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Learning Science Locally: Community Gardens and Our Future

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Abstract

This study is framed by our experiences of teaching gardening to primary students at The Old School Community Garden, in the Adelaide Hills, South Australia. As experienced educators, we are motivated by the wholistic nature of gardening as an approach to learning that provides opportunities to place science education in a context that also values other ways of knowing and draws on the cognitive, the affective and the spiritual. By engaging young people in gardening, we provide them with the opportunity to see the world as a whole, while also addressing local issues such as organic food production. We argue that nature teaching is part of the answer to live able futures in this time of climate change, pandemics, and the possible crossing of other Earth boundaries. These challenges require a focus on futures thinking and planning in order to develop the dispositions needed to live in the present with a well-formed idea of where we want to go.

Keywords: Futures thinking, Science education, Community gardens, Transdisciplinary

1. Introduction

The Old School Community Garden (TOSCG) is a public garden developed on the former site of the Stirling East School, in the Adelaide Hills (Mt Lofty Ranges), South Australia. This paper is built around the experiences and learning of young students who have been visiting the garden as part of their schooling in order to grow vegetables and plant indigenoustrees and shrubs, with the primary aim of preparing them to care for and restore Earth's degraded and exploited ecosystems. At the same time, the students' involvement in the garden provides them with opportunities for therapeutic, recreational and social experiences, and connects them to both the human and other-than-human environment.

The value of community parks and gardens throughout history, and particularly in present and future times, has been well documented [1]. They can be sites of cultural and social activity as well as places of practical small-scale food production which contribute to the sustainability, resilience and flourishing of communities [2,3].

The development of TOSCG is taking place at a time of globalisation, where our planet is reaching social, environmental, and economic limits. This is a situation which we may not beable to solve in an ideal way, but which we can survive. Eckersley (2012) [4] encouragingly suggests that "there is still plenty to dream of, and to strive for" (p. 22). The following discussion of TOSCG and its role in the local community is framed with this encouragement in mind.

In this paper, we also draw on our own experiences as educators, gardeners, and parents. Collectively, we bring over 100 years of experience in environmental science education. We start with our own stories-what impacted on us in our early years, and what experiences havecontributed to our passion for an eco-active curriculum. As 'elders', our intention is to reflect on our evolving understanding and journey, and to leave a legacy for those picking up the batonfor the future. It is ethical that our generation leaves a world worth passing on to ourgrandchildren and theirs. We utilize a set of eco-justice principles that provides a curriculum structure for live able futures and for teacher educators to develop. As Assadourian (2017, p. 304) [5] makes clear, we need an education that integrates eco-literacy into the curriculum and thatvalues young people spending time in nature.

To achieve a sustainable society in harmony with Earth's ecosystems, educators and educational policymakers will have to rethink the curriculum and adopt a different approach to instruction (Bentley 2010) [6]. We need to develop curriculum and pedagogy that integrates humans more fully with the rest of nature and that develops a disposition for living in the present while planning for sustainable futures. As Berry (1999) [7] says, "We are not here to control. We are here to become integral with the larger Earth community" (p. 48). It is important for science education, and for transdisciplinary learning more broadly, to promote educative experiences where students contemplate the beliefs, interests, and feelings of others impacted by environmental socio-scientific issues. "Learners can form an intrinsic connectionwith nature, in the sense that nature should be afforded similar intrinsic value and justice, thatis extended to people" [8]. Given the opportunity, students will see themselves as part of their nature world-likely more affectively and spiritually, than cognitively.

2. About the authors: Our brief histories

The authors are two "retired" academics from the University of South Australia with environmental science and futures studies backgrounds. Most of our academic work has beenwith middle school trainee teachers. We have taught pedagogical courses for science and mathematics, including environmental science and integral studies. We have worked particularly with pre-service teachers aiming for careers in upper primary and junior secondary education.

2.1. David Lloyd

I was born in Ormskirk, a market town in Lancashire, England, during the Second World War-a time when community gardens (allotments) became a necessity. After the war, my family immigrated to South Australia, where I attended schools in the metropolitan area. A teaching scholarship enabled me to complete Education and Science degrees which led to a career teaching secondary school science and chemistry. After further study (MSc and PhD), I spent fifteen years lecturing at the University of South Australia. Throughout my schooling, I developed a love for the natural world through adventures in Adelaide's Mt Lofty Ranges. Later in life I enjoyed caravanning and camping with my family and friends and, of course, vegetable gardening for my family at home. I became an enthusiastic member of TOSCG and have worked with local primary school teachers who visit the garden with their classes. My academic work, and my understanding of the importance of living as part of nature through my connection with it, motivated me to explore many aspects of our environment and I became concerned with the way it was being used and (mis)managed. My grandchildren have a lot of work to do to repair natural ecosystems and to hopefully live in a vibrant, sustainable, and nature-filled world.

2.2. Kathryn Paige

I was born and raised in Berri along the River Murray, South Australia. This river system is a major source of domestic and environmental water and, while the rhetoric was that there was sufficient for everyone, I remember brown water baths and being constantly mindful of the preciousness of water and the precariousness of the river flow. As a well-educated white woman of privilege, I am conscious that my "lot" have used more than our share of Earth's resources. The 70s were the times of Vietnam war, hippies and living simply. At Teachers College, our ecology lecturer inspired us to participate in frog counts (as a measure of healthy water systems) and to march down the main street of Adelaide chanting "ban the can" in a campaign that resulted in a deposit scheme for soft drink cans which remains to this day.

Through my 17 years teaching in classrooms and 25 years educating future teachers, I always strived to "walk the talk", reducing my carbon footprint through recycling, replacing single use items with reusables, cycling rather than driving wherever possible, planting trees, and gardening (later guerrilla gardening).

3. Context

The Old School Community Garden was once a primary school, hence the name. Located in the township of Stirling, approximately 15 km from the Adelaide city centre, the land is government-controlled and is managed by the district council. In 2013, the council leased the site to a group of local people who wanted to develop a community garden [9].

The garden is two hectares in size and has a flat area suitable for growing vegetables, and an undulating area ideal for growing indigenous flora. Koalas are starting to find their homes in the trees and native birds of many species are at home in the garden.

The original OSCG team, all interested in gardening and/or growing food, also saw the site as a community meeting space, for both health and economic reasons and, in particular, the local production of food which was seen as becoming an increasingly higher priority for communities. During early consultations, the managing committee established six objectives for the garden [9]:

1. A Meeting Place
2. A Growing Place
3. A Learning Place
4. A Healthy Place
5. A Sustainable Place
6. A Beautiful Place

In this paper, the educational value of TOSCG (Objective 3) is our primary concern. We focus here on the use of the garden as a learning place for Year 1 students (aged 6-7) and Year 4 students (aged 9-10) from the current Stirling East Primary School. As Gaylie (2011) [3] and Lloyd (2013) [10] note, many schools already have their own food gardens as strategies for developing sound nutritional practices and cooking skills, encouraging outdoor physical activity, and preparing students for living locally food-wise. It is hoped that this generation of young people, with the opportunity to learn how to grow food, will be better prepared for a likely challenging future [11,12].

The data used in this paper is collated from the comments of young people reflecting on their community garden experiences. Learning about our environment and how to live sustainably within it is critical for a live able future for all species including humans, so understanding, valuing, behaving, and taking action to care for our natural environment-for ourselves and for future generations-is our greatest challenge for sustainability. A necessary process in conceiving a community garden is that how we understand and "value" the future will determine how we proceed in the present. This theme will be discussed in more detail later in the paper.

4. Transdisciplinary Learning in the Community Garden

The garden is an ideal site for young people to learn about their local environment and how to manage it sustainably. In the Australian Curriculum, the concept of sustainability is a "cross-curriculum priority" from Reception to Year 10 and this, in itself, is indicative of the transdisciplinary nature of learning for sustainable and harmonious interaction with the environment. For teachers bringing their students to TOSCG, the pedagogy used is transdisciplinary, connected to place, and consistent with the agreed garden objectives [13]. The activities are also transgenerational. The teachers and students work with senior members of TOSCG team, including David Lloyd, one of the authors of this paper. The older Year 4 students act as mentors for the younger Year 1 students.

The central activity for students is planting vegetables in wicking beds, and planting trees at the site as well as at school and home (See Figure 1).

Figure 1: Community Garden wicking beds.

In the process, students learn to identify the needs of the plants. They use mathematics for measuring plant spacing, and to calculate the recommended type and amount of fertilizer. They learn to use soil moisture meters, and pH meters to test for acidity/alkalinity. They cover their garden beds with nettingto keep out the feral rabbits and white butterflies that lay eggs on their plants. Snails also need to be managed, although snail races are not uncommon, and students love the worms!

As a "Learning Place" (Objective 3), TOSCG promotes multiple ways of knowing (Gardener, 1983) [14] including the development and sharing of values and visions—a cultural perspective.

Through their participation in TOSCG, the students learn more about living sustainably, as the TOSCG team demonstrate, practice, and promote the sustainable use of resources.

Participants are provided with rich opportunities for learning including organic gardening, plant propagation, pest control/weed control, composting, and wicking bed construction. There is also a focus on biodiversity and local knowledge-specific to the Adelaide Hills conditions and microclimates around Stirling-and as part of the curriculum in Year 4.

Engaging students in the decision-making process has added to the democracy agenda. Asstudents aren't often aware exactly how their food is produced and where it comes from, Growing and cooking food have been welcomed and are now integrated into the school curriculum.

Student experiences at the garden are taken back to school, interrogated and further researched. The produce is either taken home or cooked and eaten at school, providing an opportunity for cooking lessons. Students continue their garden studies in the classroom to develop their literacy skills by researching and writing stories about their garden experiences.These stories are shared with fellow students, teachers, instructors, and parents. The student experiences are supportive in connecting them to Earth, their curriculum, and the interconnectedness of the subjects they do at school-transdisciplinary learning [15].

5. Participant Reflections

Children's personal comments on the community garden experience are provided in Table 1.What is interesting is the variety of reasons students give for being at the garden. Common themes include 1) the science of gardening e.g., learning about growing plants, planting seeds, putting out pea straw and pulling out weeds. A second theme is helping people less fortunate, for example growing food for people in need. Thirdly, being outside, walking to the garden and spending time with their buddies. Both the learning and social aspects were identified by the students.

Student stories, comments and notes can be seen as young people preparing themselves and their community for a sustainable future, not necessarily in a deliberate way but by studentsseeing the value of community gardens.

Table 1: Students' comments on the value of the garden.

Connection to nature /gardening	Frieda: "I love going to the community garden because ithelps us become connected to nature". Fleur: "I think that the community garden is a great place ifyou don't have a garden" Florence "I love going to the community garden because weget to water the plants,
Food production	Emma: More people should visit the Community Gardenbecause people can get vegetables". Violet: "I like going to the garden to learn how to grow fruit and vegetables to eat and so they don't have to pay money forit".

Companionship	Florence “I love going there with my buddy”.
Contributing wellbeing (personal /community)	Amber: “I like going to the garden because I like being able to plant whatever I want and be able to help the community. Ithink our class trips to the garden are fun and also, we can getmore exercise walking there”
The whole story	Bella: “I like going to community garden, we get to take the vegetables we have planted. I am learning how to plant. We got to go with our buddies. We would pull out the weeds andput it in the big mulch pile. I think this will help the community if we plant our own vegetables and don’t use packaging, so it is better for the environment. I think this would help the community if we planted our own vegetables,so we don’t use packaging so is better for the environment”.

The teacher also commented on the important role of children mentoring younger ones and the interdisciplinary nature of the learning, identifying both mathematics and science. The Year 4 class are working with Year 1s. This means they are able to develop mentorship skills, model social skills as well as learning all the benefits of participating in a local sustainability enterprise. They acquire knowledge about soil preparation, seedling growing and seed germination. They will gain the expertise of caring for their plants and later will reap the rewards and will be able to cook and eat their produce. It is also beneficial for the students toget to know an older citizen guiding them through the process.

6. Learning to Live Locally

TOSCG is very much about connecting to place-to the local. Many readers will be familiar with playing in the back yard when younger, or going to the park with friends, or to the garden, to play or just relax. TOSCG has become a second home for some locals particularlywhen needing a break from the “dishes”. Aizenstat (1995) [16] puts it well: “The rhythms of nature underlie all of human interactions: religious traditions, economic systems, cultural andpolitical organizations. When these human forms betray the natural psyche pulse, people and societies are sick, nature is exploited, and entire species are threatened” (p. 93).

Norbert-Hodge sees a need to “work to renew ecological, social and spiritual wellbeing by promoting a systemic shift away from economic globalization towards localization” (Local Futures - Building economies that restore community and nature.). Community gardens are an expression of localization that respects nature, justice, and real democracy, rebuildinglocal economies and communities, and restoring cultural and biological diversity.

When it comes to food, the value of local production is paramount:

The logic of local food production is unassailable: locally grown food is fresher, and therefore tastier and more nutritious, than food transported over long distances. It is also likely to contain fewer preservatives and otherartificial chemicals, because when the producer knows the consumer personally and not only as a faceless target market, he or she is less likely to take risks and liberties with the consumer’s health.

TOSCG can nurture a unique and special sense of place, and students can find an outlet for their biophilic needs [17-22]. Barrows (2012, p. 107) [23] hypothesizes that “the attraction children have for fairy tales set in nature and populated with animal characters may be explained by children’s instinctually based feelings of continuity with the natural world”. The garden is symbolic of a desired community-for both the local and the global, economically and environmentally-in striving for a sustainable world [24-26].

“As regard economics we need ... subsistence economies where the variety of human groupsbecome acquainted with the other species in the local bioregion” (Berry, 1999, p. 160) [7] and Berry (1999, p. 175) [7] adds. “It would be philosophically unrealistic, historically inaccurate, and scientifically unwarranted to say that the human and the Earth no longer have an intimateand reciprocal emotional relationship” (Berry, 1999, p. 175) [7]. Bowers (2005) [27] adds that “This bio-conservatism is concerned with the forms of community, agriculture, work, and art that improve the quality of human life by living more in harmony with natural systems” (p. 39).

Connecting to place isn’t a trivial disposition. Familiar pleasant places provide for relaxationand exercise, but can also act as outlets for the cognitive, the affective and particularly the spiritual. The wonder of our Earth becomes distinct to us when resting under a tree or in a shelter at any time of the year-although perhaps not when a bushfire warning siren is heard!

7. Futures thinking

Our global and local economies are destroying Earth’s natural support systems, putting us ona path of decline and collapse. Current literature on sustainable futures identifies the challenges for a safe and live able environment. These challenges include climate change, ocean acidification, chemical pollution, nitrogen and phosphorus loading, freshwater withdrawals, land conversion, biodiversity loss, air pollution and ozone layer depletion [28-30]. Earth is heading for an uncertain future with the likelihood of dramatic changes-a good reason to be concerned. If Earth is to remain live able, we need a futures vision that can turn things around. Futures thinking is about exploring possible futures that are evidence based and investigating how trends will affect us and our community, promoting decisions on what action needs to be taken to either fulfill thefuture scenario or work to prevent negative aspects.

At the personal, level our minds have the faculties of memory and prevision [31,32] and we have no choice but to have images of possible futures. They are acentral aspect of our worldview [32,33-36]. Images of possible futures are mental tools that deal with possible future states and are composed of a mixture of concepts, beliefs and desires that affect our choices and guide decision making and actions. They are flexible, changeable, and personal in nature and are mental constructions dealing with possible future states [37]. Images of possible futures are important and life forming, and prediction is both intuitive and learned, and can be improved when acknowledged and attended to (Loye, 1998) [36]. Hicks (1996) [38], says that “One of the main concerns of environmental education is the need to create a more ecologically sustainable future”, and that images“ of possible futures seem to be important at both the personal and community levels” [38-41].

Futures planning is not concerned with predicting the future, but rather exploring possible futures with the purpose of assisting with decision making in the present and preparing ourselves for a broad range of possible futures. The major purpose of futures studies is to maintain or improve the freedom and welfare of humankind and the life-sustaining capacities of the Earth by clarifying goals and values, describing trends, explaining conditions, formulating alternative images of the future, and inventing, evaluating, and selecting policy alternatives.

Future scenario writing aims to develop our disposition for foresight and to provide a synthesizing mechanism for cognitive, affective, and ethical learning for sustainable futures (Lloyd, 2009) [42].

[Futures] scenarios are a tool for helping us take a long view in a world ofgreat uncertainty ... Scenarios are stories about the way the world might turn out tomorrow, that help us recognize changing aspects of our present environment … Scenario planning is about making choices today with an understanding of how they might turn out [43].

The scenario needs to include the causes of change and their impact: negative decision making, cognizant of information needing to be gathered, driving forces of change, the main/most worrying trends, critical uncertainties; analysis of implications, and key indicators of change. Climate change is the most prominent negative at this time, although many otherswill need serious consideration, such as over population and pandemics [44-48].

The following extract is from a positive future story using a guided fantasy to get participants, in this example, an adult, thinking about the world in 20 years.

I spend my day working in my small garden and glasshouse with my vegetables and fruit. I enjoy the society of the main street, the library. I take interest in the public orchard I helped plant 10 years ago. The freeway is quieter, there are two train tracks where roads were; people now find the new train to the city more convenient. There is much more local cultural life, films, music, and local sociability [10].

The choice of preferred futures identifies what the author would like their Earth to be like. Many would like to see a future based on greater environmental awareness and personal and community action for sustainable futures as argued by Slaughter [41, 49,50] and many other authors [51,52]. There is ample evidence in these articles that having positive expectations for the future has a positive effect on our world view and wellbeing. This chapter discusses the need for envisioning positive futures and howcritical futures studies can empower students of all ages to transform visions into actions - to realize those futures they imagine.

Awareness of local and global issues is not generally the result of the school curriculum but rather from television and other forms of mass media [30,53]. A third view, the transformational, is that young people intuit the dangers of our time and are 'deeply cynical, alienated, pessimistic, disillusioned and disengaged' as well as 'uncertain of what the future holds' [54]. Eckersley (1995) [55] argues that the lack of confidence that youth have in futures may be due to cultural failures, loss of key values, and the rapid pace of change. That there are no clear understandings of the status and meaning of student views seems to us to be a very good reason to apply the precautionary principle and to treat them as important. Whatever the interpretation, it does seem that futures images are an integral part of students' worldviews and hence constitute prior knowledge that can influence motivation, conceptual development, and what is valued as knowledge. We believe that what student images of possible futures reveal about their interests and concerns providesa primary justification for a more explicit futures perspective in education [56-58].

Climate change, brought about by human behavior, is currently the Earth's primary challenge. Climate change is exacerbated by deforestation, a major cause of biodiversity loss and carbon dioxide removal [59]. A further significant challenge is the destruction of our natural environment-the homes of so many native plants,animals and insects. In Australia, , overfishing and illegal fishing, introduction of exotic species, pollution, and infrastructure development add up to degradation of the natural environment. Environmental degradation is evident at even well-managed sites. At TOSCG rabbits-an introduced pest-want our fruit and vegetables, leaving nothing for humans!

Toulmin (1990, p. 2) [60] explains, "futures scenario are available futures, not just those that we can passively forecast, but those that we can actively create". They are futures which do not simply happen of themselves, but can be made to happen, if we meanwhile adopt wise attitudes and policies. This position enhances considerably the need for community parks and gardens that can provide spaces for the non-human residents (plants and animals) and the growing of organic food for humans [52,61,62,9,63,64].

Planetary boundaries are boundaries within which we expect that humanity can operate safely. Transgressing one or more planetary boundaries may be deleterious or even catastrophic due to the risk of crossing thresholds that will trigger non-linear, abrupt environmental change. Community gardens can assist, provided there is enough of them touse the carbon dioxide we generate for them.

Community gardens can also play a significant role in conserving biodiversity through developing wildlife pockets and corridors across towns and cities. For example, mature gum trees and those we are planting at TOSCG provide food and shelter for koalas. The creek thatrun through the garden provides a home for animal species such as frogs, lizards and Australian wood ducks (See Figure 2). On a large scale, Gardens can also help to mitigate climate change. Their vegetation captures carbon dioxide and improves air quality. Tree and shrub roots absorb water and help stop flooding and erosion but also reduce evaporation, very important in South Australia's hot, dry summers.

Figure 2 A: shared space for humans and wildlife.

8. Community connections and wellbeing

The use of parks and gardens to improve health is known as *social and therapeutic* horticulture. As well as promoting physical and mental health benefits, social and therapeutic horticulture has also been shown to help improve people's communication and thinking skills. The University of Hull's Centre for Systems Studies is researching ways community gardening can boost wellbeing for people, societies and the wider world. They have, since 1998, been maintaining trees, shrubs and wildlife areas, growing vegetables and salad crops, and holding crafting activities. Similarly, TOSCG runs workshops on how to mulch, build wicking beds, as well as plant propagation. We must not forget social events such as barbeques and picnics-often occurring after a hard day of digging, weeding, and planting.

As mentioned earlier, the explicit objectives of TOSCG include "A Healthy Place". This objective has four main aspects—cultural inclusion, eco-system health, and personal mental and physical wellbeing. Student visits to the garden promote social interactions, physical exercise, and ecological knowledge.

Spending time in the outdoors, taking time out of the everyday to surround yourself with greenery and bird life is one of life's great joys. It certainly is for us at TOSCG; it's good foryour body, mind, soul, and sprit. Our community garden is a place of rest, connection to nature, thinking through current challenges, physical exercise, reflection, and a place for companionship, discussion and collective decision making.

Gardening can directly improve our wellbeing and encourage us to adopt healthier behaviors through physical activity, collaborating with friends, relaxing or meditating in a quiet and beautiful place, coming to a better understanding of plant growth, soil properties and the ecology of gardens. Growing food, for own use and for local distribution or sale, is the motivating purpose of community gardening. For example, surplus food from TOSCG goes to people in need and is distributed by The Hut Community Centre, operated by local government. Unlike growing food in private gardens, community gardening requires an element of cooperation and collective planning. Working together towards shared goals can create a real sense of community. And in a garden, a feeling of connection may develop, not just with other people, but with the living world. For example, Australian magpies are often our companions at the garden, particularly if turning over soil-they find food for lunch or tea for themselves and their children.

Individual wellbeing and societal wellbeing are inextricably linked. Community gardens support this connection and place people in nature. It is possible to make spaces inclusive and accessible. Wicking beds and paved pathways, for example, can improve access for wheelchair users. Community gardens such as TOSCG highlight the importance of nature places and the many benefits they can bring for people, society and the other-than-humans.

Because people's relationships with the living world affects their behaviors towards it, taking part in community gardening can also help people, old and young, be environmentally conscious, and responsible. Community gardens connect people to nature and help towns and cities to move towards local, healthy, less expensive food with a reduced carbon footprint.

9. Eco-justice and Sustainable Communities

The term eco-justice is used in this paper as a form of justice that considers the rights of organisms and the natural environment in addition to those of human beings. Drawing on research and shared practices in science teacher education, Paige, Lloyd, and Smith (2016) [57] identified several principles that underpin eco-justice education:

- *Listen, learn and challenge* worldviews and behaviors.
- Develop a *community of learners:* with knowing and valuing with compassion naturaland human systems (the cultural commons) in the geosphere and biosphere, and elements of the noosphere supportive of natural systems.
- *Engage* collaboratively towards creating socially and ecologically just and sustainablecommunities.

- Develop as *role models* who value the commons (including Indigenous perspectives),partnerships, quality of life, and material adequacy.
- Foster *eco-social wisdom*—ways of thinking, feeling and acting within places whichthey inhabit.
- Develop respect for long-term thinking through historical and *futures* studies.
- Provide opportunities for *critical reflection on student learning*.
- Prioritise *culturally responsive* pedagogies and Indigenous perspectives

The principles focus on enhancing socially and ecologically just communities, include challenging assumptions around growth and development, valuing natural and human systems, promoting knowing our place, developing a respect for long-term (futures) thinking,being culturally responsive, and taking an activist role. All of these principles are equally relevant to providing a framework for this project. These principles have also formed the basis of our planning for courses with undergraduate teacher education students, and provide direction for planning student activities at the TOSCG and at school.

These principles combine with the objectives of TOSCG to provide a focus for further planning and introducing new members-unpacking the principles can become valuable conversation starters at garden meetings and in schools with support from the literature. These discussions can help advance the sustainability aims we started out with in this article.

Bowers (2009) [65] points out that "while many indigenous cultures have understood for hundredsof years the need to adapt cultural practices to what is sustainable over the long term, it has only been in the last thirty or so years that the exploitation of the environment has become theconcern …" (p. 114). Community gardens can create conversations of hope and action through such activities.

In Table 2, we invoke eco-justice principles and align them with practical examples and actions in can be enacted in the community garden and teacher education curriculum.

Table 2: Practical Examples for Community Gardens and Education.

Eco-justice principles	Examples of practice and action	
	Community garden	Education
Listening, learning and challenging current world view values and behaviours.	Locally grown food Planting and managing native flora Empathising with and loving native flora and fauna Friendships with people and environment Living locally when possible	Reducing ecological footprint (water, energy, food, clothing, etc). Reducing waste. Studying and supporting native Australian bees. Re-attaching humans to Earth.
Develop a community of learners with a disposition to value with compassion natural and human systems (the cultural commons) in the geosphere and biosphere, and elements of the noosphere supportive of natural systems.	Undertaking physical exercise Learning and teaching gardening with the young, the older, and the old	Active in the interests of all Earth citizens, humans and other-than-humans Looking after local environments such as wetlands and river systems. Boundary crossing, e.g. school and community collaboration on community gardens and local native environments
Engage collaboratively towards creating socially and ecologically just and sustainable communities.	Sharing food with those in need Protecting natural places, plants and animals	Place-based experiences such as volunteering for 'Trees for Life' Environmental pledges
	Sharing grown food with neighbours	Inclusive of all aspects of knowing, feeling and doing
Develop students as role models who value the commons, partnerships,– quality of life, creativity, and material adequacy.	Schooling at the community garden – environmental behavior, growing and harvesting and cooking self-grown food	Observational drawing, environmental sculptures. Visiting/taking part in environmentally connected businesses/institutions.
		Managing school and community recycling.
		Activist role
		Application of learning as members of community, charity and environmental groups

Foster eco-social wisdom— ways of thinking, feeling and acting within places which they inhabit.	Connecting to the animals and natural and grown plants. Understanding and appreciate the needs of plant, and animals – the ecology	Citizen science projects. Spending time in the natural world with humans and other- than-humans Rewilding: using senses Guerrilla gardening
Develop respect for long- term rather than short-term thinking through historical and futures studies.	Take to heart the history of the land and its human past and develop utopic scenarios for its future	Historical studies of the places we live Futures scenarios to explore possible, probable and preferred futures Transdisciplinary learning and acting
Provide opportunities for critical reflection	Evaluate the season's successes and failures and plan for the next season	Slow pedagogy Planning, enacting and engaging knowledges, including Indigenous narratives
Prioritise culturally responsive pedagogies and Indigenous perspectives.	Decide on at least one method of improving growing conditions and one different or variant vegetable to grow next season	Plan for a long-term view of building relationships and trust with communities, allowing Indigenous communities and Elders to share their knowledge and narratives of local histories and environments on their own terms Learning in local places

The examples show how educators and community members can provide experiences criticalfor connecting children to the natural world, such as connecting to animals, growing plants, harvesting, and cooking self-grown food. The experiences build on how we currently understand humans should be thinking and acting in order to bring about sustainable futures. This is an evolving set of understandings and actions that will very likely change as we shift towards living more in harmony with Earth.

Developing desired futures images, working with eco-justice principles, and enacting them ensures sustainable environments. Psychological/cultural and material/natural-social systems are integrated in such future visions and plans. Integral wellbeing and sustainability are intimately connected in this process. Futures planning requires:

- Connecting to place and nature
- Respecting Earth's boundaries and
- Caring for country with the assistance of new understandings and the wisdom of thepast.

Paul Raskin (2002, p. ix) [66] argues that "by developing students' understanding of community gardens and futures scenario writing they will be able to plan for sustainable futures and work towards them. They are described as a work of analysis, imagination and engagement. As analysis, it describes the historic roots, current dynamics, and future perils of world development. As imagination, it offers narrative accounts of alternative long-range global scenarios, and considers their implications. As engagement, it aims to advance one of these scenarios ... by identifying strategies, agents for change and values for a new global agenda. (p. ix)

10. Conclusion

We have attempted to illustrate in this paper that science learning is best done when studiedas part of a transdisciplinary curriculum. We argue that transdisciplinary learning is more likely to enable us to live in harmony with a whole Earth system and that, as pointed out by Schwartz and Snoek (2003) [43]:

- Humans are in a better place with the opportunity to gain experience from pandemics,
- Reflections on the impact of futures thinking and its place in environmental science education can create futures thinkers and actors
- Humans can create a world worth living in for their grandchildren

The educative focus provides a vehicle for students to connect science learning to theirpersonal, community and their future professional lives.

In present times community gardens are becoming valued as food growing places connected to the challenges of over population, over consumption, climate change, and degradation of soils. This possible or likely future time has been well documented (Assadourian and Mastny,2017) [67]. Fortunately, student interest in food production and, "training has begun to foster the ability of researchers to embed quantitative analysis within a wider sociopolitical and economic context [68].

Community gardens, and in our case TOSCG, can become part of the solution of transitioning to a low energy economy that can adapt to, and assist in the mitigation of, climate change and other challenges such as over-population, environmental degradation, adequate quality food, ozone depletion and social inequality [69-72].

There are so many positives gained through community gardens that their popularity is likelyto rise as we learn how to live more locally. There are challenges such as suitable sites in towns and cities, but as one of us discovered, in times of need such as the Second World Wars, suitable places for community gardens can be found. We suggest that they are necessary for sustainable and flourishing communities. The many benefits of community gardens include:

- Workshops that ensure our continuous learning for sustainable futures, for examplebuilding wicking beds to reduce water use; native bee workshop [71,73].
- Supporting inner wellbeing
- Connecting to community and its culture
- Living a life in harmony with the natural world

Developing knowledge about indigenous plants that support local species (https://greenleafcommunities.org/the-many-benefits-of-community-gardens/)

The vision is to develop a sustainable community with leadership coming from today's well- informed students. We hope this vision will include local food growing at TOSCG, as well ashome gardens and new community gardens. The broader vision is long term: to support the transition of the community to a low carbon, self-managing and steady state economy within vibrant, resilient and sustainable Adelaide Hills communities and a 1000-year future. This vision cannot come about unless there is a change in understanding of a stable Earth and behaviours that connects us to place. For such a transition, education from birth and schools and community gardens, such as Stirling East Primary School, and The Old School Community Garden, have a central role to play.

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