing healthy eating habits. The adolescents’ participation can be facilitated in food chemistry education process at school together with their peers, teachers, as well as, with parents at home. Further, adolescents’ participation in healthy eating habits will encourage them to take action in environmental preservation as the entrance to sustainable development goals. The connection between ecological citizenship, adolescents, and food chemistry education can be illustrated and seen in Figure 2.

**Figure 2.** The illustration of the connection between ecological citizenship, adolescents, and food chemistry education



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