

**MASTER THESIS**

**Learning for sustainability: are Amsterdam secondary schools embracing circularity?**

Author: Eirini Tsirimokou  
Term year: Spring 2021  
Degree Programme: Education Entrepreneurship  
Supervisor(s): Blair Stevenson, Pablo Santur Arreluce

# CONTENTS

ACKNOWLEDGMENTS .....	4
ABSTRACT.....	5
1 INTRODUCTION .....	7
2 LITERATURE REVIEW: BACKGROUND AND THEORIES .....	9
2.1 Secondary Education .....	9
2.1.1 Secondary Education in the Netherlands .....	10
2.1.2 Emotional and cognitive changes in adolescents.....	13
2.2 Learning environments .....	15
2.2.1 Sustainability in Education .....	15
2.3 Circular economy .....	17
2.3.1 Circular Economy and Education .....	18
2.3.2 From 'Planetary Boundaries' to the 'Doughnut economic model' .....	19
2.3.3 Circular city of Amsterdam & Doughnut Economics .....	22
3 AIM AND RESEARCH QUESTIONS.....	25
4 METHODOLOGY .....	26
4.1 Methodological approach .....	26
4.2 Data collection process .....	26
4.3 Data Analysis process and methodologies.....	28
5 RESULTS .....	30
5.1 Teachers' interpretation of CE in schools.....	30
5.1.1 Teachers' survey.....	30
5.1.2 Teachers' online individual interviews .....	34
5.2 Students .....	36
5.3 Circular Economy Initiatives .....	39
DISCUSSION.....	43
Awareness.....	43
Implementation .....	44
CONCLUSION .....	47
FURTHER RESEARCH POSSIBILITIES.....	48
REFERENCES .....	49
Interview guide & questionnaire.....	53

Interviews' transcript.....	54
Surveys questions and answers .....	54

## **ACKNOWLEDGMENTS**

I would like to express my gratitude to all the people that helped me throughout this two-year journey. First and foremost my supervisors Blair Stevenson and Pablo Areluce for guiding me attentively and empathically during this period whilst being understanding of the limitations of the research in COVID times. Moreover, to Johanna Pihlajamaa for her inspiring teaching capabilities and her final touch on the thesis supervision. Special thanks to Jampel for the valuable comments and feedback during the revision of my thesis and constant encouragement along this process. Last but not least, thanks to my family and especially to my mother, who unconsciously inspired me to pursue this Master programme.

## ABSTRACT

The Amsterdam Circular Strategy 2020-2025 outlines how the City of Amsterdam aims to achieve its ambition to become 50% circular by 2030 and to achieve a fully circular city by 2050 by using the so-called Doughnut economics model. Within this commitment certain facets of the society are being analysed and put into assessment for transition to a circular setting. Health, employment, food, education, justice, culture, community are some of the social parameters to look into in combination with the ecological ones on water, pollution, etc. Education sits in a critical position in this shift as it holds the ability to bring systemic change from bottom up and in a more holistic way.

The aim of this study is to perform exploratory research and critically analyze the implementation of CE in secondary education within the region of Amsterdam. The research focused on the challenges that schools face in embracing circularity in their learning environments, the familiarity with the notion of CE and the elements of the Doughnut framework that are in need of improvement. These topics were examined from a critical perspective by means of a thorough literature review, content analysis of the Dutch educational system, with educational stakeholders' interviews. Additionally, educational and sustainable frameworks of public and private bodies, publications, and reports were reviewed whilst active participations to workshops and groups related to the subject took place. After a systematic data collection process and analysis, and based on the revised documentation, it is possible to state that CE is undergoing a moderate and slow paced implementation in the secondary system in Amsterdam.

In the discussion section, plausible reasons that explain these findings are provided, complemented with critical reflections regarding the concept of CE in education. Further analysis is presented to support this part of the research and render the results more concrete and inclusive.

---

Keywords:

Circular economy, sustainability in education, secondary education, Doughnut economic model



# 1 INTRODUCTION

In the past few years there has been an urgent call for action regarding the downfall of the ecosystem and the irreversible series of events triggered by human's actions that result into nature's destruction. Scientists and activists alert on the situation's gravity and provide expertise on how to reverse the current condition. Economists and climatologists work together to show that once the planetary boundaries are surpassed, the way of living as we know it, can be negatively affected (Rockström et al., 2009). These boundaries which are linked to the earth's biophysical function can create a safe space for humanity unless certain thresholds are exceeded that consequently lead to today's climate crisis state (Rockström et al., 2009).

The Sustainable Development Goals (SDG) published by the UN in 2014 aim to also confront the challenge of climate crisis by targeting the different aspects of the socioeconomic system by committing to the timeline of the Agenda 2030 (United Nations, 2015). According to the mainstream narrative, 'sustainable development' should provide environmental protection, boost economy, and offer harmonious living within the societies for the current and future generations. To address the SDG goals, various concepts within the last years, have been introduced and discussed, a prominent one being the notion of 'circular economy'. Circular economy (CE) has the ambition to transform the current system into a regenerative and distributive one, stabilising the turbulence in the earth system by delivering solutions that tackle the disequilibrium in the planetary boundaries whilst not excluding any social aspects. Kate Raworth, the pioneer of the 'Doughnut' economic model introduced a circular economic model that examines the balance of planetary boundaries with social factors. This provides a framework adapted to the urgent contemporary socio-environmental challenges (Raworth, 2017).

In light of the transition to a prosperous future that respects the ecosystem, it is vital to recognize the role education plays in a circular, regenerative system development. Paradigm and mindset shifts occur when collaborative effort is put in place towards the comprehensibility of knowledge, the acquisition of new skills and the respect for each individual. On that note, education must reflect the queries of this attempt and onboard schemes and strategies to respond to the transformation for a more sustainable future. The SDGs have a strong focus on quality of education, committing by 2030 a safe educational environment to every learner, easy access to knowledge and robust comprehension of the SDGs achievement (UNESCO, 2017)

Evidently, one sixth of the human global population consists of young people with approximately 1.2 billion individuals aged 10-19 years old, who are prone to experience the severest effects of climate crisis in the upcoming years. This generation requires empowerment and a strong voice to ameliorate the current scenario and act together upon the SDGs achievement. They can have a tremendous influence on system change, starting from their own circles and having a ripple effect to the local and global communities. Furthermore, adolescence is a sensitive period of life consisting of various neurophysiological alterations that can impact their behaviour. Hence, protecting and nurturing the youth is critical to deliver a solid ground for them to flourish and become adults who can take conscious actions for our planet (UNICEF, 2011).

In my qualitative study, I aim to find out the intersection between circular economy notion and secondary education. The study focusses on the region of Amsterdam, in the Netherlands. This study is motivated by Amsterdam's vision to be "*a thriving, regenerative and inclusive city for all citizens, while respecting the planetary boundaries*" by 2050 (DEAL et al. 2020: p3). The City has collaborated with C40, Circle Economy, and Doughnut Economics Action Lab, to pursue a strategic approach towards the goal of a circular city by 2050 (Circle Economy, Doughnut Economics Action Lab, (DEAL), C40, & Biomimicry, 2020) . My research investigated initiatives active within the broader region of Amsterdam, programmes, workshops, collaborations, as well as activities initiated by parents or educators within the age group of adolescence. The material gathered throughout this research provided meaningful information on the presence of circularity in secondary schools and contribute the discussion about how to further develop a circular strategy for secondary education. Due to the pandemic breakout the collection of quantitative data and visual material was challenging. As alternative research strategy I opted for an alternative approach that combined elements of systematic literature review with qualitative data gathering.

The first part of the thesis consists of the theoretical background with an overview of the main concepts of circular economy and secondary education. Next, the aim and research questions are introduced. This is followed by the description of the methodology, the results and the discussion section. Finally, the conclusions elaborate on the some closing remarks and reflections about future research needs.



## **2 LITERATURE REVIEW: BACKGROUND AND THEORIES**

The foundations of this research consist of four main themes: circular economy, adolescents, doughnuts economic model and learning environments. Complementary information to complete the research are sustainability in education and analysis of the secondary level education system in the Netherlands. The content of this part of the thesis will deepen the knowledge on the topics that mentioned and used to discuss the results. To begin with, laying out the importance of adolescence and the behavioural changes within this age, I discuss the importance of including sustainability in education. An illustration of Circular economy and Doughnuts model will follow to support my hypotheses around the significance of incorporating these specifically in secondary level education. Last but not least, the definition of learning environment, will round up this part of the research to address the means and aspects on how I will assess the implementation of circular economy in education.

### **2.1 Secondary Education**

In contemporary society to respond to the call of the economy's needs and pace, people need to acquire a set of skills and knowledge that cannot suffice with solely a completion of a primary education or low-quality secondary. Secondary education plays a pivotal role in the development of individuals' knowledge, intellectual and reasoning abilities and skills providing the resources to address societies current and future employment opportunities. It shapes the youth to be ready for the labour market and contribute to a civic society with an extensive gamma of knowledge. In the past secondary education was mainly for affluent and privileged social groups. Today, it forms the last stage of education that is open to all and is offered to an increased majority of the population serving as a prerequisite for a prosperous life (Sahlberg, 2007).

Policies in secondary education have gained momentum recently by rendering the level more accessible to people, providing higher quality education, and serving as a critical step to the academic or professional world. This focus can be justified since primary education has reached the highest levels of completion in plenty countries around the globe, with students looking for continuation of their studies to the next level (Sahlberg, 2007). Furthermore, parents have become more conscious around schooling and seek for the best options for their children. To build upon

that, policies have shift focus recognizing the role and importance of the youth in pursuing a sustainable future. Therefore, it is critical to ameliorate the learning process during the adolescence and search for solutions that can be fit for lifelong learning (Sahlberg, 2007).

Within Europe, where various environmental, economic, and social challenges are taking place, the role of education should be prioritized. The Europe 2020 framework, established by the European Commission, is a strategic initiative that gives ground to policies and reforms in national and regional levels and allows exchange of best practices so regions can learn from each other.<sup>1</sup> Through this strategy Europe is focusing its efforts on smart, sustainable, and inclusive growth opportunities rather than radical, big changes. Within this, secondary education is addressed by taking actions to reduce early drop out numbers and increase higher education enrolment. A target bonded to this step is employment after graduation, with a special focus on women's and migrants. Nevertheless, technological advances, require adequate upskilling of learners that can respond to the upcoming working spots of the future, over the next 10 to 20 years. Therefore, policies should reflect and determine the adequate reforms to prepare learners as future citizens who possess a strong and relevant skillset of competences for the future (Redecker et al., 2011)

### **2.1.1 Secondary Education in the Netherlands**

Education in the Netherlands is mandatory starting from the age of 5 to the age of 18. The Dutch educational system scores as one of the top rankings in the PISA 2012 results, on mathematics, science and reading, with socio-economic background not influencing considerably the performance in the average numbers. At the age of 12 students can choose their next step, having an open school choice, selecting between seven programmes (the highest number in OECD<sup>2</sup> countries) to follow an eight-year trajectory of primary education (OECD, 2014). The selection is guided and advised by their primary school teacher based also upon their end primary test results. The seven programmes are clustered into three types of secondary education, the prevocational (VMBO) that lasts four years; the general secondary education (HAVO) for five years; and the pre-university education (VWO) for six years (see Figure 1).

In particular, the Dutch six or seven “early” tracks, give the alternatives to students to change tracks throughout their secondary education according to their needs and wills, as they move along. They can easily move around the various paths resulting into a lower drop-out

---

<sup>1</sup> European Commission (2018). European framework on key competences for lifelong learning. Retrieved from <https://education.ec.europa.eu/levels/school-education/initiatives>

<sup>2</sup> Organisation for Economic Cooperation and Development

percentage. In the pre-vocational secondary education for the ages 12-16, students get prepared for MBO (secondary vocational education) or HAVO. The VMBO (pre-vocational secondary education) consists of four distinct study tracks, the theoretical, the combined, the middle-management and the basic one. Students between 12 to 16 can also choose between two secondary education programmes that set them competent for entering university HAVO or university of applied sciences HBO (higher professional education). Last but not least, the solid vocational system and multi-layered apprentices' trainings, renders high employability levels and labour market opportunities after school, with the nation scoring below the OECD average in the unemployment field (OECD, 2016)

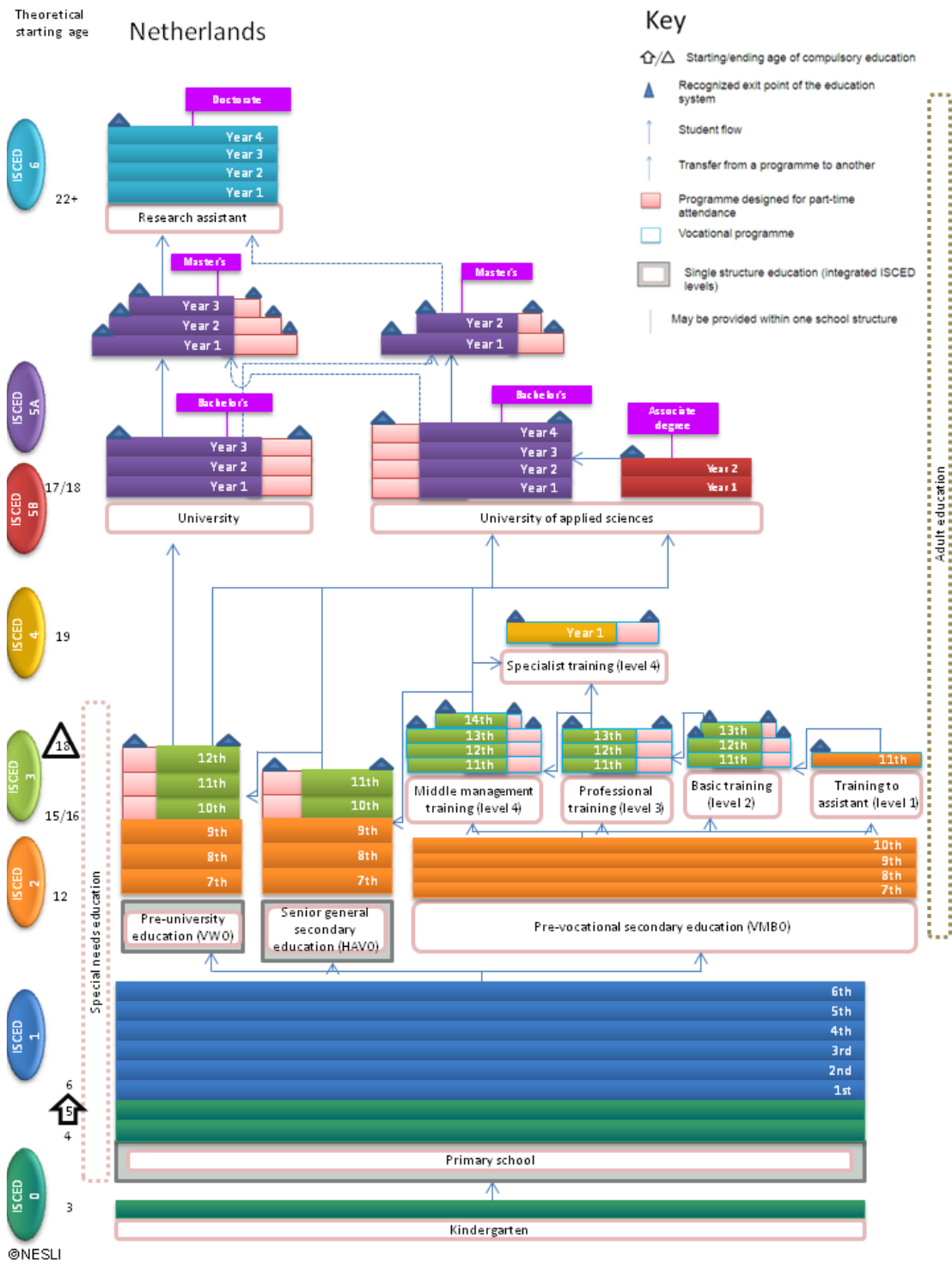


Figure 1: Structure of the Netherland's education system. Source: Own elaboration of OECD data (OECD, 2014)

The Dutch educational system operation is characterized by decentralization and autonomy. The system is supported by robust accountable national evaluations, thorough inspections conducted by the Inspectorate of Education. It includes special funding for disadvantaged students and prospects for new ideas and experimentation. There is a broader centralized framework and policy set that gives flexibility to a more decentralized school level management scheme. Schools are free to take decisions on matters such as resource allocation, curriculum, and assessment processes. As a priority in the Dutch schools to recruit quality staff, teachers are trained adequately to perform their profession with continuous additional upskilling during their career. To support a sturdy system of education, the Ministry of Education, Culture and Science prioritizes funding for all levels and especially for the ones that are mostly in need of. Some examples consist of schools with high percentage of drop out or increased number of disadvantaged students from less privileged backgrounds. (OECD, 2014)

Flaws and challenges within the Dutch education system, which raise discussions and possible policy reforms, include the track allocation after primary level being not accurately and objectively distributed. It is noticed that students from an immigrant background tend to have lower performance rate compared to the rest of the native students showcasing a risk of low diversity and inclusion in the Dutch educational system. Nevertheless, there have been discussions on reforms to ameliorate the early dropout rates by putting in action local policies and collaborations between municipalities and government parties (OECD, 2014).

### **2.1.2 Emotional and cognitive changes in adolescents**

Adolescence is a life stage compiled of diverse intensified psychosomatic changes that contribute to the sensitive nature of the growing person entering adulthood. Sex specific pubertal hormones work by shaping the body structure, the reproduction system and other sexual characteristics that combined with the neurological changes that affect brain function and cognition. The latter can cause difficulties in adolescents' concentration, memorization, judgement, reasoning as well as organization. Hence, the period of adolescence is a critical stage where the brain nature and starts transforming into an adult shape, whilst going through social and emotional turbulences (Yurgelun-Todd, 2007). At the same time, it is fascinating the ongoing development of that age group and the immediate improvements on conceptualizing theories, making decisions thinking critically, being able to perform debates and in general ameliorate their intellectual capability.

Additionally, to the above physiological factors, it is necessary to examine the socioeconomic factors that can also contribute to their health and wellbeing. A study conducted by Viner et al, identified those determinants by analysing the various structural elements of a society (e.g. wealth, inequality and access to education) and combined them with the fluctuating dynamics between family relations, school support and peer interaction. These are the ones with the highest impact to their health and growth. Nevertheless, a positive, and supportive family environment, a reliable school, and a strong, trustworthy network of peers, play a vital role in creating a safe place to express yourself and grow towards adulthood.

Within the same study these four biological and socialization processes during the development phase of adolescents were recognized:

- Puberty which drives identity formation, new behaviours, and consequently new types of health issues,
- adoption of risky behaviours such as smoking and excessive consumption of alcohol and drugs
- experience of discrimination due to sex, ethnic origin, or socioeconomic status
- life stage transitions in diverse settings of society such as, in education, the transition from primary to secondary and secondary to higher education, in work, the transition from education into workforce, in health, the transition to responsibility for own health, in family, the early marriage, in citizenship, the acquisition of citizen rights and say.

Therefore, the youth is growing up in an interconnected space where every part and actor of it can impact greatly its mental and physical health (Viner et al., 2012). Last but not least, it has been studied that the school level can have a positive effect on the adolescent's confidence whilst a negative impact on his/her wellbeing, primarily due to the time spent at school (Peter Kooreman, 2007).

Overall, mental health problems are emerging and are prevalent during adolescence, a percentage that can reach up to 20% of them having a depressive episode before the age of 18 (Costello, Mustillo, Erkanli, Keeler, and Angold, 2003; Lewinsohn, Rohde, and Seely, 1998; Merry et al., 2011). The school space can play a pivotal role in improving this condition and implementing preventive programmes to reach the youth. Within a school environment, students can acquire skills that can protect against mental health issues and ameliorate their wellbeing. Precisely, integrating preventive methods in the curriculum has been researched to be effective in an extent and help avoid worsening of the adolescent's wellbeing (Werner-Seidler, Perry, Calear, Newby, & Christensen, 2017).

## **2.2 Learning environments**

I find central to the progression of my research, to understand the definition of a learning environment and what it consists of. In order to assess the CE & Doughnut economic model implementation in schools, I consider necessary to analyse the different aspects that define a school space.

According to Davies et al. (2013) a learning environment expands beyond the school, physical, 'concrete' limits. A learning environment includes all the psychological and pedagogical elements that are present in a physical space surrounded by different people (Davies et al., 2013). The main actors in a school environment are the teachers and the students, with that expanding into the headmaster and the rest of the employees in the school who do not teach. In a school there is usually a regulated schedule and pedagogical approach that determines the activities and the learning programs that take place, which in brief is identified as curriculum. The curriculum directs teachers to follow a certain flow to accomplish the learning milestones to be achieved for the student's progress, depending on the subject, age, and time.

It is argued that a too detailed structure curriculum that does not allow freedom to the teacher to incorporate various multidisciplinary approaches and activities, can results into a less engaging learning experience for the student. For that reason, learning environments should be attended and assessed closely to provide a real-life skillset to the learners and support a holistic learning journey (Bouw, Zitter, & de Bruijn, 2019).

### **2.2.1 Sustainability in Education**

In September 2015, United Nations set an agenda for 2030 setting 17 Sustainable Development Goals (SDGs) at its core. The 17 SDGs were organized around the main priorities and challenges

for sustainability, also including education. SDG 4, focusses on education, aims at ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all.<sup>3</sup>

To build on the above, on the importance of education and specifically on sustainable education, then students should have access to environmental education and comprehension of sustainability regardless their background. Nowadays, there is a tendency that environmental education addresses elitist groups who possess more financial security and resources to provide to their offspring a more holistic and diverse education (Wals, 1994). Furthermore, it is argued that environmental education has been distorted greatly by the current globalization and neoliberalism influences, defining it as education for sustainable development that can be related to broader economic trends linked to consumerism and nature destruction (Jickling & Wals, 2008).

Sustainability in education can still be considered a vague notion. According to Wals & Rodela (2014), this is consequence of a continuous learning path towards a state that is more desirable than the one currently in prospect. Hence, it is crucial to transmit to the learners this transition towards sustainability in a reflective and multidisciplinary way.

In that sense, UNESCO clearly states that “a school culture of sustainability is one in which students, staff and families hold shared values and beliefs about the importance of taking action for a more sustainable society. Taking care of the environment and contributing to reducing climate change is an integral part of this”. Therefore, defining what climate action means to your school is part of developing a culture of sustainability “(Gibb et al., 2016).

Echoing the above, an education system that allows the transmission of sustainable development needs to be proactive and not reactive. The educators have the responsibility to form critical mindsets for their learners rather than educating in silos and focusing on individual problems. There is a need for critical thinking by the students to be able to act upon the disrupted system and build solutions for fixing the ecological catastrophe (Whiting, Konstantakos, Misiaszek, Simpson, & Carmona, 2018).

---

<sup>3</sup> United Nations, Department of Economic and Social Affairs. 17 SDGs available at: <https://sdgs.un.org/goals> - Accessed on December 2021



To conclude this section, it is important to stress out the role of adolescents in sustainable education. Adolescents should be the key players in leveraging the SDG Goal 4 and driving the change at every level by being at the front of action. This age group, the youth represent the tomorrow and our chance to create radical and immediate paradigm shift in our society. They can be the agents of change and shape our future to a sustainable and fair one (Kleinert & Horton, 2016).

### **2.3 Circular economy**

In addition to sustainability, the latest approach to address the climate crisis and achieve the SDGs has emerged from a fundamental criticism of mainstream economic paradigms. The concept of Circular Economy (CE) is built around the biophysical and environmental limits and theorizes a reduction of energy and material consumption advocating for minimum waste and maximum expansion of products lifespan as a way to reduce anthropogenic environmental pressure. Central to this vision is the reduction of production and consumption of raw materials by reuse and repair or recycling methods. Geissdoerfer, Savaget, Bocken, & Hultink (2017: p6) gathered different definitions around CE and concluded that: *“We define the Circular Economy as a regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling “.*

The definition of CE has some substantial differences with the standard definition of ‘sustainability’ which can be described as: *“a situation in which human activity is conducted in a way that conserves the functions of the earth's ecosystems, a transformation of human lifestyle that optimises the likelihood that living conditions will continuously support security, well-being, and health, particularly by maintaining the supply of non-replaceable goods and services”* (McMichael, Butler, & Folke, 2003: add page number)

The CE concept has drawn a lot of traction from several nations and generated discussions and actions within a diverse field of catalyst groups. Precisely the European Commission has adopted its Circular Economy Package in 2015 whilst the Dutch, Welsh and Scottish governments have closely embraced the concept into their strategy and activity plans (Kirchherr & Piscicelli, 2019).

According to the EU policy framework CE is projected as a strong enabler for the shift to climate neutrality by 2050. To reach that goal EU commits to speed up the process to a regenerative growth that can ensure that the resources are not exceeding the planetary boundaries and secure a fair economic model for all the countries. This Circular Economy Action Plan taps into the subjects of waste, plastics, textiles, energy use, electronics, food, water, constructions whilst using as levers digitalization, research innovation and educating the citizens on those (European Commission, 2020). CE can offer a pioneering manner to sustainable development progress and in parallel secure environmental protection, economic prosperity, and social inclusivity.

### **2.3.1 Circular Economy and Education**

Due to the novelty and early implementation of the concept, educating citizens on CE is still a complex and slow process. This also generates confusion about the right way to educate on the topic. With regards to how teachers manage the CE knowledge and upskilling students that process is still dynamic and in continuous improvement (Mendoza, Gallego-Schmid, & Azapagic, 2019) .

In the higher education level, there is a growing number of academics who incorporate research and material to educate students on CE principles and integrate them more into their teaching schedule. Few examples of pedagogical approaches involved project-based learning and problem solving such as game construction, simulation of designing according to CE principles, events, and labs (Kirchherr & Piscicelli, 2019). Specifically, a CE course at Utrecht University for undergraduate students, was considered a great success incorporating the above creative methods and proved that CE requires more exquisite elaboration beyond sustainable development in education (Kirchherr & Piscicelli, 2019).

Additionally, with regards to the knowledge transmission on CE and the overlap with sustainable development (SD), it is argued that certain aspects can complement each concept. In general, sustainable development as well as CE, are at times considered subjects that can alienate the already existing curriculum in place. That can be perceived as a non-priority for the topics and potential projection as unnecessary to be taught. Reason for that could be the traditional pedagogy that is more stagnant and segregated rather than coherent and interdependent. That results into inefficient integration of additional, new concepts in the existing curriculum.

Teaching methods for such topics as CE and SD, should be stepping out of the classic methods, and embrace diverse broader approaches. Experiential learning including holistic thinking, critical and systems thinking, can support students in understanding the notions around interdependence, inputs, outputs, emergence and relationships between the different players of a system. Games generation is a learning method to be present in the comprehension of such notions, where the student can be more actively engaged and participate in a dynamic way in his learning experience. Emphasis is also put on the planning, reasoning and critical thinking aspects that a student develops via games learning method, that are being explored further during the discussions followed after the games are completed (Whalen, Berlin, Ekberg, Barletta, & Hammersberg, 2018). Overall, education is key to increase the people's understanding of CE and train them to achieve the necessary skills needed for its implementation.

CE requires not only a cognitive, but also a behavioural and emotional commitment to it. For example, consumers should have a higher awareness on their consumption impact to the environment to be more open to change and feel responsible to take action towards that. Therefore, education is critical to support this change. For this, teacher's training is required, so they can be firstly educated on CE and be capable of teaching the updated curriculum provided to them. It is needed to train first the teachers adequately and then transmit that knowledge to the students (Bugallo-Rodríguez & Vega-Marcote, 2020).

### **2.3.2 From 'Planetary Boundaries' to the 'Doughnut economic model'**

After the industrial revolution, Holocene era- an era of thriving societies, Anthropocene appeared as an outcome of the human reign and over-exploitation of the earth. Humans are the key players during this era by bringing the environmental equilibrium to an unbalanced catastrophic state. Due to the exhaustive use of the earth resources, the industrialized agriculture, the mass production and linear use of materials, the state of the earth system has started exceeding its boundaries resulting into irreversible changes.

These boundaries, called Planetary Boundaries (PB) were defined by Rockstrom et al. (2009) and formed a framework according to which it was possible to quantify the state of each boundary and the imbalance caused in each one. A so called 'safe operating space' is defined as the intersection

point where social and economic development can exist while keeping the Earth System in balance. In the Figure 1, a representation of the nine PB is represented showcasing the 'safe operating space' where the boundaries are in equilibrium and the actual present state of each one. The nine PB are defined as: climate change; rate of biodiversity loss (terrestrial and marine); interference with the nitrogen and phosphorus cycles; stratospheric ozone depletion; ocean acidification; global freshwater use; change in land use; chemical pollution; and atmospheric aerosol loading (Rockström et al., 2009).

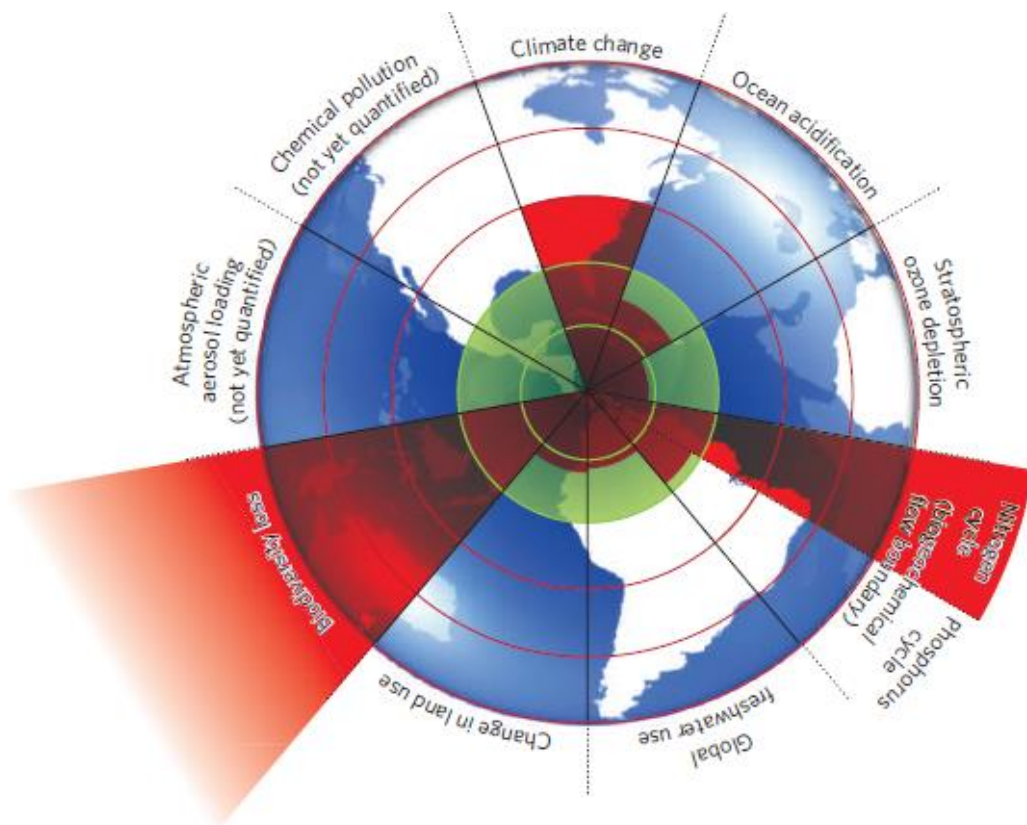


Figure 2: Beyond the boundary. The inner green shading represents the proposed safe operating space for nine planetary systems. The red wedges represent an estimate of the current position for each variable (Rockström et al., 2009: p1)

The nine biophysical elements in the PB framework (Figure 2), can measure the limit that the globe should remain within. Nevertheless, the framework analyses primarily the environmental elements that can cause destruction to the Earth. A ground-breaking addition to this research, involved the inclusion of the socioeconomic parameters in the concept. Kate Raworth's, economist's work, suggested a circular framework that incorporates Rockstrom et al. approach by integrating elements on social justice and wellbeing. The holistic concept is called 'doughnut' economic model or simply 'doughnut' and stresses out the importance of the co-existence between the

'environmental ceiling' with the ecological boundaries and the 'social foundation' with the social aspects (Figure 3) (Dearing et al., 2014)

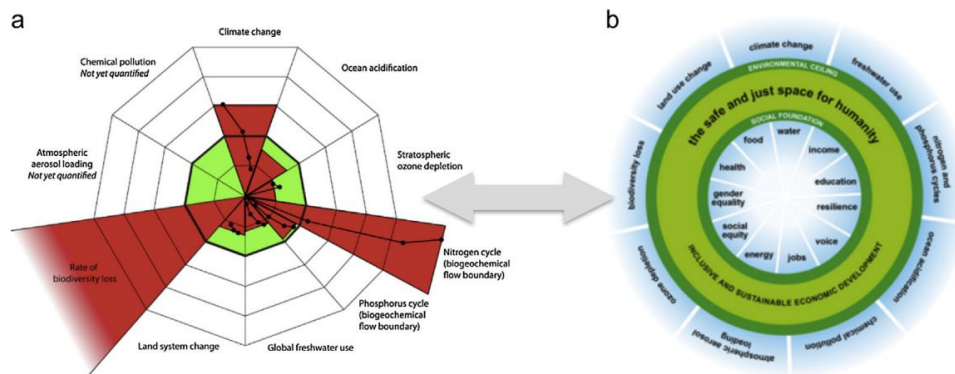


Figure 3 (a) the planetary boundary framework (Rockström et al., 2009) and (b) the social 'doughnut' framework (Raworth, 2012: add page number)

Raworth's 'doughnut', which is a layer sitting within the social and ecological boundaries, once the boundaries are in equilibrium create a safe and just space for the humanity to live in (Figure 4). During the Rio +20 Conference on Sustainable Development, the economist outlined the 12 social elements that comprise the social foundation of her model: health, education, income and work, water and sanitation, energy, networks, housing, gender equality, social equity, political voice, and peace and justice (Hickel, 2019).

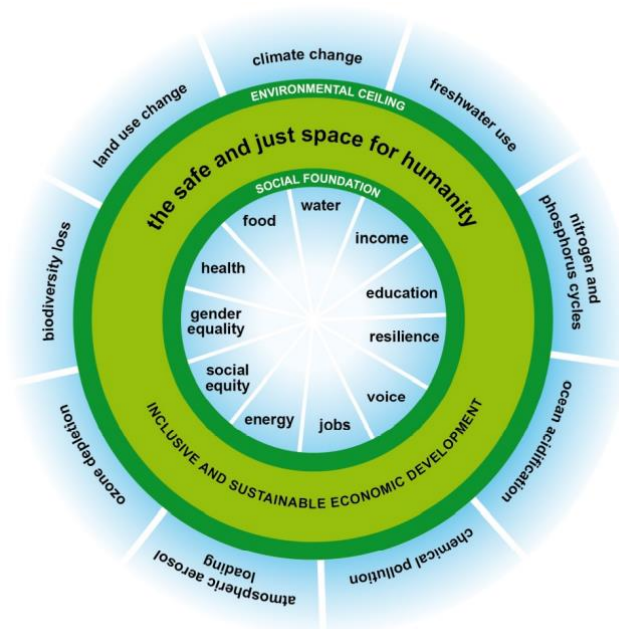


Figure 4 Doughnut economic model. The safe and just space for humanity (Raworth, 2012: add page number)

What is important to emphasize at this stage, is the interdependence of the two layers. The depletion of one ecological priority can determine the fall of a social feature. For instance, the land degradation can have a direct impact onto the income and the employment of that field. Therefore, it is argued that policies and reforms, which can play a crucial role in changing the boundaries regionally and globally should incorporate both layers in their actions and decisions.

Furthermore, the assessment of each element's state is built upon certain widely agreed norms that define the threshold for both the foundation and the ceiling. For social norms, the UN's Universal Declaration of Human Rights (1948) sets the norms and the direction to ensure that each individual has the right to life's essentials that comprise of food, water, health care, education freedom of expression, political participation, and personal security regardless their socioeconomic status. The optimal three characteristics that ensure one's life in a safe and just space are well, productive, and empowered. Within those, aspects of society and environment should be fulfilled. Precisely, well: through food security, adequate income, improved water and sanitation, and health care; Productive: through education, decent work, modern energy services, and resilience to shocks; Empowered: through gender equality, social equity, and having political voice.

To conclude, education nowadays, still promotes economic models based on linear and exclusive concepts and teaches students and employees on destructive for our planet models. Thus, there is big opportunity for institutions, governments and communities to transmit the knowledge on models that are inclusive, holistic and address the climate and human crisis we are currently experiencing (Raworth, 2017).

### **2.3.3 Circular city of Amsterdam & Doughnut Economics**

The Doughnut economics model has started being adopted by various sectors, nations, cities, and groups. The city of Amsterdam is one of the pioneers engaging with it. In line with the Paris Agreement, the government of the city has initially committed in achieving 55% CO<sub>2</sub> emissions by 2030 and be natural gas-free by 2040 (DEAL, C40 Cities, Circle Economy, & Biomimicry, 2020). By additionally adopting the Doughnut economic model, the city of Amsterdam aims to be fully circular by 2050 by eliminating the use of primary raw materials as its first missions. Since the commitment to transition into a circular city the municipality of Amsterdam has finalized over 70

circular projects so far making the theory into practice valid and reliable (Gemeente Amsterdam, 2020)

For the city of Amsterdam to accomplish a thriving, regenerative, inclusive place for all its residents, systemic transformation is needed. In 2020, Kate Raworth with her Doughnut Economics Action Lab and working closely with the Thriving Cities Initiative (TCI), C40 and Circle Economy managed to put in place a strategic Doughnut city framework to accomplish the circular transformation. A city 'portrait' was generated that can be utilized as a compass to assess the local and global impact of Amsterdam and provide a methodical direction to the circular shift (DEAL et al., 2020)

The city portrait framework can be utilized by other cities to accomplish a thriving place within the planetary and societal boundaries. As the years go by, the role of cities will become exponentially more vital to our existence, with accommodating 55% of the world's population, using 60% of global energy and more than 70% global greenhouse emission (DEAL et al., 2020) Therefore, the initiative of Amsterdam as the first regenerative and circular city, can be set as an example to be mimicked by other groups, cities, nations, or individuals.

Education plays a crucial role towards a circular Amsterdam. It is laid within the levers and enablers of the change, specifically within the aspects of policy reforms and employment. Offering knowledge and informing the citizens on circular economy and the transition to the Doughnut city, can accelerate the change. The municipality can enforce the research and development sector, introduce specified educational programmes and increase its communications campaigns around the subject. A fair fund distribution is necessary to accomplish that implies the relevant policies shifts and implementations (Gemeente Amsterdam, 2020). In parallel, upskilling on circular economy skills will generate new job opportunities, increase employment rates, and update the labour market and youth on the new narratives that will be in place within a circular city. Knowledge and education are the main instruments to make the shift smooth whilst ensuring the equivalent awareness to the residents of a circular and thriving place (Raworth, Gemeente Amsterdam, & Circle Economy, 2019).

To sum up, the circular Amsterdam case, is an excellent example of the Doughnut's model feasibility rendering it as the base for upscaling and imitation by other cities. The question posed by the core team working on the implementation project, *"How can our city be a home to thriving*

*people in a thriving place, while respecting the wellbeing of all people and the health of the whole planet?"* raises the importance of interconnectedness in this shift and the relevance of local global effect (DEAL et al., 2020: p3). In respect to this notion, to enter a circular economy, it is not enough to solely improve a local community but further assess and transmit that effect to the global scale and other communities. In a nutshell, a ripple effect is manifested in each activity that a society completes making the shift to a regenerative economy and organize change that can potentially be accomplished with the right actions and players.



### 3 AIM AND RESEARCH QUESTIONS

The aim of this thesis is the comprehension of how circular economy as a notion is implemented in practice in the educational system. It derived from the need to innovate in the linear current economic models and finding solutions into models that take into consideration all the aspects of the society and the environment. Circular economy currently explored within the fields of energy, agriculture, urban development but there is little still embedded in education (Mendoza et al., 2019)

My research assesses the presence/absence of circular economy principles and practices in education. I focus on the region of Amsterdam and specifically on the secondary level of education. The goal is to generate findings concerning the connection between the educational main elements and the fundamental principles of circular economy. That entails an assessment of the curriculum, the teaching methods, and the physical spaces from the perspective of the educators, parents, and students.

I have limited the examination to the region of Amsterdam to be able to understand in a microscale the impact of circularity in the education. This could provide a baseline for future research to compare and potentially scale it up to other cities in the Netherlands and the EU. Furthermore, Amsterdam's commitment to be fully circular by 2025 renders the region as the ideal scenario for examination.

More specifically this thesis focuses on finding answer to the main overarching question, "How secondary schools in Amsterdam are developing content, teaching methods and school spaces regarding circular economy?". This overarching question is articulated through three sub questions that will guide the analysis:

1. *What challenges and needs for support schools have concerning circular economy?*
2. *What kind of experiences students currently have around circular economy?*
3. *What kind of features a future second level education could look like embedding circularity?*
4. *What elements of the Donut model need further improvement with Amsterdam's secondary learning environments?*

## 4 METHODOLOGY

This section describes step-by-step my research design, the methodological approach and the data collection and analysis employed in my research.

### 4.1 Methodological approach

Because of the nature of the study a qualitative approach was chosen. According to Chhabra et al. (2021: p2), *“qualitative research is based on identifying the ‘voices’ of the people they study and contribute through the humanising of science through its illumination of people’s perspectives”*.

A qualitative research methodology compiled of eight online interviews with adolescent’s parents, and teachers. Moreover, two surveys with adolescents between the age 13-17, three teachers in Amsterdam and three Dutch sustainable educational organisations were conducted. The material was collected during the period of October 2020 - March 2021. This empirical approach was selected as it addressed the restrictions of physical interviews, focus groups, school’s observations due to the COVID-19 pandemic and consequent closing of schools. Moreover, to better inform my perspective I conducted 4-months of participatory research collaborating with the Amsterdam CE/Doughnut working group. This experience provided me with information, experiences and perspectives that strongly influenced my analysis.

### 4.2 Data collection process

During the period of October and November 2020, online interviews were conducted with three teachers of adolescents between the age 13-17 years old. The participants were a mix of teachers working at Dutch speaking public schools and international private schools within the broader area of Amsterdam. The aim of connecting with the above participants rests on the exploration of CE in the adolescent’s life and the main barriers of its application.

The structure of the interviews entailed a series of questions that tapped into the interests of adolescents, their interaction with nature, the comprehension of circular economy and involvement with it, the struggles of teenagers nowadays, their ambitions and their attitudes. During the

teacher's interviews further analysis was conducted to unfold the barriers of teachers within the school and interaction with adolescents and the extent which circular economy is utilized in the curriculum and in the various aspects of the school spaces.

The interview durations ranged from 30 to 60 minutes and were transcribed manually for later analysis and documentation. All interviews were conducted based on the consent of the interviewees by ensuring the non-disclosure of personal details of the participants and using pseudonyms to protect their privacy.

As a follow up method to collect additional qualitative data to back up my research question, I carried out two online ad-hoc surveys addressed to adolescents between 13-17 years old and adolescents' teachers in Amsterdam both female and male.

A sum of 39 adolescents' responses were collected via the online survey, using the Survey monkey platform. The aim of the survey was to address the everyday life of adolescents in Amsterdam area and realize their perception towards certain sustainability concepts and their connection with nature.

A sum of 10 responses were collected by secondary level teachers in Amsterdam, a survey conducted also via the Survey monkey platform. The aim of the survey laid out the assessment of CE elements in school. The elements were split into two parts, one entailing the physical & environment aspects of a school and the second one involving the more abstract, socio psychological aspects of education. Last but not least, the survey served as a tool to comprehend the teachers' understanding towards circular economy and the need for further upskilling.

To support my qualitative data collection, I conducted a research and documentation of the CE initiatives occurring within the Netherlands in order to identify their relation to education and more specifically to secondary level education. The scouting and evaluation of the several initiatives occurred via diverse means of communication. Online interviews with each representative or key account manager were performed, laying out the goal of each initiative and their linkage to education as well as ongoing projects and vision to implement circularity in the future. Moreover, my active participation in Amsterdam Doughnut Coalition Group, a group of individuals and institutes with a common interest the circular economy/doughnut economy, brought me in direct contact with the actual current educational ventures that operate in this field.

### **4.3 Data Analysis process and methodologies**

To analyse my qualitative data, which was a mix of semi-structured interviews and responses via surveys, I referred to the grounded theory approach and narrative and content analysis.

Strauss's data analysis involved the open coding technique. The technique involves a systematic identification of similar patterns in reactions, wording, statements, which can be grouped together into themes and draw conclusive results (Mohajan, 2018). In my case, I used open coding to identify the key themes that teachers were finding difficult in the CE implementation at school. Through the open-ended question in my survey, I identified words that could indicate certain categories, such as time or curriculum.

To draw reliable conclusions, I coupled the grounded theory with the narrative analysis, that supported me in 'decoding' my individual interviews with teachers as well as CE initiatives ambassadors. Narrative analysis focuses on stories, interviews, testaments of research participants which can be collated via different means such as focus groups, interviews, photographs, diaries and results into a mix of narration based on the insights collected. It concentrates rather on the similar categories and themes representation to the actual experience of the participant and emphasizing on their inputs (Mohajan, 2018). In my work, I decided to incorporate the narrative analysis, within my CE initiatives where, I could combine diverse means of insights, either from interviews, or from personal immersion in group discussions or notes keeping and online research of the CE organisations.

Last but not least, content analysis complemented my results breakdown, as it served as a directional and systematic gathering of my data. According to Leedy and Ormrod (2001, if you can add page number) content analysis is "A detailed and systematic examination of the contents of a particular body of materials for the purpose of identifying patterns, themes, or biases." The collection of the content occurs in two stages. First the researcher should gather the materials and try to add them in a table with the relevant features identified, second the researcher should carry out an analysis so the results can be in a more quantitative format (Mohajan, 2018).

In my approach, I coded the different initiatives into a table and analysed them according to their relevance to the educational level and to CE. Therefore, a summative analysis of my diverse inputs was generated and resulted into a framework of CE assessment of the various organisations in the Netherlands.

## **5 RESULTS**

This section presents the key findings from the stakeholder interviews, surveys and analysis of CE initiatives within Amsterdam region. The content entails the interpretation of students' responses to the survey, the teachers' responses to the survey, the content analysis of the interviews with teachers and finally the analysis of the CE initiatives including semi structure interviews with few of those. To build on this, my 4-months participation in an Amsterdam CE/Doughnut working group, concentrating on education, provided me with observations that can build upon my research questions. Results are presented based on the importance and relevance of the responses to comprehend the extent of CE definition by teachers and students followed by the implementation of CE elements in learnings environments. Also, in order to gain a sense of the whole, I added a summary of the main results from all the parts at the end of this chapter.

### **5.1 Teachers' interpretation of CE in schools**

#### **5.1.1 Teachers' survey**

In the survey I was interested in the level of understanding of CE as a concept, the need for trainings, the main challenges for implementation at school and the assessment of the main Doughnut model's elements of CE in the learning environments. Figure 5 illustrates the main challenges teachers identify in implementing CE in their daily working routine, the challenges are categorized in themes around space, teaching methods, management, and time.

In the space theme, the school building, as an infrastructure and capacity, came as challenge, pointing out the limited capacity that schools undertake in relation to the number of students. Teaching methods was the next theme stressed out, that entailed mainly the manner of which subjects are taught, that do not allow freedom for additional skills. Management, was the third topic outlined, related to the limited decision making from the teachers themselves on adding new skills or to the lack of collaboration between them. Time was the most prominent and reoccurring topic mentioned as the barrier to circularity implementation at school. Half of the respondents stated that time constraints and too many subjects taught in restricted time do not allow any time for circular economy to be taught to students.

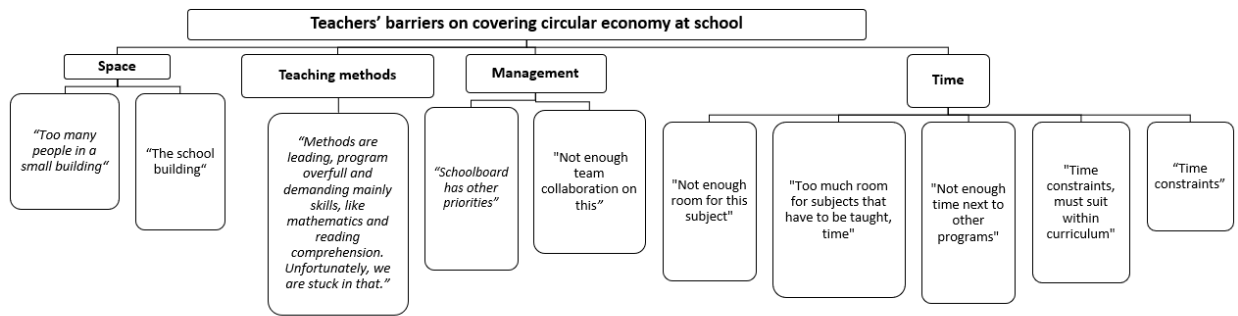


Figure 5 Teachers' barriers concerning CE implemented at school. Teachers responded to the open question: "Please state the main barrier to cover circularity within a school (Own elaboration),

To build upon the above, teachers were asked if they have attended a training on CE in the past and if not if they were willing to attend one. 90% replied negatively with the same percentage expressing the willingness to attend one in the future.

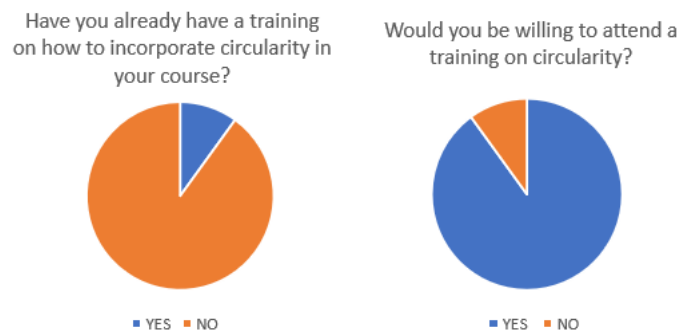


Figure 2 Training on CE for teachers (own data and elaboration).

Later on, in this survey, I tried to assess circularity elements in the school. To do that, I divided those elements in relation to school spaces and in relation to teaching method & sociopsychological factors. My attempt was generated by the division of the two layers of the Doughnut, that lie into the environment and the social one. I translated those elements into the education ones, according to my interpretation.

Within the school spaces, I tried to cover the more environmental factors that can be found in a school building, schoolyard, and infrastructure. Energy, hygiene, schoolgrounds, water, transport,

mobility, educational material, nutrition connectivity and waste were the features assessed (Figure 3). Energy, schoolgrounds, educational material, nutrition and waste were the ones scoring the poorest in the scale. Energy efficiency scored neutral to satisfactory (80%), showcasing a dilemma on how good schools are tackling the energy consumption and green energy implementation. Schoolgrounds, scored low (70%), in addressing green spaces where students can grow their own food and have enough space to be active. Aside to this, waste is perceived also as a matter not addressed sufficiently enough (60%-90%) so recyclability of materials and adequate waste separation can occur. Last but not least, educational material lacks (50%-90%) recyclability aspect, with books and other utilities being produced from scratch and from non-sustainable materials. The lowest rating in absolute disagreeing that did not include the neutral scoring (80%), was attributed to the nutrition. Healthy food that is provided to students is a coherent struggle at schools, providing them low quality food, non-organic and not nutritious. Nevertheless, the positive responses were mainly gathered around hygiene, water, transport, mobility, and connectivity. The highest scores around transport and connectivity, relate to the ease of reaching a school via a green vehicle (i.e. bike) and also providing to students the means to technology and connection when needed.

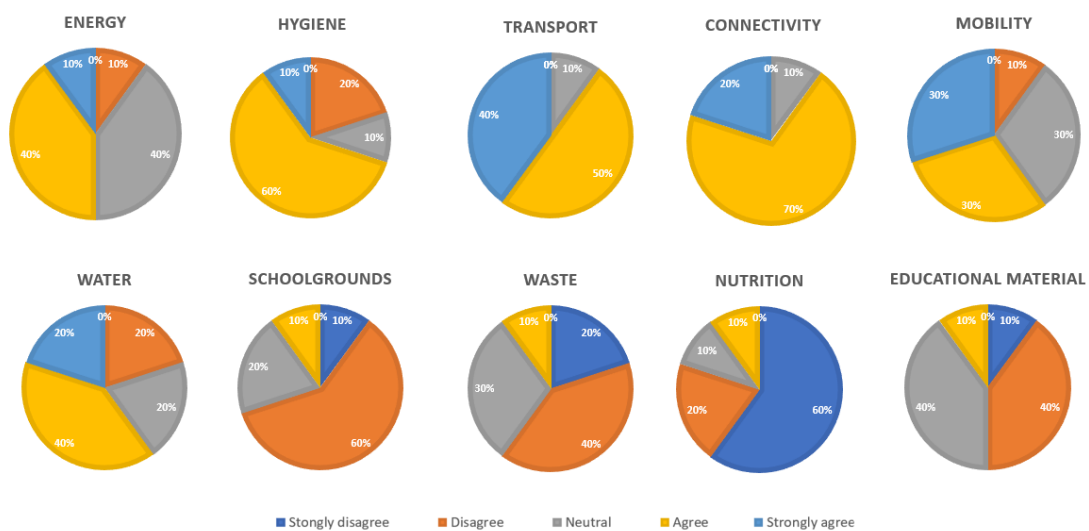


Figure 3 Circularity assessment in relation to school spaces. On a scale from 1 (strongly disagree) to 5 (strongly agree), please rate how much you believe the below circularity factors are addressed in relation to your school? (Own elaboration).

Figure 4 shows the results of circularity and sociopsychological factors within a school environment. The overall impression was positive with the lowest scores being neutral rather than negative. Hence, the lowest, neutral scores were allocated to the elements of community and



political voice that relate to the involvement with social activities and expression of critical thinking around subjects on politics and economics.

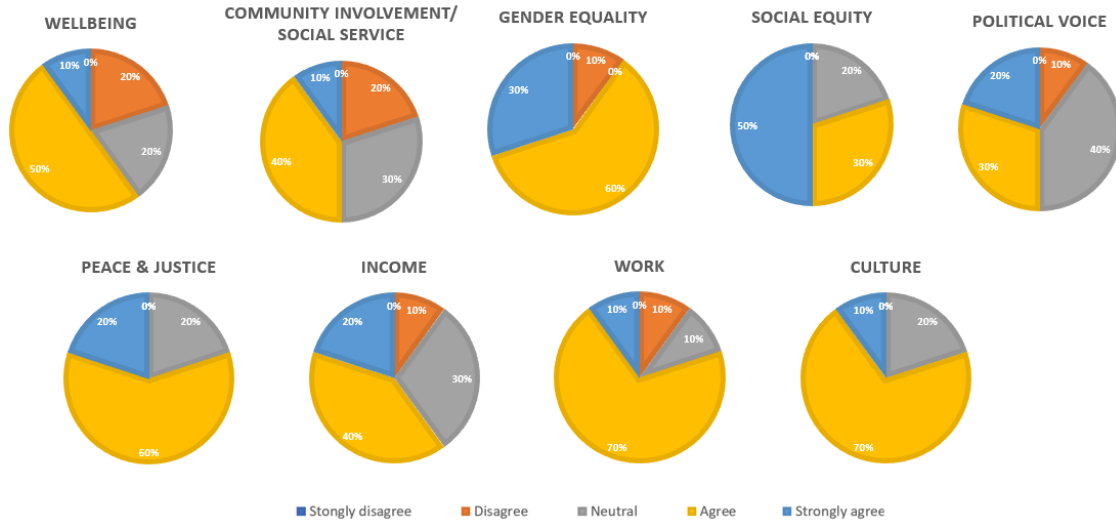


Figure 4 Circularity assessment in relation to teaching method & sociopsychological factors. On a scale from 1 (strongly disagree) to 5 (strongly agree), please rate how much you believe the below circularity factors are addressed in relation to your school. (Own elaboration).

To summarize my findings, I designed a representation of the average scores and colour coded them according to their relevant scoring. In this manner I wanted to replicate a similar framework as the Doughnut model to indicate the regions where a school falls short on those boundaries and where further improvement needed to re-establish balance (Figure 5).



Figure 5 Average scoring of circularity elements' assessment within schools in a "doughnut" representation. Red colour variations correspond to 50%> disagree responses and green colour variations correspond to 50%> agree scores. (Own elaboration).

### 5.1.2 Teachers' online individual interviews

During the interviews with the teachers it was showcased the challenges that teachers experience regarding time management and limited capacity to integrate additional to the curriculum activities. Nevertheless, the design teacher through her course has more flexibility to incorporate multidisciplinary, sustainable approaches compared to the other ones on biology and maths. For instance, during her course, she included activities like, nature drawing in the school's greenhouse or building birdhouses or working on SDG goals on a fashion project. The other two teachers, one the maths and biology expressed frustrations over too many online platforms or too limited time.

*"I am frustrated with the infinite educational platforms I need to use for my students especially at this moment"*

*"I also took them out to check certain species of birds and they really like it. Although it can be tricky to take them out all the time as they don't have enough time for the next course to be back"*

Moreover, concerning circular economy there is a clear implementation and more awareness at the international school rather than the public Dutch speaking school in a challenging area. To elaborate on this, at the international school, there are ongoing projects and progress by the board to incorporate sustainability and circularity in the near future. These vary from smaller projects integrated in existing courses such as the design course or by tackling the entire school infrastructure and leveraging the right stakeholders and funds, such as:

*“The school has a collaboration with EU on a circularity project that will be implemented in the new school”*

*“Last year, it was the first year of starting a cooperation with businesses where students work together to deliver a business idea with a sustainable purpose”*

*“They also have a greenhouse, and they were initiatives on how to incorporate it in the restaurant”*

On the other hand, in the Dutch speaking school in an area a bit further from the center of the city, those matters like sustainability and circularity are more deprioritized. According to the Biology teacher’s view, sustainability is not only a subject to be taught in class, but there is also a family responsibility to educate children in their daily life about it. In his words:

*“Sustainability is not only something they should learn at school but also from their family, and that is not very common in his students”*

To build on this, he stated that there are initiatives and topics around aspects of recycling or waste but not specifically on circularity. It is considered a more ‘privileged’ students’ topic to cover in comparison to the student he teaches. In his words:

*“They do have topics around plastic, waste or renewable energy but not circle economy”*  
*“Privileged kids tend to know more about those subjects”*

Last but not least, an aspect around the food quality in the schools was raised that stressed out how unhealthy it is and simultaneously difficult to alternate to a nutritious one due to a shortage in funds. This is a reoccurring topic, addressed above, at the circularity assessment. Food at schools is a grey area that is not managed in the appropriate way so students can have a proper nutrition.

*“School’s restaurant has very bad quality food, I tried to change it, but it was not feasible as we get big supplies that are cheaper from big suppliers. You need big funding to change the food into a healthier one”*

## 5.2 Students

At this part, I ran an online survey with n=39 students from international and Dutch secondary schools in Amsterdam, of a diverse age & gender split as shown in the graph below (Figure 6). Most of the students’ age for both Dutch and International was primarily around 13 and 14 years old.

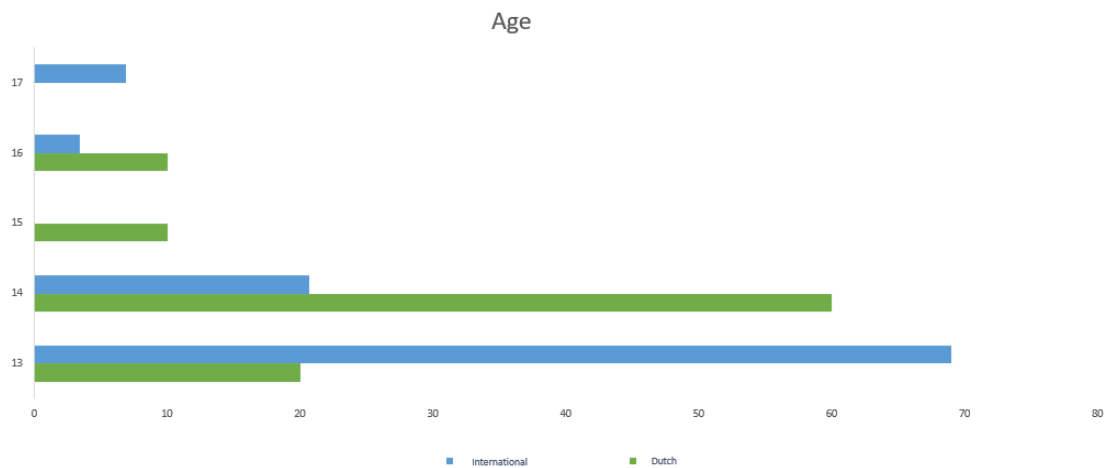


Figure 6. Representation of age split for Dutch and International students in Amsterdam (Own elaboration).

Two main questions were of my interest: first, how teenagers spend their free time, second, what is the level of familiarity with certain environmental concepts. The results followed the same patterns for both schools, international and non-international. The majority designated interests around socializing with friends, playing sports, watching YouTube or using social media. Watching YouTube was the sole discrepancy with one of the highest appeals specifically for international students. (Figure 7).

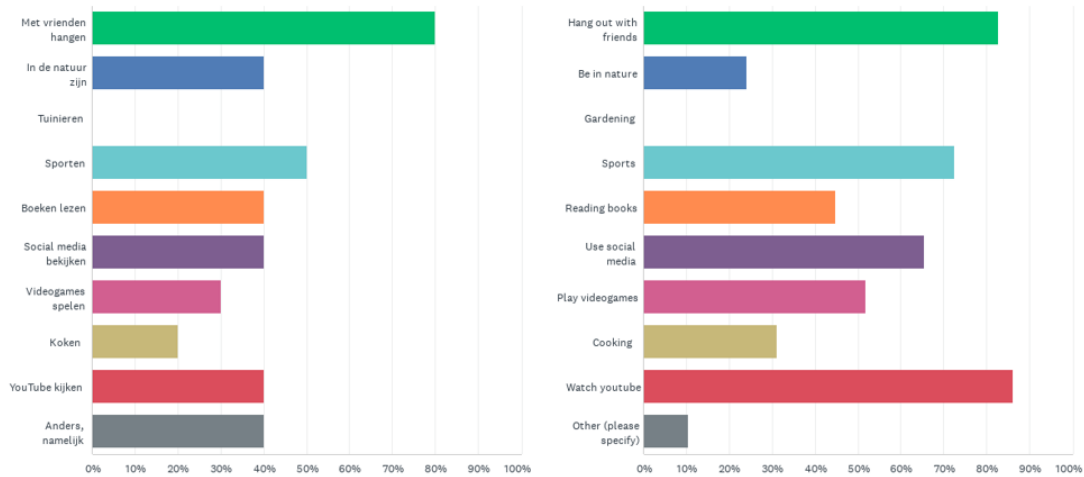
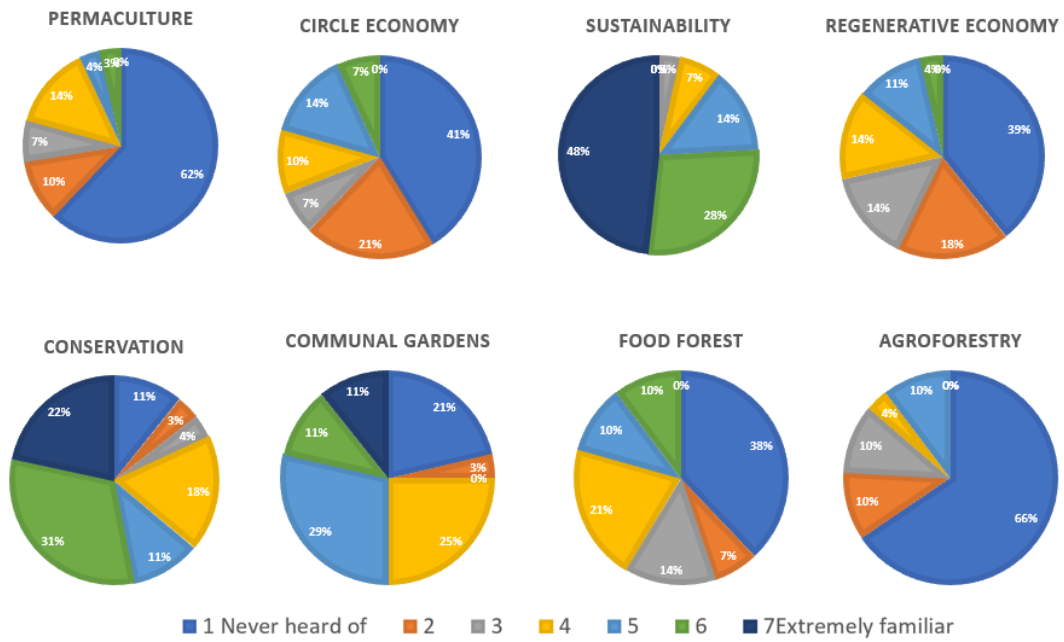


Figure 7 Which of the below activities you perform usually during the week? You can choose more than one option (own data and elaboration).

For the second part, around understanding several environmental concepts we see that students have little familiarity with circularity as a concept for both schools (~70%) with a slightest higher percentage of international students having heard about it compared to the Dutch speaking ones. Sustainability on the other hand scored equally high, showing the higher awareness with the notion and most probably involvement (~90%) from the students (Figure 8).

### INTERNATIONAL STUDENTS



### DUTCH STUDENTS

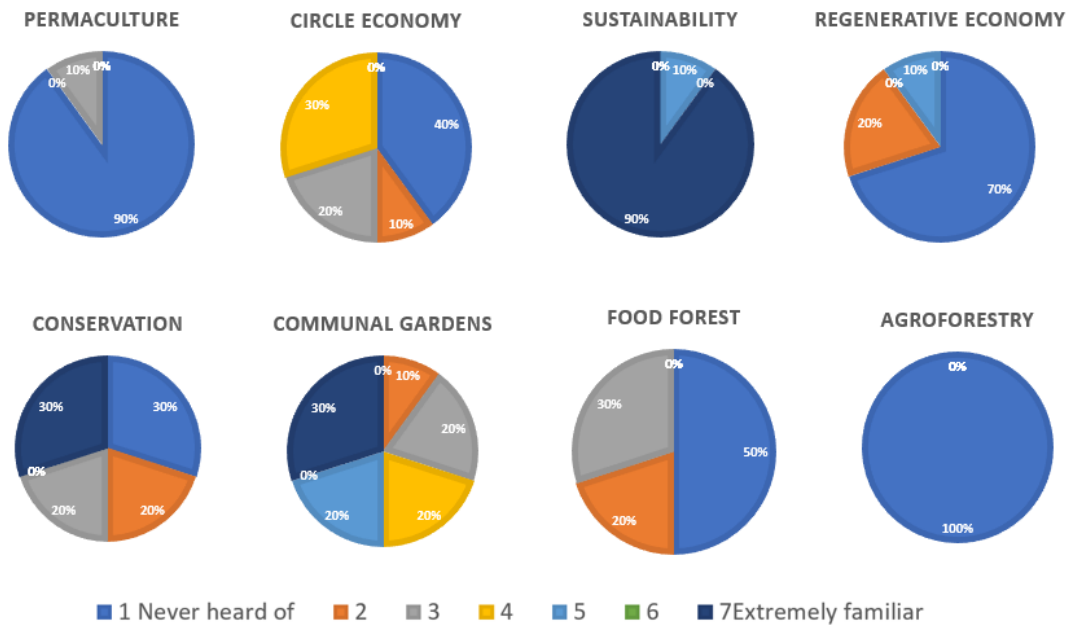


Figure 8 Scoring on familiarity with certain environmental terms between International and Dutch students. ‘On a scale from 1 (never heard of) to 7 (extremely familiar), please rate how familiar you are with the below terms/principles. By familiarity, we mean how often you have come across the term/principle in a book, at school, from a friend, in your social media, etc.’ (Own elaboration).

### 5.3 Circular Economy Initiatives

In the last part of my collection of data, I performed an analysis of the educational initiatives facilitated in the Netherlands around the broader subject of circularity. Interviews with few of them were conducted, and an analysis in the table below (Table 2) related to secondary education and circularity was performed. With the analysis, I placed out the objective of each initiative, the link or not with CE and the relevance to the secondary level. In that manner, I want to achieve an overview of the various activities that are happening within the region but are not bind to the school frame, but still allow students to be educated on CE.

NAME	PROPOSITION/BENEFIT	GAP WITH CE	EDUCATION LEVEL
Circular stars club	Kids for kids platform to learn together about doughnut economics	No	Primary level
Eco schools	Delivering certifications to schools related to sustainability	Yes	Primary & Secondary level
Amsterdam Donut Coalition Group	Entrepreneurial projects on Doughnut framework into education	No	Secondary & Tertiary level
Leren Voor Morgen	Organisation that manages all educational initiatives in the Netherlands around sustainability and circularity	Yes	Primary & Secondary level
ikCirculeer	Connects practical stories of sustainable entrepreneurs and artists with vocational education.	No	Secondary & Tertiary
Wageningen University	Research focus on regenerative and circular economy in education	No	Tertiary level

TABLE 2. Circular economy initiatives in the Netherlands (own elaboration).

Overall, there are few initiatives that are operating within the field of CE and education focusing especially on secondary education (Table 2). The main initiative that operates in that field is the Amsterdam Doughnut Coalition group, a group that originated organically after the collaboration of the city of Amsterdam and Kate Raworth into transforming the city into a Doughnut city. Separate groups around education, food production, finance, culture and arts work on bringing the Doughnut framework within those categories. Within the education group, where I was also part of, three main projects are running of those two-targeting tertiary education and the third secondary education. A card-game representing the different elements of the doughnut is being developed with the ultimate goal to educate students in a fun and creative way on CE and its aspects. Once the game is fully developed and produced the aim is to be distributed in secondary school classrooms in Amsterdam, starting with certain teachers who are interested in presenting it in their class. The vision of this group is to further develop projects around Doughnut that could be applied on all the levels of education.

Leren Voor Morgen (LVM), is a cooperative of collaborating organisations that is committed to sustainable education from primary to tertiary education level. Within the frame of circularity, LVM attempts to bring together circular skills and vocational education through different projects, varying from circular textile projects, conferences/symposium on circular skills, generation of manual/training on the topic or even waste management. Those projects are run across the Netherlands, and not solely in Amsterdam. Ikcirculeer, another organization stated in the list, collaborates with LVM on the education of vocational students around circular skills and providing with practical learning tools for their professional future. Reverting to LVM, the cooperation is also active on a sustainability and circularity roadmap together with a number of pilot schools, although none within the region of Amsterdam. Furthermore, their research results into the whole school approach (Figure 9), which addresses sustainable development into education through different external and internal domains of the school. These different domains are curriculum, vision, didactics, environment, operational management, and professionalization and form an integrated approach that is gradually embedded in the DNA of the school.





Figure 9 The WSA (whole school approach) different domains: curriculum, vision, didactics, environment, operational management, and professionalization(<https://www.lerenvoormorgen.org>)

In addition, Circular stars club is an educational platform that run projects with primary schools on different topics so students could be trained on circular skills. The organisation's founder is also part of the Amsterdam Coalition group, working with the other members on developing projects based on the Doughnut framework. A global organization called Eco-schools, is also present in the Netherlands and working with primary and secondary schools in Amsterdam. Eco-schools, is a certification organization that certifies schools as sustainable based on several metrics and working together with the students on approximately two2 years plan to accomplish that. Based on the student's interest, the core team picks two to three sustainable topics to act upon and transform their school into a sustainable one. The metrics entail, energy, climate change, water, energy, transport, food, waste, items, money and people. During an online interview with one of the organisation's employees, I recorded that three secondary schools are holding the eco-schools certification in Amsterdam, one of them being an international school and the other two Dutch speaking.

Last but not least, Wageningen University is dedicated in researching the possibilities of sustainable education and exploring the notions around circular and regenerative educational

models. Nevertheless, the research conducted in this field is primarily focused on tertiary level and professional implementations after university studies. Arjen Wals, a professor in Wageningen University is leading the work on Transformative Learning for Socio-Ecological Sustainability. Through his work, he delves into designing learning processes that can create the right conditions for a sustainable world, where students are able to embrace diversity, creativity and resourcefulness. Nevertheless, most of this work is focused on the higher education level and transitioning that part of the education, rather than secondary or primary.

To conclude, from the initiatives I came across throughout my research, the above ones, where the ones mainly operating within the setting of circular economy. Sustainability is a more common theme that is usually correlated with circularity and usually being more prominent as a focus. Despite the fact that, the organisations address less the secondary level, there is still some exploration within the vocational secondary level and tertiary that could be potentially combined with the lower level as a future advancement of those projects.

To wrap up the results section, from the analysis and the information gathered during the interviews it can be stated that CE has not yet been incorporated in the secondary educational system in the Netherlands. Initiatives around sustainability tend to be more common with primary education having more interactive activities within the subject whereas secondary lacking the multidisciplinary character of it. Tertiary education tends to incorporate CE the most in their curriculum, within the higher education as well as vocational studies. The primary reason for the lack of CE implementation in schools, it seems to be the lack of time in combination with the overloaded curriculum, stated by the majority of the teachers interviewed. Last but not least, lack of awareness of CE term within students demonstrates the little interaction with the topic. Teachers on the other hand, do not possess adequate training to be armed with the right skills to transmit the skillset of CE to their students.

## **DISCUSSION**

This chapter aims to provide an interesting discussion and a general overview of the previous chapters by integrating the main findings of the results section and the theoretical background. For this purpose, a reflection on the overarching research question and sub-questions will be conducted to demonstrate the validity of my arguments and scope of this study.

In sum, the main issues that were found in the reviewed documents are the following: Lack of awareness on CE concept from students, lack of adequate training for teachers, lack of time to incorporate CE in the curriculum and influence of socio-economic dynamics for exploration of new sustainability terms in schools. The patterns and key topics found during the research as stated above, will be critically discussed in two main subtopics. Awareness and implementation. The reasoning of these two groupings, was based on a common perception by the teachers and students of insufficient understanding of the term of CE as well as the struggle of CE frameworks' implementation in schools by the school or external organisations.

### **Awareness**

It is commonly stated throughout the surveys of international and Dutch students that sustainability is the most familiar concept to them whereas CE falls back, with primarily international students comprehending the concept better. These results combined with the insights by the teachers, validate the assumption that international and private educational institutes tend to incorporate more diverse curriculum that entails concepts such as CE. At the International school as well as at schools inside and outside Amsterdam that implement alternative teaching approaches such as Steiner & Montessori systems, it is often seen that CE elements are more prominent in their curriculum.

As rightly stated by (Wals, 1994), nowadays it is often seen that sustainable education addresses elitist groups that can 'afford' the more rounded education of their children rather than having a more inclusive approach and target challenged neighbourhoods and groups. During the interview with the biology teacher at an Amsterdam school based in a poorer area of the city, the above argument was also stated by him. His clear statement of CE is not a priority for these types of students and area, specified the lack of inclusivity in this subject.

Furthermore, the lack of necessary and rounded training, as well as the stated will by teachers to pursue one, demonstrated the lack of awareness on the concept of CE. This outcome confirmed the biggest barrier of CE implementation in secondary schools, which is the education of the educators. Educators are the students' guides and knowledge transmitters, where in this case, if they miss the robust comprehension of the circularity skills, consequently their students will not be capable of incorporating it in their everyday life.

Last but not least, disorganised management and full curriculum, are obstacles that do not allow teachers to explore the different aspects of their subject and incorporate new elements. Time is limited and the pressure of performance of their students is driving most of their purpose, by putting aside the examination of new skillsets.

## **Implementation**

The second part of my critical analysis, involves the actual implementation ways of CE in secondary education and its immediate correlation with the lack of awareness and understanding with the concept.

Throughout my content analysis of the various educational organisations within Amsterdam and the Netherlands, my active participation at the Amsterdam Doughnut Coalition group and the three interviews with the organisations, made me conclude that organisations address less the secondary level of education. CE is seen either a practical subject, incorporated in vocational secondary level and tertiary as a more academic concept to be researched. To be able to bring circularity in the city of Amsterdam, CE should be placed in the entire spectrum of education and allow the exploration of bringing all the elements of CE social and environmental to be taught.

According to the Doughnut city model by Kate Raworth, employment is key to make the transition to circular economy. Hence, focus should be placed on upskilling all the levels of education to prepare them for the shift. Governmental funds, municipal activities and policy reforms are some of the steps to be accelerated to boost the transition to circularity (Gemeente Amsterdam, 2020). With education being the main lever of change in any systemic change, makes the funding allocation to be fixated towards relevant educational programmes rather than infrastructure and development.

With sustainability in education still being considered a vague notion according to Wals & Rodela (2014), it is crucial to provide trainings to teachers on how to create a curriculum that simplifies it whilst continuously educating them. Trainings on the different concepts of sustainability including CE as well as workshops and programmes on multidisciplinary ways of building relevant curriculum are some of the ways that can be taken forward by the educational institutions.

Examples, such as the Amsterdam Doughnut card game developed by one of the members of the coalition groups or workshops by external educational organisations such as *leren voor morgen* or *circular stars*, can be easily add-ons to the current curriculum, not limiting the time of the teacher whilst incorporating multidisciplinary approaches. Pedagogical approaches involving project-based learning and problem solving such as game construction, simulation of designing according to CE principles, events, and labs (Kirchherr & Piscicelli, 2019) can be effective methods for students to learn.

To argue further on the above, it is crucial to mention that a too detailed structured curriculum that does not allow freedom to the teacher to incorporate various multidisciplinary approaches and activities, can result into a less engaging learning experience for the student (Bouw, Zitter, & de Bruijn, 2019). CE is a concept that needs to be taught in a holistic approach, involving elements of the Doughnut framework, of both social and ecological ceiling. The fact, that nutrition and schoolyards were the elements less considered in the assessment by the teachers, indicates a missing link and alignment to a full circular system. All the elements of the doughnut are interdependent and can function balanced when they are in balance.

To wrap up, the character of the Dutch educational system, being decentralised and easy to adopt new methods can allow the resource allocation and processes to include circularity in its curriculum in a manner that can be less invasive for the wellbeing of teachers whilst upskilling its students with the right tools. Flaws within the Dutch education system, around inclusivity and high dropout rates of usually immigrant background students should be considered into the policy reforms that are under discussion on the municipal level.(OECD, 2014).

As a summing statement of my discussion part, for the city of Amsterdam to shift to circular city by 2050 a systemic transformation, education should be put in the center of every action. Working

closely with all the stakeholders of the urban system, engaging with the broader community and raising awareness to all the levels of the society, Amsterdam can shift its operations to a fully circular. Secondary education is vital for the transition, preparing the youth to become the citizens of a thriving ecosystem.

## CONCLUSION

The aim of this research was to empirically study if and how circularity is addressed in Amsterdam secondary education. This exploratory analysis employed qualitative research methods, namely: content analysis of educational organisations in Amsterdam coupled with educational stakeholders' interviews. Despite the novelty of the topic, interesting and relevant conclusions can be made.

According to the data gathered and the subsequent analysis there are strong indications that CE is still not widely explored and implemented as a concept within the secondary schools in Amsterdam, regardless the commitment of the city to become fully circular by 2050. Awareness and lack of training on the subject for both students and teachers make the shift more challenging to be incorporated. Limited time due to demanding curriculum obligations for final exam preparations and standardised themes and topics, are the common barriers to allocate CE in schools. Additionally, it can be stated that this situation is more prominent at schools where non alternative pedagogical methods are in place and there is less privileged number of students.

All in all, my findings were a sum of qualitative interviews and surveys, with the ambition to end up to a quantitative collection of data, with a number of over 50 responses. Nevertheless, the number was not achieved, due to COVID limitations resulting to a qualitative sum of answers that can still support the objective of this study.

## FURTHER RESEARCH POSSIBILITIES

The present study has addressed -to some extent- the current gaps in the implementation of CE in secondary schools in Amsterdam and the potential implementation methods that can be explored. However, it is important to note, that there are strong indicators showing that the scope should be expanded, as well as the integration of other methodologies in order to have a more comprehensive perspective of on the subject.

Indeed, during the data collection process a limited number of teachers were interviewed rendering difficult to have a robust sample to base my assumptions and results. Hence, further investigation of the various types of secondary schools within Amsterdam needs to be taken into consideration.

Further analysis and an extension in the implementation of the Doughnut framework is recommended in order to study in depth the accurate implementation rate. For that to be completed, interviews with circular economy experts, government and municipality stakeholders should be carried out.

Additionally, it would be intriguing to study how other cities transition to circularity and what are the best cases or approaches to bring it in the secondary educational system. Collaboration within the municipalities outside Amsterdam and between schools could also be explored as an implementation technique.

The circular Amsterdam case, is a pioneering example to be replicated in other cities and upscale its impact. Therefore, following the city portrait (DEAL et al., 2020) framework, cities can implement the steps to transition to a fully circular one. That indicates the importance of interconnectedness in this shift and the relevance of local global effect and the role of communities in this. Last but not least, a final investigation relevant to the above framework, could be a creation and design of a circular school portrait that could be utilised in any level of education.

In a nutshell, a ripple effect is manifested in each activity that a society completes making the shift to a regenerative economy and organize change that can potentially be accomplished with the right actions and players.



## REFERENCES

- Bugallo-Rodríguez, A., & Vega-Marcote, P. (2020). Circular economy, sustainability and teacher training in a higher education institution. *International Journal of Sustainability in Higher Education*, 21(7), 1351-1366. [10.1108/IJSHE-02-2020-0049](https://doi.org/10.1108/IJSHE-02-2020-0049)
- Costello, E., Mustillo, S., Erkanli, A., Keeler, G., & Angold, A. (2003). Prevalence and development of psychiatric disorders in childhood and adolescence. *Archives of General Psychiatry*, 60, 837–844. <http://dx.doi.org/10.1001/archpsyc.60.8.837>
- Davies, D., Jindal-Snape, D., Collier, C., Digby, R., Hay, P., & Howe, A. (2013). Creative learning environments in education—A systematic literature review. *Thinking Skills and Creativity*, 8, 80-91. [10.1016/j.tsc.2012.07.004](https://doi.org/10.1016/j.tsc.2012.07.004)
- Dearing, J. A., Wang, R., Zhang, K., Dyke, J. G., Haberl, H., Hossain, M. S., Langdon, P. G., Lenton, T. M., Raworth, K., Brown, S., Carstensen, J., Cole, M. J., Cornell, S. E., Dawson, T. P., Doncaster, C. P., Eigenbrod, F., Flörke, M., Jeffers, E., Mackay, A. W., . . . Poppy, G. M. (2014). Safe and just operating spaces for regional social-ecological systems. *Global Environmental Change*, 28, 227-238. [10.1016/j.gloenvcha.2014.06.012](https://doi.org/10.1016/j.gloenvcha.2014.06.012)
- Doughnut Economics Action Lab (DEAL), Biomimicry 3.8, Circle Economy, C40 (2020). *The Amsterdam City Portrait*, 1-26
- European Commission. (2020). Communication from the commission to the European parliament, the council, the European economic and social committee, and the committee of the regions. *A new Circular Economy Action Plan For a cleaner and more competitive Europe*.

- Glaser, B. G., & Strauss, A. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research*. New York, NY, Aldine De Gruyter.
- Gibb, Julia Heiss, & Sabine Detzel. (2016). *Getting Climate-Ready. A guide for schools on climate action*. United Nations Educational, Scientific and Cultural Organization
- Jickling, B., & Wals, A. E. J. (2008). Globalization and Environmental Education: Looking beyond Sustainable Development. *Journal of Curriculum Studies*, 40(1), 1-21.  
10.1080/00220270701684667
- Kleinert, S., & Horton, R. (2016). Adolescent health and wellbeing: a key to a sustainable future. *The Lancet (British Edition)*, 387(10036), 2355-2356. 10.1016/S0140-6736(16)30297-5
- Kooreman, P. (2007). Time, money, peers, and parents; some data and theories on teenage behavior. *Journal of Population Economics*, 20(1), 9-33. 10.1007/s00148-006-0121-8
- Mendoza, J. M. F., Gallego-Schmid, A., & Azapagic, A. (2019). Building a business case for implementation of a circular economy in higher education institutions. *Journal of Cleaner Production*, 220, 553-567. 10.1016/j.jclepro.2019.02.045
- OECD. (2014). *Education Policy in the Netherlands*. London
- Raworth, K. "A Safe and Just Space for Humanity: Can We Live within the Doughnut." *Oxfam Policy and Practice: Climate Change and Resilience* 8, no. 1 (2012): 1–26.
- Raworth, K. *Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist*. White River Junction, Vermont: Chelsea Green Publishing, 2017.
- Redecker, C., Leis, M., Leendertse, M., Punie, Y., Gijsbers, G., Kirschner, P., Stoyanov, S., & Hoogveld, B. (2011). *The future of learning*.24960  
<http://bookshop.europa.eu/uri?target=EUB:NOTICE:LFNA24960:EN:HTML>

- Rockström, J., W. Steffen, K. Noone, Å. Persson, F. Stuart Chapin III, E. Lambin, T. M. Lenton, et al. "Planetary Boundaries: Exploring the Safe Operating Space for Humanity." *Ecology and Society* 14, no. 2 (2009).
- Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin III, F.S., Lambin, E., Lenton, T.M., Scheffer, M., Folke, C., Schellnhuber, H., Nykvist, B., De Wit, C.A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P.K., Costanza, R., Svedin, U., Falkenmark, M., Karlberg, L., Corell, R.W., Fabry, V.J., Hansen, J., Walker, B., Liverman, D., Richardson, K., Crutzen, P., Foley, J., 2009a. A safe operating space for humanity. *Nature* 46, 472–475
- Sahlberg, P. (2007). Secondary education in OECD countries. Common challenges, differing solutions
- United Nations, Department of Economic and Social Affairs, Population Division. (2014). World urbanization prospects: the 2014 revision. New York (Accessed on 1st November 2016).
- Viner, R., Ozer, E., Denny, S., Marmot, M., Resnick, M., & Fatusi, A. (2012). Adolescent Health 2 Adolescence and the social determinants of health. *Lancet*, 37910.1016/S0140-
- Yurgelun-Todd, D. (2007). Emotional and cognitive changes during adolescence. *Current Opinion in Neurobiology*, 17(2), 251-257. 10.1016/j.conb.2007.03.009
- Wals, A. E. J. (1994). *Knowing and Caring for the Natural Environment*
- Wals, A. E. J., & Rodela, R. (2014). Social learning towards sustainability: Problematic, perspectives and promise. *NJAS - Wageningen Journal of Life Sciences*, 69(1), 1-3. 10.1016/j.njas.2014.04.001

Werner-Seidler, A., Perry, Y., Calear, A., Newby, J. M., & Christensen, H. (2017). School-based depression and anxiety prevention programs for young people: A systematic review and meta-analysis. *51*, 30. 10.1016/j.cpr.2016.10.005

Whalen, K. A., Berlin, C., Ekberg, J., Barletta, I., & Hammersberg, P. (2018). 'All they do is win': Lessons learned from use of a serious game for Circular Economy education. *Resources, Conservation and Recycling*, 135, 335-345. 10.1016/j.resconrec.2017.06.021

Whiting, K., Konstantakos, L., Misiaszek, G., Simpson, E., & Carmona, L. (2018). Education for the Sustainable Global Citizen: What Can We Learn from Stoic Philosophy and Freirean Environmental Pedagogies? *Education Sciences*, 8(4), 204. 10.3390/educsci8040204

## ANNEXES

### Interview guide & questionnaire

#### Interview guide (Tentative Questions)

Brief introduction of the interviewee: Stating that I am conducting research on secondary education, and everything will be kept anonymous. At the end of the interview, I will update them more on the cause of the study, to avoid any bias during the interview.

1. Tell me a bit about you. Who you are? Where do you live? Family status.
2. Can you please describe a day at school?
3. What is it that you like most as a teacher?
4. How is the infrastructure at your school? Does it miss anything? What would you change?
5. What is your interaction with the students?
6. What are the most common struggles you face with them and how do you think can be solved?
7. If you could how you change the educational system?
8. How much time students spend outside during the break?
9. Are there any activities at your school around climate change?
10. Are they familiar with Circular economy?
11. Are there any projects around the subject?
12. How would you teach your subject in relation to nature?
13. Would you like to add anything that you consider relevant that has not been mentioned?
14. Could you suggest other teachers or experts, that I should interview for this research?
15. Thank you very much for your time and help. I really appreciate it! Can contact you if I have any question regarding our interview?

The same approach was followed for the educational organisations with more precision on the link between their cause and CE.

1. How much circular economy is embedded in your cause?
2. Is specifically addressing secondary level education?
3. How is it being perceived what you do by the schools?
4. What projects do you currently have in the pipeline on circular economy and education?

## **Interviews' transcript**

Teachers' transcript:

<https://docs.google.com/presentation/d/1OPd2NbmaWLegdF6A7yPLX9emvkwYdYGq/edit?usp=sharing&oid=107964111236984637611&rtpof=true&sd=true>

Educational organisations:

- Ecoschools

[https://docs.google.com/spreadsheets/d/1Ze7QleMhj6vmyPHdIfm42yPpz5\\_SWN4/edit?usp=sharing&oid=107964111236984637611&rtpof=true&sd=true](https://docs.google.com/spreadsheets/d/1Ze7QleMhj6vmyPHdIfm42yPpz5_SWN4/edit?usp=sharing&oid=107964111236984637611&rtpof=true&sd=true)

- Leren Voor Morgen

<https://docs.google.com/document/d/1BZrathOLWJDi9BE88FS8fAcXDIXnxfq4/edit?usp=sharing&oid=107964111236984637611&rtpof=true&sd=true>

- Wageningen University

<https://docs.google.com/presentation/d/1OPd2NbmaWLegdF6A7yPLX9emvkwYdYGq/edit?usp=sharing&oid=107964111236984637611&rtpof=true&sd=true>

## **Surveys questions and answers**

Dutch students survey

[https://docs.google.com/spreadsheets/d/1Lfa\\_EMHvD\\_iSus9jy5V62XFiNVjQDiFv/edit?usp=sharing&oid=107964111236984637611&rtpof=true&sd=true](https://docs.google.com/spreadsheets/d/1Lfa_EMHvD_iSus9jy5V62XFiNVjQDiFv/edit?usp=sharing&oid=107964111236984637611&rtpof=true&sd=true)

International students survey

[https://docs.google.com/spreadsheets/d/111QmfrCaB\\_nE\\_wev77Zp6HeGxaq-D8Xi/edit?usp=sharing&oid=107964111236984637611&rtpof=true&sd=true](https://docs.google.com/spreadsheets/d/111QmfrCaB_nE_wev77Zp6HeGxaq-D8Xi/edit?usp=sharing&oid=107964111236984637611&rtpof=true&sd=true)

Teachers' survey

[https://docs.google.com/spreadsheets/d/1Ze7QleMhj6vmyPHdIfm42yPpz5\\_SWN4/edit?usp=sharing&oid=107964111236984637611&rtpof=true&sd=true](https://docs.google.com/spreadsheets/d/1Ze7QleMhj6vmyPHdIfm42yPpz5_SWN4/edit?usp=sharing&oid=107964111236984637611&rtpof=true&sd=true)