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Article

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Establishing and researching school gardens in Oman as a resource for improving education and health outcomes

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Abstract: Like many other countries where the standard of living is rising, the Sultanate of Oman is facing a potentially serious increase in what are now termed ‘lifestyle’ diseases. These include diabetes, heart disease, hypertension and various forms of cancer. The lifestyle factors that contribute to these diseases are poor diet and limited exercise. A school gardening project being implemented in Oman is intended to improve educational outcomes across the curriculum in the short term but also dietary outcomes in the longer term. If successful the project will be expanded to a much larger number of schools in Oman. In a country that imports much of its fruit and vegetables there are also potential, long-term economic benefits in encouraging the local production of these food items. This article reports on the rationale behind this project and its overall conceptualization and design. The project is funded through the Oman Research Council.

Keywords: *Oman, school gardening, ‘lifestyle’ diseases, curriculum, quasi-experimental design, imports*

JEL codes: *I15*

1. Introduction and context

This article reports on the conceptualization of a project designed to introduce school gardens to the Sultanate of Oman and research the efficacy of these gardens as teaching and learning resources across the curriculum. While the project is still in its infancy, the goal of this article is to inform readers of its significance, aims, intended outcomes and overall design. The project

may act as model for countries with similar climatic conditions and heavy dependence on imports of fruit and vegetables. The context of the research project is the Sultanate of Oman, one of the Gulf Co-operation Countries. It is surrounded by three Arab countries: the United Arab Emirates, Yemen, and Saudi Arabia. The population is almost 4.3 million, of which around 1.6 million are expatriates, mainly from South Asia (India, Pakistan, and Bangladesh). The Omani government has a long-term vision to move the country's economy from one that is highly dependent on oil and gas to one that is more diverse, with tourism as a key contributor.

2. Significance of the Research

There is a growing body of evidence that school gardens can lead to excellent education and health benefits once they have been established in schools. This in turn has the potential for long-term economic benefits. According to Desmond, Grieshop and Subramaniam (2002), who conducted a major international review of school gardening projects for the United Nations, 'garden based learning has the potential to enrich basic education in all cultural settings' (p. 9). They reported that garden-based learning can contribute to education in any society in several ways. Academic performance, ecological literacy, school environment and culture, community linkages, nutrition and health, and vocational education can all be impacted positively. They also observed that gardening projects contribute to a greater appreciation for the environment and concern for human impact on the environment.

In another major report for the Royal Horticultural Society in the United Kingdom, Passy, Morris and Reed (2011) listed a number of key outcomes from students involved in school gardening projects. These included:

- Greater scientific knowledge and understanding.
- Enhanced literacy and numeracy, including the use of a wider vocabulary.
- Increased awareness of food production.
- Increased confidence, resilience and self-esteem.
- Development of physical skills including fine motor skills.
- Development of a sense of responsibility.
- A positive attitude to healthy food choices.
- Positive behaviour.

- Improvements in emotional well-being.

The Royal Horticultural Society now runs a campaign in the UK to encourage schools to establish gardens, which they support with a series of resources. Furthermore, they have established four demonstration centres within the UK where school children can visit and learn about gardening and healthy eating with the assistance of on-site education officers (<http://www.rhs.org.uk/Children/For-schools/School-visits>).

One particularly encouraging outcome of this study was that schools reported that children were willing to try new vegetables as part of their diet. This was believed to be because the students were involved in growing the plants and often cooking them. Given that there is clear evidence that inadequate vegetable and fruit intake is associated with higher risk of a range of chronic diseases, including heart disease, obesity and some forms of cancer (Block, Patterson and Subar, 1992), and it is well established that early intervention is an integral step in the prevention of such diseases (Caballero, 2001), with major international initiatives focusing on enhancing vegetable and fruit intake in children (Anderson et. al., 2005), this outcome from school gardening represents a potential major health benefit.

These potential health benefits are of particular significance to Oman. Since 1970, modernization has reached into all corners of life in the Sultanate of Oman. A well-treated water supply and a well-designed sewage system are being built to minimize water-borne diseases. However, in the last 10 years, there has been a rapid increase in what are termed “lifestyle diseases,” such as heart disease, high blood pressure, and diabetes (Ambusaidi and Al-Balushi, 2012). Certainly, Al-Moosa, Allin Jemai, Al-Lawiti and Mossialos (2006), report a high prevalence of diabetes and associated coronary risk factors particularly in urban Oman. Given the relatively young population in Oman these authors believe that there is likely to be an escalation in prevalence of diabetes and other chronic diseases. Furthermore, they believe that dietary patterns will be a key factor in reducing this potential health threat. This work supports the findings of an earlier study by Al Riyamai and Afifi (2003) who found metabolic cardiovascular syndrome to be a significant public health problem in Oman.

According to a recent article in Times of Oman, this trend of increasing childhood obesity is causing concern amongst Omani parents. Some are now urging some schools to remove ‘junk food’ from their menus and encourage children to eat a more balanced diet (Al Shaibany, 2011).

Establishing school gardens in which children produce their own vegetables would assist in this endeavour and parents could be encouraged to become involved.

Clearly there are potential education and health benefits to Oman if schools establish gardens as learning resources. However, there may also be longer-term economic benefits as well. The Omani government has paid great attention to agriculture, since His Majesty Sultan Qaboos bin Said came to power in the country in 1970. The Ministry of Agriculture and Fisheries was established to develop the agriculture in the country and provide support to the Omani farms. Such support includes supplying them with seedlings, fertilizers and pesticides, and provided them with tillage and harvesting machines for wheat and barley harvesting. Furthermore, the ministry supplies the Omani farmers with modern irrigation machines. However, although the Omani Government gives considerable support to the agricultural sector, there is reluctance on the part of Omani youth to engage in the agricultural sector, which is dominated by expatriate workers. For example, according the agricultural census conducted in 2004/2005, the percentage of expatriate workers was 25.1% of the agricultural workforce. This increased to 32% in the 2012/2013 census (Ministry of Agriculture and Fisheries, 2014). This situation may ultimately have a negative effect the agricultural sector and the county's long-term economic development.

The government's economic development policy emphasizes the expansion of such non-oil sectors as agriculture, fishing, industry, and mining in its bid to diversify the economy and diminish its dependence on oil exports (US Department of State, 2014). The goal is to establish a sustainable economic base in preparation for the time when hydrocarbon reserves are depleted. Increasing domestic fruit and vegetable production would help achieve this goal as at present Oman imports about 50% of its vegetables. This is particularly true as the value of food imports by the Sultanate is projected to surge 128 per cent to \$4.8 billion by 2020 (Oman Daily Observer, 2011). If students learn how to produce their own fruit and vegetables for domestic consumption, albeit on a small scale, this can potentially help reduce Oman's dependence on imported food.

The project will constitute a preliminary study for Oman. Oman has a very dry climate and in certain areas quite poor soil. However, if necessary, school gardens can be established by composting waste vegetable matter to produce green manure that will enrich the soil. This planting media can be used in large containers for gardening with minimal maintenance and water use. This means that almost any school in the country should be able to establish a garden as a teaching and learning resource. This project will address the following research questions:

- (1) What science, environmental and health learning outcomes can be achieved using school gardens in the context of Oman climatic and social conditions?
- (2) What impact will a school gardening project have on teachers' and students' attitudes toward growing their own food?
- (3) To what extent do school gardens encourage students to incorporate new vegetables in their diet?

3. Literature review

According to Marturano (1999) the philosophical roots of garden-based learning advocate every child having access to a garden in which they are encouraged to use all their senses to study plants in increasing detail and value plants in the history of mankind. The value of gardening was recognised over a century ago, as records show that school gardens have been used since the 1800s. Fredrick Froebel founded and designed the first kindergarten in 1840 in order to teach through gardening (Bowker and Tearle, 2007). Furthermore, as early as 1909, Montessori identified that children's gardens could be used beyond the standard curriculum to help to develop patience, enhance moral education, increase responsibility and improve appreciation for nature and develop relationship skills (Montessori, 1964).

School gardens are a non-classroom based initiatives and a key source of experiential learning (Crisp, Swerrissen and Duckett, 2000). They can be used to teach core academic subjects such as science, language, arts, maths and even nutrition by incorporating a hands-on learning environment (Morris, Briggs and Zidenberg-Cher, 2002). They have been documented as having a positive influence on children's food choices by improving preferences for fruit and vegetables, increasing nutrition knowledge and fruit and vegetable consumption (Lavin, Shapiron and Weil, 1992). However, realistically, integrating school gardens into the curriculum also requires time, energy, funding and effort. It also requires student and staff support, especially from the school principal (Hawe and Shiell, 2000).

School gardens are considered to be a flexible teaching tool that can be shaped by styles and goals of individual teachers. Teachers are not required to have knowledge of, or experience in, gardening as this can be acquired (Graham, Beall, Lussier, Mclaughlin and Zidenberg-Cher, 2005).

Ozer (2007) has conducted a review of the research into school garden programs in the United States and reported that such programs varied widely in scope, intensity of participation and integration into the regular school curricula even within the same district. Some programs included a wide expanse of planting, while others consisted of a small number of above-ground planter boxes. She noted that the most successful garden programs developed a broad base of support among teachers and administrators at the school site as well as amongst parents and community volunteers. As well as increased nutrition, science learning and environmental awareness, Ozer noted that school garden coordinators reported positive impacts on the school culture including a sense of pride in the school and an increased sense of ownership by students. Overall, from her review, Ozer concluded that there were multiple pathways by which school garden programs could potentially strengthen the healthy development of students (e.g. nutritional intake, academic engagement and achievement and the sense of connection to the school) while strengthening qualities of the school and the relationship of the school to family and broader community.

Morgan, Warren, Lubans, Saunders, Quick and Collin (2010) argue that school gardens have emerged as innovative and potentially engaging to improve vegetable intake amongst children as they increase students' exposure to vegetables, which may positively impact on attitudes, preferences and eating behaviours. They believe that garden-based experiences provide a context for understanding seasonality, add a sensory domain to learning and foster a better understanding of how the natural world is sustained and where food comes from. Furthermore, school gardens provide an opportunity to teach life skills such as gardening, cooking, working cooperatively on real tasks and they involve students in planting, harvesting and food preparation.

The same authors conducted a quasi-experimental study involving two primary schools in Australia. They found that students who experienced garden-enhanced education were generally more willing to taste vegetables and eat them as snacks. These findings were consistent with those of Knai et al. (2006) and Lineberger and Zajicek (2000) who claimed that gardening-enhanced education could positively influence vegetable preference at crucial life stage when lifelong eating habits are being formed.

For some time, there has also been evidence that school gardening projects can improve academic performance across a range of curricular areas. In 1992, Sheffield used standardized

testing to demonstrate that an experimental group of gardening students outperformed a control group of non-gardening students in mathematics and literacy. More recently, Passey, Morris and Reed (2011) reported teachers in their study of school garden projects undertaken in the UK were able to identify specific cognitive outcomes across a number of contexts. They identified cases in which, through garden-related activities, children were able to demonstrate improved understandings of science concepts including taxonomy, habitats and life cycles and scientific skills including devising experiments as well as improved scientific language. Furthermore, mathematical skills such as measurement, estimation and the use of graphs also improved.

In a cross-national study of school gardening projects that involved 67 schools in England, Kenya and India, Bowker and Teale (2007) were able to demonstrate these projects had a positive impact on curriculum learning. In particular, children developed an improved understanding of aspects of weather and climate, conservation, fruit and vegetables and flowering plants and trees.

School gardens have also been demonstrated to improve self-confidence and self-esteem particularly amongst underachieving students (Sheffield, 1992; Hoffman, Trepagnier, Cruz and Thompson, 2004). Smith and Aldous (1994) explored the therapeutic associations of horticulture, and found that gardening resulted in students with learning disabilities feeling more valued as individuals. Clarke (1997) found that the gardening experience was useful in helping children to learn responsibility. He noted that, in caring for plants, children must be responsible for and respond to a living thing; gardening is one of the few situations in which children are guided in this affective style of learning. A further study of children in the USA participating in a school gardening program indicated that they developed better interpersonal skills and attitudes toward schools (Waliczek, Bradley and Zajicek, 2001).

Viola (2006) introduced school garden programs to two remote Indigenous (Aboriginal) communities in Australia. These communities traditionally suffer from extremely poor nutrition and associated health problems because of their remote locations. After the six-month intervention, Viola found that the project had become a major focus for teaching, to the extent that almost every lesson was tied into the theme of the school garden and nutrition. Furthermore, the two schools involved in the project began to incorporate healthier food choices into their menus as a result of the project.

There has been very little work conducted with school garden projects in the Gulf and Middle East Regions and none specifically in Oman. However, Elzaanen (2010) did conduct an intervention with a garden based science unit using a quazi-experimental design in Gaza. The intervention involved 125 grade 7 students and the findings, based on pre and post testing, indicated the superiority of the experimental groups in both of science achievement, and understanding of science processes.

4. Theoretical Considerations

Although the research on the impact on school garden projects is not exhaustive, there is sufficient evidence from across a range of different contexts to suggest that, if properly supported, garden projects can improve learning outcomes, and potentially longer term health benefits. Furthermore, if effectively implemented they appear to offer other benefits such as, increased self-esteem for underachieving students and improved interpersonal skills. The project outlined in this article has been designed to determine if well-designed gardening projects can impact education positively in Oman.

Learning is inextricably related to the social setting and this need not be a classroom, where students actively participate and create new meanings (Biggs, 1999; Falk and Dierking, 2000; Goodrum 2007; Preston and Rooy, 2007). This suggests that students may enjoy learning more when engaged in socially mediated learning activities where they have choice and some control over their learning (Griffin, 2004; Scott, 1998). Consistent with this, Falk and Dierking (2000) and Paris (1997) say that student's value autonomy and independence of learning, and this may be easier to achieve in less formal environment such as school gardens. This is because the type of learning that occurs out of the classroom is different from formal classroom learning. Rauschenbach et al. (2004) speaks of learning outside the classroom, as learning "which is generally voluntary and features affordance" (p. 29). This affordance occurs because of the extent of social interactions, which assist learning. Hence visits to places such as science centres, museums and zoos collectively allows for non-formal learning which stimulates social interactions and the social construction of knowledge (Coll, Gilbert, Pilot and Streller, 2013; Tofield, Coll, Vyle and Bolstad, 2003).

Students' learning in out of class settings is an excellent way to enrich students' learning experiences, motivate them to learn science, encourage lifelong learning and also expose them to future careers (Tal, 2012; Bamberger and Tal, 2007). Since these informal settings are idiosyncratic, learning occurring at these sites depends on the students' personal and social context in which learning takes place.

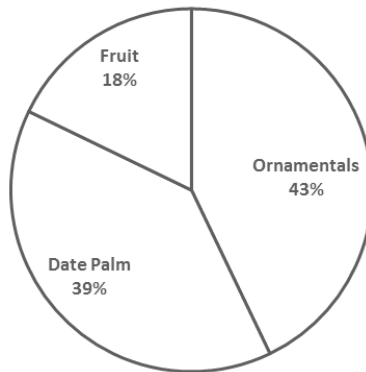
The literature also suggests that personal identities are influenced during out of class activities, through 'learning talk'. Griffin (2007) along with Leinhardt and Gregg (2002) say that this 'learning talk' can comprise up to 89% of the total time spent in student conversations in setting such as school gardens. In support of this, many studies suggest that students value autonomy and independence with their learning at out of class settings because they have the opportunity to investigate their topic as well as become accustomed to new learning contexts. It seems that students viewed their learning at out of the classroom as entwined with the social environment, and studying in small groups provides an optimal context for sharing information and finding answers to complex issues (Falk and Dierking, 2000; Paris, 1997). According to Griffin (2004) students enjoy learning and engaging in socially mediated learning environments where they have both choice and control of what they are doing. Bamberger and Tal (2005) explained this perspective, and report that even limited choice helps students to develop natural curiosity with substantial engagement and sound learning outcomes.

The literature suggests that non-formal learning employs a variety of methods for providing instruction and enables choice in learning. Useful learning may occur in unexpected places involving non-formal learning processes. The type of learning that occurs out of the classroom can be conceptualized through the social constructivist lens and socio cultural theories of learning. These learning theories focus our attention on the social processes operating in these out of class settings where students construct their knowledge through collaborative learning. Lave and Wenger (1991) view learning as social practices rather than just cognitive processes, and Rogoff sees learning as occurring through participation (Rogoff, 1991, 1995). These sociocultural perspectives consider learning as a situated activity occurring through participation, as distributed cognition, and as mediated action and out of class settings provide opportunities for such learning practices.

5. Project design and methods

A preliminary survey of 13 schools with an average student class number of 31 and average 717 students per school showed that five of them (38%) had gardens in the past but none had a current working school garden. Date palms and ornamental plants were the most common plants on premises of these schools along with a few other fruit trees (Figure 1). Most schools cited financial issues and labor availability as reasons for not having school gardens. However, all schools showed an interest in having school gardens reinstated and were willing to make the necessary changes to their schedules to carry out teaching activities in the school garden.

Figure 1. Types of plants grown at 13 schools in three governorates in Oman



Source: authors' own research.

This project will act as a preliminary study for using school gardens as a teaching and learning resource in Oman. Schools in three geographical regions are being used in the study, these regions include including Muscat, Batinah, and Wadi Al-Waael. Six schools have been selected from Basic Education Schools grades 1-10 with two schools of grade 1-4 (these are mixed gender; male and female) and four schools of grade 5-10 (two male and two female.). Schools were chosen based on their willingness to participate in the project and presence of a teacher willing to oversee the management of the garden, preferably someone with some expertise in gardening. The project employs three research assistants, one in each directorate of education. The research assistants report to the principal investigators and advise on maintaining the schools gardens, provide advice on pedagogy and collect data from the project. The project involves a quasi-experimental design employing a mixed-methods methodology and runs in a series of phases described below:

Phase 1 – Pre-intervention data collection

Questionnaires have been developed for students, teachers and parents. These have been adapted from existing questionnaires employed by Block and Johnson (2009) in their evaluation of the Stephanie Alexander Kitchen Garden Program in Australia. These instruments will be used to determine how much knowledge these groups have about growing fruit and vegetables, the health benefits of including fruit and vegetables in one’s diet and the environmental and economic benefits of schools and home gardens. This data will be supplemented by interview data from a subset of the same participants. These data sources will allow for triangulation of the findings.

Figure 2. Children watering plants in a school in Oman



Source: authors’ own picture.

Phase 2 – Establishing the school gardens

In this phase, the researchers will work with each of the six selected schools to establish the gardens. Some schools may have grounds and soil suitable for establishing gardens directly, but where soil is poor, gardens will be established in raised beds. Compost bins will also be established in each school to provide an ongoing source of soil for each garden.

Figure 3. Children planting flowers in a school in Oman



Source: authors' own picture.

Phase 3 – Linking gardening to the curriculum

The researchers will work with teachers to develop a set of garden activities that link to the curriculum at the primary and secondary levels. This will involve conducting an in-depth analysis of the Omani primary and secondary curricula, and then adapting existing published activities to the Oman context and developing some new ones to match curricular outcomes. Activities will largely be linked to science, health and environmental education and where appropriate to life skills including how best to prepare the garden produce when cooking and preserving it. These

will be written to cover grades 5 – 10. Students and teachers will use the garden to study its ecology and learn about pest and beneficial organisms, nutrient cycling, soil composition and general plant husbandry.

There is considerable scope for linking school garden activities to the formal curriculum in Oman predominantly the science curriculum which also encompasses key aspects of environmental and health education (see Ambusaidi and Elzain, 2008; Ambusaidi and Al-Rabaani, 2009; Ambusaidi and Al-Balushi, 2012). For example, in Grade 6, the Life Skills Curriculum covers ‘Teenage Health’ including nutrition. While in Grade 5 the Science Curriculum explores ‘Human Body Systems’ including the digestive system.

The materials will be in draft form and will be modified on the basis of the research findings.

Phase 4 – The intervention

Following the establishment of the school gardens and the preliminary data collection, a six-month teaching intervention will take place at each of the six schools. During this period teachers will use the draft activities written in Phase 2. At each school specific teachers will be provided with initial intensive training in using the activities. As part of this training, the researchers will model some of the activities with the students and the teachers to allow teachers the opportunity to experience the garden as a learning resource from a learner’s perspective. Parents and other members of the local community will be invited to an open day at each participating school at which point the project will be explained in detail, including the nutritional and health benefits of growing and consuming their own vegetables and they will be given instructions on establishing small scale vegetable gardens in their own localities.

Phase 5 – Post-intervention data collection

Students, teachers and parents will complete the same questionnaire used in the pre-intervention data collection phase at the completion of the intervention. A series of post-intervention interviews will be undertaken with a subset of participants to help triangulate these.

Quasi-experimental design

Pre and post questionnaires will be compared along with pre- and post-interview responses to determine if knowledge about and attitudes to gardening, dietary and health issues have improved

as a result of the intervention, further validation will sought through the use of ‘comparison’ schools. Six equivalent schools will complete the pre and post questionnaire but without the gardening interventions. Data from this administration of the questionnaire will be compared statistically with those from the ‘experimental’ to determine the impact of the gardening intervention.

6. Book

A book of school gardening activities related to the curriculum covering both the primary and secondary years will be developed and published from project funds. This will also include information on establishing and maintaining a school garden and how to set one up in the home environment. It will also have information on interesting ways to prepare vegetables and fruit for eating. This will have relevance for other Gulf States.

7. Conclusion

This paper has outlined the conceptualization of a project in Oman and it is hoped that the information provided will benefit other educators and education systems interested in pursuing similar initiatives. The project is still in its early stages but participating schools are making excellent progress. Each participating school has identified a coordinator for their gardening project and the school gardens have been established using raised beds and shade cloth to allow the best growth conditions in the harsh climate. Curriculum materials are also being developed and the project has already drawn interest from the Ministry of Health and the Food and Agriculture Organisation in Oman. As the project progresses and generates data, the authors hope to provide more articles on its overall progress and effectiveness.

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***Zakładanie oraz badanie ogrodów szkolnych w Omanie
jako źródła poprawy edukacji i zdrowia***

Streszczenie

Jak wiele innych krajów, w których zaobserwować można rosnący standard życia, Sułtanat Omanu stoi w obliczu potencjalnie poważnego wzrostu zjawiska określanego mianem chorób „stylu życia”. Zalicza się do nich między innymi cukrzycę, choroby układu krążenia, nadciśnienie i różne formy raka. Główne czynniki stylu życia powodujące problemy zdrowotne to nieodpowiednia dieta oraz brak ruchu. Projekt ogrodnictwa szkolnego wdrożony w Omanie zakłada poprawę wyników edukacji w całym programie nauczania w krótkim okresie, ale też efekty dotyczące sposobu żywienia w długim. Jeśli projekt zakończy się sukcesem, zostanie rozszerzony na znacznie większą liczbę szkół w Omanie. Co więcej, w kraju importującym znaczną część konsumowanych owoców i warzyw mogą pojawić się potencjalne długoterminowe korzyści ekonomiczne dzięki wspieraniu lokalnej produkcji tych produktów żywnościowych. Artykuł omawia przesłanki projektu, jego ogólną koncepcję oraz założenia. Projekt został sfinansowany przez Radę Naukową Omanu.

Słowa kluczowe: Oman, ogrodnictwo szkolne, choroby „stylu życia”, program nauczania, quasi eksperymentalny projekt, import