

5-2017

Science Teachers' Views about Incorporating Socioscientific Issues in the Curriculum and Teaching in Al Ain Schools

Sara Samir El Arbid

Follow this and additional works at: https://scholarworks.uaeu.ac.ae/curriculum_theses

Part of the [Curriculum and Instruction Commons](#)

Recommended Citation

El Arbid, Sara Samir, "Science Teachers' Views about Incorporating Socioscientific Issues in the Curriculum and Teaching in Al Ain Schools" (2017). *Curriculum and Instruction Theses*. 2.
https://scholarworks.uaeu.ac.ae/curriculum_theses/2

This Thesis is brought to you for free and open access by the Curriculum and Instruction at Scholarworks@UAEU. It has been accepted for inclusion in Curriculum and Instruction Theses by an authorized administrator of Scholarworks@UAEU. For more information, please contact fadl.musa@uaeu.ac.ae.



United Arab Emirates University

College of Education

Department of Curriculum and Methods of Instruction

SCIENCE TEACHERS' VIEWS ABOUT INCORPORATING
SOCIOSCIENTIFIC ISSUES IN THE CURRICULUM AND
TEACHING IN AL AIN SCHOOLS

Sara Samir El Arbid

This thesis is submitted in partial fulfilment of the requirements for the degree of
Master of Education (Curriculum and Instruction)

Under the Supervision of Professor Hassan Tairab

May 2017

Declaration of Original Work

I, Sara Samir El Arbid, the undersigned, a graduate student at the United Arab Emirates University (UAEU), and the author of this thesis entitled “*Science Teachers’ Views About Incorporating Socioscientific Issues in the Curriculum and Teaching in Al Ain Schools*”, hereby, solemnly declare that this thesis is my own original research work that has been done and prepared by me under the supervision of Professor Hassan Tairab, in the College of Education at UAEU. This work has not been previously been presented or published, or formed the basis for the award of any academic degree, diploma or similar title at this or any other university. Any materials borrowed from other sources (whether published or unpublished) and relied upon or included in my thesis have been properly cited and acknowledged in accordance with appropriate academic conventions. I further declare that there is no potential conflict of interest with respect to the research, data collection, authorship, presentation and/or publication of this thesis.

Student’s Signature: _____



Date: _____

23/5/2017

Approval of the Master Thesis

This Master Thesis is approved by the following Examining Committee Members:

1) Advisor (Committee Chair): Professor Hassan Tairab

Title: Professor of Science Education

Department of Curriculum and Methods of Instruction

College of Education

Signature  Date 21/5/2017

2) Member: Dr. Qasim Alshannag

Title: Associate Professor

Department of Curriculum and Methods of Instruction

College of Education

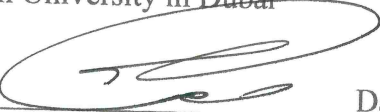
Signature  Date 25/5/2017

3) Member (External Examiner): Professor Sufian Forawi

Title: Professor

Coordinator of the Masters of Education Program

The British University in Dubai

Signature  Date 5/22/2017

This Master Thesis is accepted by:

Dean of the College of Education: Professor Bernard Oliver

Signature Bernard Oliver Date 23/5/2017

Dean of the College of Graduate Studies: Professor Nagi T. Wakim

Signature Nagi T. Wakim Date 8/6/2017

Declaration of Original Work

I, Sara Samir El Arbid, the undersigned, a graduate student at the United Arab Emirates University (UAEU), and the author of this thesis entitled “*Science Teachers’ Views About Incorporating Socioscientific Issues in the Curriculum and Teaching in Al Ain Schools*”, hereby, solemnly declare that this thesis is my own original research work that has been done and prepared by me under the supervision of Professor Hassan Tairab, in the College of Education at UAEU. This work has not been previously been presented or published, or formed the basis for the award of any academic degree, diploma or similar title at this or any other university. Any materials borrowed from other sources (whether published or unpublished) and relied upon or included in my thesis have been properly cited and acknowledged in accordance with appropriate academic conventions. I further declare that there is no potential conflict of interest with respect to the research, data collection, authorship, presentation and/or publication of this thesis.

Student’s Signature: _____ Date: _____

Copyright © 2017 Sara Samir El Arbid
All Rights Reserved

Abstract

The main aim of this thesis is to study the views of High School Science Teachers in Al Ain about the inclusion of Socio-Scientific Issues (SSIs) in the curriculum. The problem statement relies on addressing the gap in the literature when addressing the inclusion of SSIs especially in the UAE context. To address this gap, a survey was conducted amongst High School Science Teachers for a better understanding of their views. The study showed that Science Teachers (from the sample) agreed with the inclusion of SSIs into the curriculum. They also identified resources, teaching strategies and knowledge as the top three factors that facilitate the inclusion of SSIs into the curriculum. As for factors that impede inclusion, the science teachers identified teaching strategies for real classroom situations, maturity of students and the influence of SSIs on participation levels as the top three factors. It was also found that there was statistically significance differences between the views of the teachers based on their prior knowledge as measured by courses related to SSIs studied with regards to inclusion of SSIs into the curriculum and based on teachers who have undergone PD courses about SSIs against those who did not. There was a significance difference also between the views of the teachers that studied SSI courses or teachers that did not study SSI courses with regards to factors that facilitate inclusion of SSIs into the curriculum and the teachers who have undergone PD courses about SSIs and teachers who have not, (in favor of the former). There were also statistically significant differences between the views of teachers with regards to inclusion, factors that facilitate and impede the inclusion of SSIs into the curriculum based on their specializations (subject taught).

Keywords: Socio-scientific issues, science teachers views, science curriculum, UAE.

Title and Abstract (in Arabic)

آراء معلمي العلوم حول دمج القضايا الاجتماعية العلمية في المناهج والتدريس بمدارس العين

الملخص

هدفت الدراسة إلى استطلاع آراء معلمي العلوم في المرحلة الثانوية بمدينة العين حول دمج القضايا الاجتماعية العلمية في المناهج الدراسية، وتحددت المشكلة في معالجة الفجوة في البحوث السابقة حول موضوع دمج القضايا الاجتماعية العلمية في دولة الإمارات العربية المتحدة. من خلال إجراء دراسة استطلاعية لمعرفة آراء معلمي العلوم في مرحلة الثانوية. وأظهرت نتائج الدراسة أن المعلمين (عينة الدراسة) وافقوا على دمج القضايا الاجتماعية العلمية في المناهج الدراسية وحددوا الموارد واستراتيجيات التدريس والمعارف كأهم ثلاثة عوامل تسهل دمج القضايا الاجتماعية العلمية في المناهج الدراسية. أما بالنسبة للعوامل التي تعيق عملية الدمج، فقد حدد المعلمون استراتيجيات التدريس الفعلية في الفصول الدراسية، ونضج الطلاب وتأثير القضايا الاجتماعية العلمية على مستويات المشاركة كأهم ثلاثة عوامل. وأظهرت الدراسة أن هناك فروق ذات دلالة إحصائية بين آراء المعلمين ممن لديهم معرفة سابقة من خلال المناهج الدراسية لدراساتهم الجامعية بالقضايا الاجتماعية العلمية والمعلمين الذين خضعوا فقط لدورات في القضايا الاجتماعية العلمية لصالح الأول. وفيما يتعلق بالعوامل التي تيسر أو تعيق دمج القضايا الاجتماعية العلمية في المناهج الدراسية أظهرت النتائج فروق إحصائية على أساس تخصصاتهم (المادة التي تدرس).

مفاهيم البحث الرئيسية: القضايا الاجتماعية العلمية، مناهج العلوم، الإمارات العربية المتحدة، آراء معلمي العلوم.

Acknowledgements

I would like to express my gratitude to my thesis advisor, Professor Hassan Tairab, for his generous advice, inspiring guidance and encouragement throughout my work for this thesis. Thanks to his leadership and support I was enlightened throughout the whole process of learning. He showed me how to truly become an educator by always being a learner.

I would also like to thank the members of my committee, Dr. Qasim Alshannag and Professor Sufian Forawi, for their guidance, support and assistance throughout my preparation of this thesis. I would like to thank all the faculty members of the College of Education at the United Arab Emirates University for their valuable effort and dedication, which made me acknowledge the vitality of education.

Special thanks go to my husband and son for their patience and support throughout my journey. Thank you to my father, my sisters and brother for encouraging me to pursue my dreams. As for my mother, my inspiration, I was only able to make a step because of her. Thank you.

Dedication

To my beloved parents, husband and family. I hope I will always make you proud

Table of Contents

Title	i
Declaration of Original Work	ii
Copyright	iii
Approval of the Master Thesis	iv
Abstract	vi
Title and Abstract (in Arabic)	vii
Acknowledgements	viii
Dedication	ix
Table of Contents	x
List of Tables.....	xiii
List of Abbreviations.....	xiv
Chapter 1: Introduction	1
1.1 Background	1
1.2 Statement of the Problem	3
1.3 Purpose of the Study.....	4
1.4 Research Questions	5
1.5 Significance of the Study	5
1.6 Limitations and Delimitations	6
1.7 Definition of Terms	7
1.8 Summary	8
Chapter 2: Literature Review	9
2.1 Chapter Overview.....	9
2.2 Theoretical Framework	9
2.2.1 Socio-scientific Issues in the UAE	11
2.2.2 Incorporating SSIs in the Science Curriculum	13
2.2.3 SSIs in the Science Curricula of the UAE	15
2.2.4 Science in a Social Context	17
2.3 Studies Related to the Inclusion of SSIs	18
2.3.1 Science Teacher Views Studies	22
2.3.2 Factors that impede the inclusion of SSIs in the curriculum	27
2.3.3 The Application of SSIs in the Science Curriculum.....	28

2.4 SSIs in the UAE	30
2.5 Summary	33
Chapter 3: Methodology	34
3.1 Chapter Overview.....	34
3.2 Participants	34
3.3 Instrumentation.....	34
3.4 Instrument Validation Procedures	36
3.4.1 Validity	36
3.4.2 Reliability.....	36
3.5 Design.....	37
3.6 Procedures	38
3.7 Data Analysis	38
3.8 Summary	39
Chapter 4: Results	40
4.1 Chapter Overview.....	40
4.2 Domains of the Views of Teachers	40
4.3 Science Teachers Views of the Inclusion of SSIs in the Science Curricula... 41	
4.4 Science Teachers Views of the Factors that Facilitate Inclusion	43
4.5 Science Teachers Views of the Factors that Impede Inclusion	44
4.6 The Demographic Variables and Science Teachers' Perceptions of SSI..... 46	
4.6.1 The Impact of Teacher's Demographic Variables on the Views about Inclusion	46
4.6.2 The Impact of Teacher's Demographic Variables on the Views about Factors that Facilitate the Inclusion of SSIs into the Curriculum	47
4.6.3 The Impact of Science Teacher's Demographic Variables on the Views about Factors that Impede the Inclusion of SSIs into the Curriculum ..	48
4.7 The Impact of Science Teachers' Specialization (subject taught) on the Perception of SSIs	49
4.7.1 The Impact of Specialization (subjects taught) Variable on the Science Teachers' Views about Inclusion	49
4.7.2 The Impact of Subjects Taught Variable on the Factors that Facilitate Inclusion	51
4.7.3 The Impact of Subjects Taught Variable on the Factors that Impede Inclusion	53

4.8 Summary of Results	55
Chapter 5: Conclusion.....	57
5.1 Chapter Overview.....	57
5.2 Domains of the Views of Science Teachers	57
5.3 Science Teachers’ Views of the Inclusion of SSIs in the Curriculum	58
5.4 Science Teachers’ Views of the Factors that Facilitate Inclusion.....	60
5.5 Science Teachers’ Views of the Factors that Impede Inclusion.....	61
5.6 The Impact of Science Teachers’ Demographic Variables on the Perception of SSIs.....	62
5.6.1 The Impact of Science Teacher’s Demographic Variables on the Views about Inclusion	63
5.6.2 The Impact of Science Teacher’s Demographic Variables on the Views about Factors that Facilitate the Inclusion of SSIs into the Curriculum	64
5.6.3 The Impact of Science Teacher’s Demographic Variables on the Views about Factors that Impede the Inclusion of SSIs into the Curriculum ..	65
5.7 The Impact of Science Teachers’ Specialization (subject taught) on the Perception of SSIs	65
5.7.1 The Impact of Specialization (subjects taught) Variable on the Views about Inclusion	66
5.7.2 The impact of Subjects Taught Variable on the Factors that Facilitate Inclusion	67
5.7.3 The Impact of Subjects Taught Variable on the Factors that Impede Inclusion	68
5.8 Summary of Discussion.....	69
5.8.1 What are Al Ain Science Teachers’ Views of Inclusion of SSIs?.....	69
5.8.2 What are the Factors that Impede or Facilitate including SSIs in the Al Ain Secondary School Science Classrooms?	69
5.8.3 What is the Impact of Science Teachers’ Demographic Variables (gender, experience, type of school and background) on the Perception of SSIs?	69
5.9 Recommendations for Further Research	70
References	73
Appendix A – Survey.....	80
Appendix B – Abu Dhabi Educational Council Approval.....	88

List of Tables

Table 1: Descriptive statistics of the domains.....	41
Table 2: Teachers views of the inclusion of SSIs in the curriculum.....	42
Table 3: Science teachers' views of the factors that facilitate the inclusion of SSIs.	43
Table 4: Teachers views of the factors that impede inclusion into the curriculum ...	45
Table 5: The impact of science teachers' demographic variables on the views about inclusion	47
Table 6: The impact of science teachers' demographic variables on the views about factors that facilitate the inclusion of SSIs into the curriculum	48
Table 7: The impact of science teachers' demographic variables on the views about factors that impede the inclusion of SSIs into the curriculum	48
Table 8: Descriptive statistics of the subjects' variable and the domain of inclusion	50
Table 9: One-Way ANOVA of the subjects' variables with regards to inclusion	50
Table 10: Post-Hoc tests of the subjects' variables with regards to inclusion	51
Table 11: Descriptive statistics of the subjects' variable and the domain of factors that facilitate inclusion	51
Table 12: One-Way ANOVA of the subjects' variables with regards to factors that facilitate inclusion	52
Table 13: Post-Hoc tests of the subjects' variables with regards to factors that facilitate inclusion	52
Table 14: Descriptive statistics of the subjects' variable and the domain of factors that impede inclusion	53
Table 15: One-Way ANOVA of the subjects' variables with regards to factors that impede inclusion	53
Table 16: Post-Hoc tests of the subjects' variables with regards to factors that impede inclusion	54
Table 17: Descriptive statistics of the percentages teachers that had taken courses or professional development in each of the specializations	55

List of Abbreviations

M	Mean
SD	Standard Deviation
Sig.	Significance
SSI	Socio-Scientific Issues
Std. Error	Standard Error
UAE	United Arab Emirates

Chapter 1: Introduction

1.1 Background

Recently there is an increase in the advancement of science and the innovation of technology, which has affected in turn almost every aspect of the human development and activity. This increase has resulted in raising the awareness of a range of socio scientific issues. A call for raising ethical issues within science education fields is found in international literature (Berne, 2014). This call is based on the ever-growing field of scientific technology that is occurring around the world, and considerations of the application of these technologies are an important part of the process. The issues that surround and join both science and social context are called Socio-Scientific Issues (SSIs). They are issues that raise controversies within communities and include issues such as human cloning, genetically manufactured food, environmental pollution, radioactive waste disposal and many more (Lee, Abd-El-Khalick and Choi, 2006). It is necessary to study their impact on society and reflect on the connections between science, real - life applications and the quality of life within the community.

It is essential that SSIs are included in the school curricula and studied as early as in the school grades. The inclusion of SSIs in the science curricula allows students to develop their scientific reasoning, critical thinking skills, moral and ethical reasoning, bio-ethical decision making skills and scientific reasoning (Lee, Abd-El-Khalick and Choi, 2006; Kara, 2012; Gutierrez, 2014).

Inclusion of SSIs in school curricula is however tricky especially in certain countries that have more of a conservative nature for example Islamic countries, and even Christian factions within the western world. Science is usually conducted within

certain cultural contexts and influences the social, economic, political and religious circles within a community (Kara, 2012). Scientists' perceptions which include their assumptions, beliefs, values, biases, and training nature, influence what sort of problems they verify, what they observe and what answers they can produce. Hence scientists make value judgments (Lederman, Abd-El-Khalick, Bell and Schwartz, 2002). These issues are necessarily dealt with not only within the scientific knowledge, but they need moral reasoning and judgmental skills in students. Zeidler and Sadler (2008) use this argument to further support the inclusion of these issues in science curricula to give students these opportunities to develop such skills that in tandem develop scientific literacy.

Internationally, a number of research studies have been conducted to study the advantages of teaching SSIs in science curricula (Sadler, Barab and Scott, 2007). For example, Lee, Abde-El-Khalick and Choi (2006) found that Korean secondary science teachers perceived a need to address SSIs. However, only a few of these teachers were able to implement teaching or to discuss these SSIs. This is due mainly because of the lack of instructional time, unavailability of relevant resources and low personal science teaching efficacy (PSTE) beliefs.

As for the impact of introducing SSIs into the curriculum, in a study by Chin, Yang and Tuan (2015) indicated that when sixth grade students in central Taiwan were taught a global climate change issue and through argumentation strategies, they found that students had significant improvements in writing and associations among reading, and arguing to learn.

The United Arab Emirates (UAE) has yet to include controversial topics in its science curriculum in both private or public schools in the Emirate of Abu Dhabi.

The official religious views on SSIs are yet to be classified in Arab states and so impact the teaching of these issues (Dagher and BouJaoude, 2011). The failure to include SSIs in the curricula could result in limiting the students' knowledge about issues that are happening in the cutting edge technologies that are occurring all around the world. Students may lose an opportunity to develop their decision-making skills in bioethical issues and their formation of argumentation skills that are directly related to these issues.

Although this public acceptance / refusal of SSIs does have an indirect impact on teaching however, the willingness of science teachers to address subject matter, seems to have a direct impact on what and how SSIs are introduced into classrooms. Teachers are the primary source of education and their beliefs and views are very important on how students receive any materials. Hence, the present study aims to investigate science teachers' views of SSIs and of the inclusion of SSIs in the science curriculum in Al Ain. Also, it aims to investigate the factors that might influence science teachers' instructional practices that are related to teaching these issues.

1.2 Statement of the Problem

Science teachers often discuss issues related to the inclusion of SSIs in the curriculum in professional learning communities such as forums, workshops and conferences. In schools' nowadays, science teachers are expected to incorporate real-life applications when teaching any subject and specifically science; this serves as a motivational push towards incorporating SSIs in the curriculum to further link what the students are learning with what is happening around the world. However, given the controversial nature of some scientific topics, educators within the context of this

study are reluctant to integrate them into the science curricula. There is also a certain gap in the literature when addressing the inclusion of SSIs especially in the UAE context. How, when, and why these topics should be included remain an area of mystery due to the lack of information surrounding SSIs. Although personal beliefs can be regarded as an important factor in decision-making (Lederman, Abd-El-Khalick, Bell and Schwartz, 2002), the ability to fully discuss, reason and form decisions about SSIs depends on many factors that include skills, content knowledge and ethical reasoning. Hence, it is important that students within the UAE are subjected to SSIs to increase their scientific literacy, develop students' critical thinking skills, and develop bioethical decision making skills.

Although many studies conducted within the international context have studied the implementation and views of students and teachers regarding SSIs (Sadler, Barab & Scott, 2007); teachers are still not comfortable in implementing these teachings (Duschl, 2007 & Lee, Abd-El-Khalick and Choi, 2006). Lee, Abd-El-Khalick and Choi (2006) found that teachers perceived that lack of instructional time and the unavailability of relevant resources are the primary obstacles that stopped the implementation of SSI teachings in Korea. Mirroring these findings, it is found that personal views of educators that will deliver this curriculum, decide the coverage of SSIs in the classroom (Berkman, Pachecho & Plutzer, 2008).

1.3 Purpose of the Study

Given the scarcity of research and views about SSIs in the UAE, this study is intended to investigate science teachers' views of the inclusion of SSIs in the curriculum and explore factors that could facilitate and impede the inclusion of these issues in the school curriculum. Specifically, the purpose of the study is to study the

knowledge and views of Al Ain science teachers with regards to SSIs and study the factors that may affect the inclusion of SSIs in the curriculum. The study will attempt to explore:

- The views of the science teachers in this area with regards to the inclusion of SSIs.
- The study will examine the views of the science teachers in what factors may impede or facilitate their inclusion.
- The views will also be linked with some factors that may affect the views of the science teachers which are gender, experience and background.

1.4 Research Questions

The study aims to answer the following research questions:

- 1) What are the Al Ain science teachers' views of inclusion of SSIs?
- 2) What are the factors that facilitate or impede including SSIs in the Al Ain science secondary classrooms?
- 3) What is the impact of science teachers' demographic variables (gender, experience, and background) on their perceptions of SSIs?

1.5 Significance of the Study

Finding answers on how to integrate SSIs into the science curriculum so that it provides students with scientific literacy, decision-making skills and bioethical reasoning skills. Students' need to develop skills to think, discuss, and form decisions about SSIs. Students will in tandem develop critical thinking skills and ethical reasoning. Hence, it is important that students within the UAE are subjected

to SSIs to increase their scientific literacy, develop students' critical thinking skills, and develop bioethical decision making skills. This study will attempt to study the views of science teachers and act like a baseline for further studies in this region about incorporating SSIs in the curriculum and teaching. It will be beneficial to see the views of these teachers' especially in educational councils, curriculum developers and specifically by teachers and school leadership. The lack of any previous studies of the inclusion of SSIs in the UAE specifically and the gulf region in general gives a motive to study the views of the science teachers regarding the SSIs and the factors that may impede or facilitate their implementation in the curriculum. Furthermore, the expected findings may contribute to the knowledge base of including SSIs and input to the evidence based information within the context of this study.

1.6 Limitations and Delimitations

This study is designed to be exploratory in nature, in a sense it relies on the examination of science teachers' views of the SSIs. It is generally accepted that the nature of views in general is of human characteristics and can be regarded as a subjective notion which may limit the generalizability of the findings. Since the present study is to be conducted within a short time frame, this time frame of the study as well as the quantitative nature of the data collection may also limit the understanding of some of the issues that may not be revealed by quantitative data. The issue of time frame as well as the quantitative nature of data that included only a small sample will most likely decrease the generalization of the findings.

Delimitations

The scope of the study will only include high school science teachers in Al Ain schools which allows the researcher to narrow the factors and findings to this region and use this information in the region and with the Governmental council found in this area.

1.7 Definition of Terms

SSIs: Socio-Scientific Issues are controversial issues that exist at an intersection between science and the broader social context in which the products and processes of science are situated. These include topics like stem cell research, genetically modified foods, evolution, radioactive-waste disposal and climate change (Kara, 2012).

Bioethical issues: Issues that encompass environmental ethics and the social and ethical dimensions of biological and biomedical science and of medicine. (Bryant and La Velle, 2003).

Personal Science Teaching Efficacy (PTSE): The perceptions of science teachers, belief and confidence towards teaching a science unit. (Lee, Abd-El-Khalick, & Choi, K. 2006).

Teacher Views: The teachers' ways of regarding, understanding, or interpreting a certain topic.

SSIs inclusion: The explicit inclusion of Socio-Scientific Issues into the science curriculum.

1.8 Summary

SSIs are controversial issues that are yet to be included in the curriculum of the United Arab Emirates. In countries that have already applied them as part of the education of high school students, they were found to develop critical thinking skills, bioethical decision making skills and scientific literacy. All in all, this study attempts to investigate the views of science teachers about Socio-scientific inclusion in the curriculum. This is done by investigating the awareness of the topic amongst science teachers and the views about including the topic in the curriculum and teaching. This investigation would serve as a baseline to build upon in later testing when applying these controversial topics into the curriculum and teaching in the UAE as it was found that there is a gap in the literature of teaching SSIs in the Gulf region. Although the limitations encompass subjectivity among perceptions and views of science teachers, generalizability, and time management, this study can be an important first step towards introducing SSIs among schools in the UAE.

Chapter 2: Literature Review

2.1 Chapter Overview

This chapter reviews and discusses previous research findings related to the socio-scientific issues that are related to the purpose of this study. The chapter presents the theoretical framework based on scientific literacy by providing the vision linked to Scientific Literacy. It also provides an explanation of the importance of socio-scientific issues in the UAE and the gap in the literature surrounding it. This chapter places science in a social context by providing a history of previous studies surrounding it. The chapter further elaborates the studies that explored the inclusion of SSIs and science teacher perceptions of this inclusion.

2.2 Theoretical Framework

Science Education has been aiming, promoting and discussing “scientific literacy” increasingly. This phrase represents what is expected of students to know and what to do with this information as a basis for their science learning experiences. In the *Handbook of Research in Science Education*, Roberts (2007) argues that although no consensus has been reached about scientific Literacy (SL) there are two visions in the categorization of SL. For this study, it is important that Vision II is enunciated. Vision II envisions SL as the literacy (through knowledge ability) of science-related situations that students encounter as ‘citizens’. Roberts also describes a scientific literate person as someone who is able to link science and technology to real life, discuss and make decisions about issues that involve science and the society as a whole. The real-life situations are influenced by many disciplines that include social, political, economical and ethical issues. To cross link these issues with science in

education, it is essential that they are included in the curriculum and explored at what boundary they should be considered.

According to the SEE-SEP model that was introduced by Chang Rundgren and Rundgren in 2010, there are 6 main dimensions that are needed to be considered in the process of informal reasoning and argumentation about SSIs. These are Sociology/Culture, Environment, Economy, Science, Ethics and Policy (Rundgren & Rundgren, 2010). With regards to sociology, students should comprehend the importance of their SSI decisions as future leaders of the society. As for environmental, SSIs are linked to numerous topics like climate change, global warming and genetically modified organisms. Also, one of the competencies in the UAE framework which is based on Abu Dhabi Economic Vision 2030 is environment and global awareness. Students should also understand that as future leaders their decisions about the environment impact on the world. In the economy aspect, students need to consider different scenarios that impact countries. For example, in a country that uses pesticides including DDT to kill mosquitoes but saves lives due to it being a poor country is to be evaluated differently than a rich country that can find alternatives other than DDT (promoting sustainability) which impacts the environment. The science aspect, is crosslinking science and the real world for students. Giving students real life applications in the scientific disciplines for example athletes chemical doping allows them to apply what they are learning and make informed arguments to their daily life. The ethical reasoning aspect is a skill that students can develop using SSIs. Students can make decisions together within the social aspect based on being informed about these topics. An example is human cloning, which is a controversial topic in religions however it is currently being used in human organs and hence, impacting the society. Students' subjected to

such topics can enhance their ethical reasoning. This also directly impacts policy making, as future leaders and government officials and knowing the above-mentioned examples, students need to be knowledgeable about why policies and laws are in place. They should also know how they are impacting the society around them.

An example of this interdisciplinary approach to teach SSIs is introduced by Rundgren as the 'post-it' strategy where teachers engage students and promote their understanding of the multi-dimensional aspect of SSIs and informal argumentation skills (Rundgren, 2011).

2.2.1 Socio-scientific Issues in the UAE

The United Arab Emirates, throughout the years, has strived for a world-class quality of education among their citizens. This is to prepare them for a more diversified knowledge-based economy that the country aims to achieve. Aside from investing heavily in the educational system within the country, the UAE government also sends students abroad to equip them with the latest and world-class education that could be useful in UAE's futuristic vision. In the light of this educational reform in UAE, it is imperative that Socio-Scientific Issues are integrated into the country's educational curriculum. The UAE has also introduced competencies derived from the 21st century skills. This framework is based on the Abu Dhabi economic vision 2030 and enunciates problem solving, critical thinking and global and environmental awareness. The framework targets K to 12 students to enhance these skills for students. A strategy of incorporating SSIs into the curriculum may help in enhancing these skills. For example, in the UAE context, genetically modified fruits and vegetables are currently being used in grocery shops. Students must be aware of

these usages and how they are impacting the society and the economy. Socio-scientific issues are an intersection between science and the broader social context where the products of science are found (Kara, 2012). Science is believed to be influenced by social, economic, political, religious and moral aspects (Edge, 1986). The inclusion of SSIs into the context of the science learning, addresses ethics in the science classroom which develops teachers' and students' ethical sensitivities. It is also found that discussing ethics in the context of SSI is believed to improve students' moral and ethical judgments (Kara, 2012). Hence, it is essential to discuss the inclusion of SSIs into the teaching and learning of students. SSIs could help students in confronting the daily issues relating to science that are considered significant in day to day activities. The call by science teachers for scientifically proficient citizenship is unmistakable (Driver, Newton and Osborne 2000; Hodson 2003; Zeidler and Keefer 2003). As the twenty-first century moves on, numerous nations have perceived the significance of a dream of exploratory proficiency in science instruction that includes a familiarity with a good and moral improvement of students. The importance of the expression "experimental proficiency" is generally talked about (Hand, Alvermann, Guzzetli, Norris and Phillips 2003; Roberts 2007), yet is seen as a vehicle that empowers people to have adequate consciousness of science and its procedures to have the capacity to bargain ably and unhesitatingly with science-related matters in today's reality. Goodrum, Hackling and Rennie (2001), in their audit of universal patterns of science instruction, reasoned that logical proficiency ought to be a point of school science training. The authors suggested the following characteristics of helping students (as referred to in Rennie 2005):

...to be occupied with, and comprehend their general surroundings; to participate in the talks of and about science; to be wary and addressing of cases made by others about logical matters; to have the capacity to distinguish inquiries, research and draw evidence-based conclusion; and to settle on educated choices about nature and their own wellbeing and prosperity (Goodrum, Hackling and Rennie 2001, p.10-11).

2.2.2 Incorporating SSIs in the Science Curriculum

Despite the fact, there are diverse accentuations in definitions for experimental education, they are steady in that they concentrate on science training for future subjects, not merely future science experts. For the case, Zeidler (1997) and Zeidler and Keefer (2003) proposed that, keeping in mind the end goal to accomplish experimental education, socio-scientific issues (SSI) should have been incorporated into educational science modules. Joining socio-scientific issues, especially ones that are locally dubious, in science projects is not by any means the only approach to creating experimental proficiency. However, such projects can give a number of vehicles for instructors to "invigorate scholarly and social development of their students" (Sadler 2004, p. 533). As per Reiss (2007), the fundamental thought of experimental proficiency ought to "improve a comprehension of key thoughts regarding the nature and routine of science and a percentage of the focal finishes of science" (p. 18). Roth and Lee (2002) widened the point of experimental proficiency and contended that it is a characteristic of groups as opposed to people. Roth and Barton (2004), utilizing a scope of contextual investigations, further argued that "basic experimental proficiency is inseparably connected with social and political

competence in the administration of social obligation" (p. 10). Dawson (2007) proposed that exploratory education can offer students some assistance with weighing up contentions about SSI using basic thinking abilities, and making adjusted, that are very much educated choices that they can legitimize.

An educated citizenry is connected nearly to the idea of experimental proficiency. Berkowitz and Simmons (2003) expressed that Science instruction must serve as an establishment for the training of an educated citizenry who take an interest in the flexibilities and forces of an advanced, popularity based, innovative society. With the fast improvement of investigative information and the appearance of new advances, all individuals from society must have a comprehension of the ramifications of that learning upon people, groups and the "worldwide town" in which we now live. (p. 117).

In a study carried out in Turkey, students from a science teaching program were subjected to the Jigsaw collaborative method to make decisions about nuclear energy in Turkey. A pre-survey and post- survey was conducted and it was found that students had negative views and had little knowledge or literacy to support these views in the pre-survey. Most of the students' views changed from negative to positive when the students were provided with knowledge including possible advantages and disadvantages of using nuclear energy. Using this collaborative Jigsaw approach, the students could make decisions by use of logical reasoning processes about an SSI (Tekbiyik, 2015).

2.2.3 SSIs in the Science Curricula of the UAE

Embedding SSI in the science curricula of secondary schools in the United Arab Emirates offers different beneficial effects especially in how students will be able to interact and confront with their daily surroundings. The rapid innovations and issues confronting socio-scientific should be learned by students to awaken their sense of reasoning, critical thinking abilities and other skills needed at the early stage of their lives. The knowledge that students will get out of these learning will eventually prepare them in confronting the real world especially when they have to enter workplaces in the future.

Given the context of cultural orientation that the UAE has, the SSI inclusion in the secondary curriculum remains controversial, especially with regards to science teachers' views about SSIs. While teachers in the UAE, based from studies, are amenable to practices such as collaborative, student centered and inquiry based learning in the classrooms (Dickson, Kadbey and McMinn, 2015), there are still no studies in the UAE that shows teachers perception of integrating SSIs into the curriculum. In countries like Turkey (Kara, 2012), teachers did show an amenable perception toward SSI integration however there are still struggles that should be confronted with the effective outcome of the process and overcoming other limitations.

SSI inclusion in UAE's education is confronted with different scenarios. First, the educational system in the country is volatile to movements among students and teachers, especially that there an influx of expatriates in the area, and the teachers are mostly expatriates as well. This volatility encompasses a diversified cultural and racial view about SSI. This could compromise the norms of UAE students regarding

how their society views some delicate aspect of SSI. For example, a teacher who comes from a foreign country could have a separate view on certain topics in SSI, which might contradict how the UAE view the subject entirely. This could stir a conflict of opinion and belief regarding the topic. This cultural difference is among the significant barriers that could impact the possible adaption of SSI in UAE school curricula. Furthermore, having teachers from different cultural background could also pose problems in terms of language issues in UAE context, especially in public schools.

Nevertheless, the willingness of the science teachers and their positive appreciation of SSI inclusion, along with the right government policies and perspective in developing a design for SSI inclusion, plus addressing all the potential barriers along the path could go a long way in attaining the common objective of effectively teaching SSI to UAE secondary students and make them understand even the most complex areas of socio-scientific subjects.

In the ADEC Science curriculums across the 3 subjects taught: Biology, Chemistry and Physics there is a minimal 'inclusion' of SSIs into the curriculum. This is only found in the Biology subject where the consequences of continued exponential population growth are explored in a Grade 10 unit. Also, there is an analysis of the advantages and disadvantages of small and large nature reserves on biodiversity and its impact on society in Grade 11. As for the other subjects' there are no SSIs included. As for the NGSS (Next Generation State Standards) that are taught in private American curriculum schools there are units in life science that include Genetically Modified Organisms (GMOs) and Human Cloning (HS-LS2 & HS-LS3). As for Physical Science and Earth Science the standards include Hydraulic

Fracturing, Nuclear Energy, and Renewable Energy Devices (HS-PS1, HS-ESS3, HS-PS3).

2.2.4 Science in a Social Context

In the 1970's, one of the aims of science, technology, and society was addressing controversial issues in a science context (Solomon, 1994). The primary focus was on issues such as the impact of new technologies on society and environmental issues (Solomon, 1993; Aikenhead, 2003). The teaching of controversial issues became sidelined in 1988 with the introduction of a National curriculum in England, Wales, and Northern Ireland (Aikenhead, 2003). However, with the rise of political and social issues they again regained popularity in the school agenda by 1999 (DfEE/QCA, 1999). According to Levinson (2006), there are typically three characteristics included in the definition of a controversial issue. These pertain that controversial issues are when people hold different key beliefs and values that offer conflicting explanations; when the issue includes different groups of numerous people; when the issue is not settled by appeal to evidence. To truly understand the importance of SSIs it is essential that the definition and the limits of controversy are explained thoroughly to all stakeholders included in the education process. For example, in an activity design by Raven, Klein and Namdar (2016), students were taught argumentation skills and evidence based reasoning using SSIs. Students are asked to pair with each other and have multiple opportunities to revise their scientific arguments and reach a position that differentiates between disagreeing based on 'emotion' without evidence and being critical of a position (Raven, Klein and Namdar, 2016). Currently in the UAE, renewable energy devices are being explored and the government aims at creating sustainable energy sources. Hence, students that

are subjected to such issues and are encouraged to discuss and research such issues may strengthen their evidence based reasoning and be part of the solution.

2.3 Studies Related to the Inclusion of SSIs

The topic regarding the inclusion of SSI in curricula and the perception of teachers about SSI has been widely discussed through various researches and studies. It has risen in countries like America (Saunders and Rennie, 2013) where there is various literature that tackled the subject of varying differences and similarities. Among this literature was about the impact of SSI on experimental proficiency (Kolstø Bungum, Arnesan, Isnes, Kristensen and Mathiassen, 2006; Ritchie, Thomas, and Tones, 2011) where it was found that students prefer to analyze the reliability of a socioscientific issue, indicating that this practice needs to be emphasized in science education and to raise scientific literacy. A study by Eastwood, Sadler, Zeidler, Lewis, Amiri and Applebaum (2012) revealed that students that were subjected to SSIs tended to use examples to describe their views of the social/cultural Nature of Science and increasingly communicated in a scientific way. (Albe, 2008, Eastwood, Sadler, Zeidler, Lewis, Amiri, and Applebaum 2012; Khishfe 2012, 2014; Sadler, Chambers, and Zeidler, 2004) Another critical field of researches improving the students' abilities to use informal reasoning. In this setting, some ordinarily examined subjects that included argumentation in SSI found that students' argumentation skills and informal reasoning increased (Dawson and Venville, 2013). In another study by Foong and Daniel (2013) it was found that in a 'Confucian' setting in Malaysia, there was an introduction of SSIs and argumentation skills that resulted in a progression in the exchange of argumentation aptitudes (Foong and Daniel, 2013). Zeidler, Sadler, Applebaum and Callahun (2009) used a reflective judgment model as a tool to explore possible relationships between SSI inclusion and

reflective judgment. They found that students had a more sophisticated epistemological stance towards higher stages of reflective judgment (Zeidler, Sadler, Applebaum and Callahun, 2009; Zeidler, Herman, Ruzek, Linder and Lin, 2013). With regards to the link between resolving socioscientific issues that may involve moral considerations, it was found in a study by Sadler and Zeidler (2004) that students interpret genetic engineering – an SSI, as a moral problem. Students engaged in moral reasoning that reflected on the consequences that may occur based on the application of the SSI (Sadler and Zeidler, 2004). In two studies done on pre-service teachers in Turkey it was found that informal reasoning and casual thinking was promoted amongst them. This is also believed to promote this type of thinking among students (Topcu, Sadler and Yilmaz, 2010; Topcu, Yilmaz and Sadler, 2011). Correspondingly, the significance of substance information concerning casual thinking and argumentation aptitudes has been concentrated on in many studies to link them with scientific literacy (Sadler and Donnelly, 2006; Sadler and Zeidler, 2005b). Fewer studies researched the relationship between SSI and the learning results that could impact students. In this appreciation, researches have concentrated on the impact of SSI in encouraging learning (Rudsberg, Öhman, and Östman, 2013) and on the learning results (Ottander and Ekborg, 2012). Other research concentrates on challenges educators confronted in classroom discourses (Day and Bryce, 2011), instructors' perspectives on SSI (Ekborg, Ottander, Silfver and Simon 2013), the part of SSI in citizenship training (Barrue and Albe, 2013; Lee, Yoo, Choi, Kim, Krajcik, Herman and Zeidler 2013), how SSI are utilized as a part of classes with students speaking to distinctive financial status and ethnicities (Ideland, Malmber and Winberg 2011). One study assessed how SSI are taken care of in course books (Morris, 2014).

Most of the studies agreed that science teachers, although they have strong willingness about the incorporation of SSI in the curriculum, are still hesitant about its efficacy. In a study by Dickson, Kadbey and McMinn (2015), the research found that teachers are constrained by different factors concerning delivery of science discussion due to lack of readily available materials and lab support. Also, there are other hindrances in the UAE context, especially in terms of the language barrier, considering that teachers in the UAE are mostly coming from foreign countries.

Kara (2012) pointed out in her study that science teachers are confronted with compounding fundamental problems concerning SSI. Kara surveys 102 undergraduate pre-service biology teachers by using a questionnaire that comprises of Likert Type and open-ended questions. She finds that pre-service teachers perceive a need to address SSIs. However, they identify these problems as something to do with their value position and the apparent tension in teaching a controversial issue in a traditional setting. They also believe that adding more processes and substantial changes in the existing science classes would be a burden. Furthermore, Kara (2012) also cited that teachers with a rooted scientific discipline, incorporating SSI will likely bring in conflict.

But then, Kara (2012) noted that her study on pre-service biology teachers revealed that most of the teachers who participated in her research agreed to tackle SSI in the biology classroom and that students, especially high schools should be concerned with and learn SSI. They are also willing to undergo training programs that will help them to acquire the needed additional knowledge in managing SSI discussions in the classroom. However, these same teachers expressed less willingness in developing their resource materials for teaching SSI. One of the most significant responses of the

teachers in Kara's study is how they view SSI as an opportunity to break away from the incorrect emphasis concerning science. Like for example, the issue of genetically modified organisms, which was hyped in the scientific world as a solution to declining food production and food shortage. A teacher, who participated in the study, noted that after seeing the effects of GMO in their biology lessons, they are convinced that their health will be sacrificed, and so they will just refrain from buying any GMO product (Kara, 2012).

Yager (1992) recognizes the fact that teaching science has been portrayed as authoritative, generalized and academic (as cited by Levinson, 2006). Levinson (2006) also cited that controversial issues such as those that are socio-scientific in nature have never been easy, and more often than not, lead to little discussion. Also, the socio-scientific issue was clouded with uncertainties and compounded with other issues relating to political, ethical, social and personal conflicts (Levinson, 2006). This conception of conflicts with SSI, prompted Levinson to arrive in developing a framework for teachers dealing with SSI, which include reasonable disagreement, communicative virtues and modes of thought (Levinson, 2006).

Citing various studies, Karahan (2015) noted that only a small percentage of teachers incorporate SSI contents in their science classrooms on a regular basis. Karahan (2015) recognizes the fact that despite a vast amount literature available that delve into SSI and teaching, along with values and motivations, there is little focus on the practices of these teachers and the potential outcome on their learners. Karahan (2015) pointed out a need for in-depth studies that will also focus on the practices of developing or designing and teaching SSI-based learning environment. Also, there

should be a study that will likewise focus on the beliefs and motivations for effective SSI teaching, along with how the students respond to these practices.

Sadler (2009) stated that teaching science content is not alone enough if the objective is to help students become better in negotiating challenges of science, especially that societal issues related to applications of science and technology could help them become well-rounded citizens (as cited by Karahan, 2015). Science does not just revolve around the limits of science alone but are also intertwined with other areas of learning such as politics, economics and ethics and other several various domains. Researchers recognize these complexities and even branded SSI as an ill-structured problem, which entail no single correct answer (Karahana, 2015).

Karahana (2015) delve into another aspect of science, which is technology and how it helped teachers and students have a better grasp of SSI. In the study, there is no amount of significant changes on the quantity of technology in the classroom, but the effectiveness lies in the high-quality integration of these equipment. It was noted that students, who were encouraged to use these technologies interactively showed beneficial results (Karahana, 2015). Teachers should also be knowledgeable enough about the proper use of these technologies and how to effectively use them as among the media in teaching SSI in their classes.

2.3.1 Science Teacher Views Studies

In the study by Lee, Abd-El-Khalick and Choi (2006) it was found that science teachers had a general positive view about the addressing of SSI in education. Lee, Abd-El-Khalick and Choi surveyed 86 participants using a survey that contained Likert Type questions and Open-ended questions and then followed up with semi-

structured interviews with 12 randomly sampled participants. The study's purpose was to examine Korean secondary science teachers' perceptions of SSI, with regards to introducing and teaching SSIs into the curriculum. The authors also studied the factors that might impede or facilitate addressing SSIs in the classroom. The factors that were studied included teachers' perceptions of the necessity of addressing SSI, teachers' personal science teaching efficacy (PTSE) and situational factors like time management and unavailability of resources. The participants were 86 in-service secondary science teachers that were enrolled in a program that aimed to raise their skills in implementing SSI, STS oriented instruction. The teachers all held a bachelors' degree in education and specifically in teaching secondary science courses. They also were teachers ranging from less than five years of experience in teaching and a maximum of 10 years of teaching. The teachers filled out a Likert type questionnaire that targeted their perceptions of introducing SSI into the science curriculum, their perceptions of the factors that facilitate or impede the implementation and their PTSE beliefs regarding SSI topics. 12 randomly selected teachers were then probed in a semi structured interview regarding their perceptions about the definition of science, and if science interacts with the lives of human beings and further elaboration with this regard. The participants were also asked about their experiences with science teaching and learning, their perceptions of SSI and addressing these topics in their classrooms, and their personal opinions about SSI topics that include animal dissection, genetically manufactured organisms, and human cloning. The results showed that the participants viewed SSI negatively. They believed that SSIs are equated with the negative side effects of science and that science destroys the natural ways of living. They also believed although science and technology help humans in some instances, moral-ethical laws must be invoked

preliminary before they are implemented. On the contrary to those beliefs the majority of the teachers also believed that it is important to include SSI topics in the curriculum because it raises students' decision making skills, it also gives students a better understanding of science's relevance to personal and social problems. Furthermore, they believed that it would enhance debating skills and the conceptions of nature of science in students.

Although teachers encouraged the implementation of SSI in their curriculum they did not however address SSIs or provide students with the skills to explore these issues. This is due to the factors that include low PSTE (Personal Science Teaching efficacy) which encompasses their content knowledge, pedagogical knowledge and how to address these issues. Teachers themselves did not know their own values regarding these issues and preferred to remain neutral in their views. Teachers were not confident in their students' ability to form their own views or in their own teaching to help students instill their own views. The other situational factors that participants found impeded the teaching of SSIs include lack of time, lack of resources, managing classrooms to include role-playing, small class discussions, and activities. Also, participants felt that it is difficult to assess students especially in moral and ethical issues.

In a research conducted by Tal and Kedmi (2006), the researchers applied a unit to a tenth-grade class as an attempt to increase scientific literacy. The research itself touches on incorporating SSIs into the curriculum and assessing SSIs through assessment for learning techniques. This unit was taught to non-science major students that chose this course an elective. The authors chose curricula that are non-traditional and consist of personal and relevant topics that could promote value laden

arguments within groups of students. The unit of Treasures in the Sea that discussed fish farming, spilling waste and nature preservation are all relevant to the country that they live in. Students were given case studies that enhance higher order thinking skills, critical thinking skills and place based pedagogy. These dilemma-based case studies were predicted to push teachers towards facilitating small group and whole class discussions to allow students to use and foster their critical analysis skills.

Tal and Kedmi (2006) used 6 different classes as part of the research that ranged between different levels of students, different specters of the religious background (one of the schools was a religious school) and different socioeconomic levels. Tal and Kedmi (2006) mention that the unit was taught over 1 month and 3 of the teachers underwent PD sessions to teach such units and the 4th teacher was experienced and was studying at a PhD level. The data collection consisted of observation that included informal interviews, content analysis of the tasks and formal interviews. Tal and Kedmi (2006) found that the teachers focused more on the scientific knowledge of the students while thinking skills were a minor concern and were not addressed as needed. This supports the current research that teachers still have a problem giving up content although they were exposed to the idea of incorporating SSIs, underwent PD and importance of scientific literacy even to non-science majors they were more concerned with their abilities in conceptual scientific knowledge than in their ability to critique and contribute to society. The research itself not only talks about incorporating SSIs it also goes beyond and discusses the techniques including class discussions (small or whole), outdoor hands on experiences, independent research and argumentation it gives an insightful realization that teachers need further addressing when it comes to covering the content that may limit their ability to incorporate such higher order thinking triggered

topics in the correct way. The teachers also did not give any formative feedback to the students which not only did not help with the notion of assessment for learning; it also indicated the teachers themselves avoid dealing with values in science classes. This resulted in the coauthor to co-teach with the teachers to allow students to challenge values in classes and to reinforce science as community praxis. Although students enjoyed the topics and how they were taught they understood that the study was being administered to compare between the traditional way, incorporating SSIs and how to assess them. They further supported these notions by referring to the potential of SSIs in enhancing critical thinking and functioning in everyday life. This further supports the current study and their study that dealing with SSIs helps them think, and through arguing and having to convince others they made more value laden decisions.

In a study by Carson and Dawson (2016), it was found that 75 Australian secondary science teachers responded positively to the workshops and curriculum resources in teaching the topic 'climate change' – an SSI. The teachers underwent a professional development program developed based on 2 pillars: PD and curriculum resources. The teaching strategies focused on argumentation skills to improve students' decision making. The teachers were found to be eager to trial these strategies resulting in classes being observed in 2 schools.

All in all, the research itself highlights the goal of science education as and for participation in community life. Although teachers themselves used small group and whole class discussions they emphasized the students' academic level and not the idea of sociocultural perception of learning and collaboration needed to promote scientific literacy through SSIs. They also found that these issues require the

integration of scientists and science with social issues and community members that are external to the scientific community and the social communications of scientists in “communal, epistemic and ontological values” that are internal to the scientific community. As a direct link to the current study it was found that teachers must address their own perceptions of science and the teaching philosophy when addressing incorporation of SSIs and the use of strategies to enhance scientific literacy. The article itself is very relevant to the current study, it could be argued that the actual factors of socioeconomic status, abilities of students and religious backgrounds are not analyzed and linked to the conclusion. SSIs being controversial must have also triggered issues with teachers in their own beliefs affecting the teaching of the unit, or students who are not aware of these issues due to their abilities (in the case of their low reading comprehension skills and their inability to comprehend cause and effect relationships as per the study). These factors could have been studied to triangulate the whole topic of incorporating SSIs in the curriculum. Another aspect that was discussed but not elaborated in the discussion itself was the assessment; unfortunately, it was only touched upon by suggesting that teachers need more practice to change the assessment culture in the class. The recommendation and reflection would be to ensure that the factors are discussed thoroughly in the current study.

2.3.2 Factors that impede the inclusion of SSIs in the curriculum

Most of the literature regarding SSI recognizes the fact that inclusion in the educational system is vital to students learning, however, there are certain barriers that should be undertaken to effectively achieve a common objective of delivering a better standard of teaching to the students. Kara (2012) found that pre-service

science teachers identified these barriers as lack of time to cover SSIs, lack of resources, classroom difficulties with incorporating small group discussions, role playing and other needed teaching strategies and assessment strategies especially with moral and ethical dimensions. In another study by Lee, Abd-El-Khalick & Choi (2006) it was found that Korean Science teachers perceived that lack of instructional time and resources were the barriers impeding the inclusion of SSIs in the curriculum. It is important to investigate these barriers in the UAE to have a better understanding of the problem and hence in further studies find solutions.

2.3.3 The Application of SSIs in the Science Curriculum

Information from an overview of secondary science teachers in New Zealand (Saunders, 2009), uncovered that albeit all educators reported that they were tending to SSI in their classrooms, for some it was minimal or not structured as part of the curriculum. Further, as of not long ago issues were not a required portion of their instructing projects. New Zealand instructors communicated comparative worries to those reviewed by Levinson and Turner (2001), with numerous demonstrating that they were not well prepared to address showing and finding out about dubious issues. They recognized various requirements to doing as such, for example, the absence of time to plan and show projects, the lack of individual science foundation information, the absence of learning of viable showing and learning techniques, and absence of backing as far as instructing assets. The individuals who were trying to address issues in their showing projects utilized a thin scope of pedagogical procedures and these were prevalently instructor focused, or concentrated on individual exploration being done by students. There was an absence of ability amongst teachers to use a scope of student-focused, collective showing and learning

methodologies to address SSI in their science classrooms. There was additionally an absence of comprehension by instructors of moral structures for moral considerations.

Goldfarb and Pritchard (2000) set forward contentions for the significance of instructing moral thinking in the science classroom. They contended that such instructing empowered the good creative ability of students, offered students some assistance with recognizing good issues, offered students some assistance with analyzing key moral ideas and standards, fortified students' awareness of other's expectations, and helped students to bargain adequately with good vagueness and contradiction. Allchin (1999) additionally expressed that a general go for issues-based training in optional science classrooms was that it could "support both ethically touchy researchers and logically educated humanists" (p. 44). However, utilization of the terms good and moral is not effortlessly separated, and they are regularly utilized conversely. Reiss (1999) recommended that "good" is what individuals believe is the best thing to do, frequently taking into account feeling or instinct. "Moral" tests the thinking behind our ethical thinking and endeavors to touch base at thinking and utilizing to set up structures of moral considerations. Incorporating SSIs into the science curriculum could result in students having an opportunity to make well informed moral decisions.

In a recent study in Saudi Arabia by Khishfe, Alshaya, BouJaoude, Mansour and Alrudiyan (2017), 74 eleventh grades were examined by administering a questionnaire about 4 scenarios addressing SSIs – global warming, Genetically Modified food, acid rain and human cloning. It was found that most students were not able to generate well-developed arguments and did not hold informed views

about the Nature of Science (NOS) aspects. Although among the students that did have well- developed arguments, these same students had more informed understandings of the NOS aspects across the four SSIs.

In South Korea, 132 9th graders were subjected to a SSI program on gene modification technology. The researchers investigated to what extent this SSI instruction enhanced their communication skills by using a communication skills questionnaire, semi-structured interviews and classroom observations. It was found that this SSI inclusion could bring about a moderately large impact on students' ability to understand the key ideas of others and to value others' perspectives, as well as a marginal positive effect on developing active assertions (Chung, Yoo, Kim, Lee & Zeidler, 2016). In a study by Sadler, Romin and Topcu (2016) 69 secondary students taught by 3 teachers that implemented an SSI about the use of biotechnology for identifying and treating sexually transmitted diseases. It was found that this inclusion of SSI-based teaching can promote student learning of scientific content and hence, improve performance in assessments. Hence, the inclusion of such issues in the curriculum may lead to enriching and helping the UAE curriculum in enhancing the critical thinking, problem solving and global and environmental skills.

2.4 SSIs in the UAE

The education system of the United Arab Emirates has taken to a great height for the past several years, compared to what it was since its establishment in 1971. Since 2006, UAE's education has soared to a higher ground through different educational reforms (Dickson, Kadbey and McMinn, 2015). This enormous transformation has been credited for the government's effort to invest considerably in the educational

system for its ever-expanding population. In the country's vision 2021, education is still at the top of government's priority and is seen as the major factor in enhancing its human capital and preparing them for a more diversified knowledge-based economy (UAE Interact, n.d.) The government even allocated billions of Dirham budgets for upgrading education in the country from Kindergarten to college studies (UAE Interact, n.d.) In line with the government's focus on education, the Ministry of Education even developed "Education 2020", an ambitious five-year plan that aims to deliver a quality improvement in the country's educational system, taking more emphasis on the way teachers teach and how the students learn (UAE Interact, n.d.)

With the aggressive move of UAE government towards education, and the striking reality that the world has today in terms of different factors, including modernization, the innovations in areas of science and technology, etc., it is also imperative for UAE to embrace and embed, as early as in secondary education the concepts that surround socio-scientific issues. The inclusion of socio-scientific issues in the curricula will give students awareness in the issues surrounding socio-scientific perspectives. Zeidler and Nichols (2009) describe SSI as the deliberate use of scientific topics that will make students engage in dialogue, discussion and debate regarding topics that has something to do with science and the realities of the world around us.

Most researchers regard SSI as a controversial topic to tackle in classrooms (Zeidler and Nichols, 2009). This is especially true in countries like UAE, where the culture belongs to conservative tones. Nevertheless, SSIs are issues that have to be tackled to make students wide aware about their surrounding especially that they are, for sure, have to confront these issues once they enter the real world comes the time that they

graduated from their studies. Teaching them early on SSI will give them information from educators' perspective, which is an informed perspective rather than getting them from uninformed one, which may misguide them along the way. With the vast option available for taking information from the internet (which also offers unreliable information), an uninformed citizen about SSIs might take out wrong information and incorrect perspective about the issue. SSI will help students not to miss out engaging school activities that will take its focus on present issues that require scientific knowledge that would be beneficial in having an informed decision making (Zeidler and Nichols, 2009).

The inclusion of SSIs in the curricula within the public secondary schools in the United Arab Emirates, on the other hand, would be an arduous process, from developing the teaching materials to its applications in the classrooms. Studies found out that even today, materials related to SSIs in the secondary curriculum are not widely available, and teachers deal with the SSIs domains within a limited context. Even so, there is no assurance that its availability would translate to effective delivery of SSI would be effective in the classrooms (Kara, 2012).

Teachers' views and perceptions regarding SSIs are pivotal in the effectiveness of the delivery of discussions and lesson relating to SSIs (Kara, 2012). Being the primary intermediaries of the curriculum, the success and failure of teaching SSIs among students lie heavily on the teachers' capability of delivering the topic. In a study conducted by Kara (2012) among biology teachers regarding their perceptions on SSI, most of the teachers who participated in the research believe that high school students should have concerned and learn about SSIs. They are likewise willing to address SSIs if there are available instructional materials at hand and also, they are

willing to participate in training programs that would equip them with the right knowledge on how to carry out their SSI teachings. Nevertheless, these same teachers are less willing to develop the course materials themselves (Kara, 2012).

In a study conducted by Dickson, Kadbey and McMinn (2015) among the best science teaching practices within private and public secondary schools, it was noted that both private and public school teachers struggle with the fact that there is a lack of experimental resources and laboratory support. Among other constraints are time, behavioral management and language barrier, which is so common, especially in public schools (Dickson, Kadbey and McMinn, 2015). These same factors may be impeding the inclusion of a 'new' topic and hence must be investigated. All in all, there is an imminent need to obtain the views of the science teachers in this region about the inclusion of SSIs and of the place of the inclusion of SSIs in the science curriculum. The factors found in the studies discussed will also be considered to have a better idea about this type of inclusion. The science teachers' views also must include what they think might impede or facilitate the inclusion.

2.5 Summary

The essential inclusion of SSIs into the science curriculum is portrayed in many studies. Previous literature links SSIs to scientific Literacy, citizenry, awaken sense of reasoning, critical thinking abilities and other skills that may be needed. There are currently no studies of socio-scientific inclusion in the UAE. As noticed, the first step towards this inclusion is to analyze the perceptions of stakeholders into this inclusion. To study the status of SSIs in the UAE it is imperative that the knowledge of science teachers is studied and the barriers that may facilitate or impede this inclusion.

Chapter 3: Methodology

3.1 Chapter Overview

This chapter explains the methodology used in this study. Specifically, a description of the participants and how they are selected, the instrument and its validation procedures as well as the design of the study and the procedures that were used to collect data and the statistical analyses to be employed.

3.2 Participants

Participants proposed in this study are from the Al Ain region in the United Arab Emirates. All teachers participating in this study are science teachers and are from both expatriate and local nationalities. The science teachers' demographic variables include gender, experience and background will be explored to study their impact on the views of SSIs. The study employed 130 participants of different experience, gender, qualification background, and experience. The sampling procedure used is the stratified sampling procedure because the study is interested in a particular stratum within the population. These are males versus females, public schools versus private schools, more experienced (equal to or above 5 years) versus less experienced science teachers (less than 5 years), if they had received professional development sessions in socio-scientific issues, and if they had studied any courses related to socio-scientific issues at university level. This sampling procedure ensures that there is an equal chance of selecting each strata from the sample.

3.3 Instrumentation

The method of data collection that was used is a survey adapted from a previously completed study by Lee, Abd-El-Khalick and Choi (2006). The survey was chosen based on the targeted audience and types of questions and variables being surveyed.

The survey consists of 24 Likert type questions that asked science teachers about their views of SSIs, the factors that may facilitate or impede their inclusion and the knowledge of science teachers about SSIs. Three main domains which include science teachers' overall views of the necessity of including SSIs in the science curriculum (10 items), and the science teachers' views of the factors that facilitate SSIs and the knowledge of science teachers linked as a factor that may impede SSIs (14 items) was the focus of the instrument.

Before beginning the survey, an opening page explaining that this survey is anonymous because of the sensitivity of responses will be provided. The first section of the survey includes an introduction about SSIs and some examples of them. It then proceeds to ask the respondent about his/her background. This includes gender, level/ class taught, subject taught, teaching experience, courses studied that relate to socio-scientific issues and the PD activities that have been attended on socio-scientific issues within the last 3 years. The second part of the survey includes Likert-type questions about the inclusion of SSIs in the curriculum and the factors that facilitate or impede this inclusion including science teachers' knowledge. Both sections will be measured using a 5 point Likert type scale from "Strongly agree" to "Strongly disagree". The Third section included the open-ended questions which asked for additional information about science teachers' knowledge of SSIs, difficulties of implementing SSIs in the classroom and the types of SSIs that could be introduced into the Science classroom. The open ended questions mean to combine all the domains.

3.4 Instrument Validation Procedures

3.4.1 Validity

Validity is known as the extent to which the instrument measures what it is supposed to measure. Construct and content validity are regarded as the most important aspects of any instrument (Gay, Mills, and Airasian, 2011). It is therefore important to make sure that the construct and the content validity are clearly addressed and identified for the purpose of this study.

To establish the content and construct validity of the instrument, the survey instrument was assessed for construct and content validity aspects by obtaining expert opinions from a panel of professionals in the education sector that include Education professors and 3 Science teachers. Reviewers were asked to provide comprehensive feedback of the questions in relation to the factors and how the content and construct (the 3 domains) are suitable and appropriate to the study. Changes include switching the order of items to prioritize them and adding factors that were accounted for and then applied to improve the survey instrument.

3.4.2 Reliability

Reliability is defined as the extent of accuracy of the instrument. That is the degree to which the instrument consistently measures what it is supposed to measure (Gay, Mills, and Airasian, 2011). In this study, Cronbach's alpha for each domain was obtained, to indicate that the three domains have adequate internal consistency using 40 teachers from similar schools not participating in the study as a pilot study. The overall Cronbach alpha was calculated to be 0.80, for science teachers' general views of SSIs domain (Question 1 to 10); it was found to be 0.73. For science teachers'

view of facilitating factors (Question 11 to 14 and Question 23 and 24), the reliability was found to be 0.81, whereas for science teachers' view of impeding factors (Question 15 to 22) Cronbach alpha was calculated as 0.66. Generally, the calculated Cronbach alpha values indicate a high level of internal consistency.

To provide further triangulation to the perception data to be collected by the survey instrument, a further, 3 open ended questions adopted from Lee, Abd-El-Khalick and Choi (2006) will be used. This is to collect further data with regards to knowledge about SSIs, the difficulties of implementing SSIs in the classroom and the types of SSIs they think could be introduced into the Science classroom. In this way further information can be checked as regard to science teachers' understanding of the SSIs.

3.5 Design

The design of this study is based on exploratory descriptive survey design. Descriptive exploratory survey design is the determination and description of the situation and comparing how sub-groups view a certain issue (Gay, Mills, and Airasian, 2011). The purpose of this study is to describe the current situation of SSIs inclusion in the UAE. Furthermore, the study will examine science teachers' views with regards to SSIs and impeding or facilitating associated inclusion factors of SSI. This design allows the researcher to assess the perception of science teachers as a first step to understand their views. The researcher does not aim to find the impact or correlating views with other variables, however it does aim to pave the path to begin studies of this nature after inclusion of SSIs. Since the study uses both a quantitative approach (survey) and a qualitative approach (open-ended questions) it fulfills the descriptive survey design.

3.6 Procedures

As a first step to distribute this survey, permission from the Abu Dhabi Education Council (ADEC) through the university to access public and private schools was obtained. To ensure high rates of correspondence, the researcher contacted ADEC to send a notification about the importance of the teachers input to all teachers. Since this survey is administered to both Arabic and English speaking teachers, it was officially translated and then retranslated to English to check the validity of the translation done. Teachers were asked to give a consent before starting their survey and surveys will be anonymous because of the sensitivity of the factors. The survey is then distributed physically to the schools and will be sent out during the third term when curriculum reviews are taking place for the upcoming year to teachers in the Al Ain Region, specifically to Secondary schools with a request that it is only administered to teachers that fit the criteria of Grade 9 to 12 science teachers. The survey instrument recorded teachers' responses in a database for later statistical data analysis using SPSS. This note was included in the opening page of the survey and a request was sent to schools to ensure there are no biased responses.

3.7 Data Analysis

Before considering any data, a screening method of the data was conducted. This was done by descriptive statistics analysis to deal with Likert-type responses. Descriptive statistics provided answers to research questions which are: How much do Al Ain Science teachers know about SSIs Inclusion? What are the Al Ain Science teachers' views of the place of the SSIs inclusion in the science curriculum? What are the factors that facilitate or impede including SSIs in the Al Ain secondary classrooms? For these questions, a t-test was performed to compare the mean values and the highest and lowest perceptions were categorized. As for the third question of

the impact of science teachers' demographic variables (gender, experience, type of school, and background) on the perception of SSI, a t-test was also used and the perceptions were categorized. Specifically, for the specializations an analysis of variance (ANOVA) was done to find if there are significant differences compared to the domains, a Tukey post-hoc comparison test was used to identify the source of significant differences emerged in ANOVA analysis. All statistical analysis of the survey data will be conducted with the help of the Statistical Package for Social Sciences Software (SPSS) and the results will be interpreted based on the established values for statistical significance of the factors.

3.8 Summary

This chapter provides information related to the methodology that were used in this study including a description of the participants and how they were selected, the instrument to be used and how it was validated. It also explains the design of the study and its justification, the procedures to be followed to collect data, and how the collected data was analyzed to answer the research questions.

Chapter 4: Results

4.1 Chapter Overview

This chapter presents the results pertaining to the data that was collected to answer the research questions pertaining to investigate science teachers' views of the inclusion of SSIs in the curriculum and explore factors that could impede the inclusion of these issues in the school curriculum. Quantitative data was collected using a survey, which was purposely developed for the present study. The survey consisted of issues related to the inclusion of SSIS in the curriculum and the factors that may affect the inclusion of these SSIs in the curriculum.

The purpose of this chapter is therefore to present findings related to answers to the research questions that were presented in chapter 1 as follows:

- 1) What are the Al Ain Science teachers' views of inclusion of SSIs?
- 2) What are the factors that facilitate or impede including SSIs in the Al Ain secondary classrooms?
- 3) What is the impact of science teachers' demographic variables (gender, experience, type of school, and background) on the perception of SSIs?

4.2 Domains of the Views of Teachers

Table 1 shows the mean of the three domains that attempt to answer the question presented in this study. The views of the inclusion of SSIs have a higher mean score ($M = 3.94$) when compared to the views of the factors that facilitate inclusion ($M = 3.60$) and the factors that impede inclusion (3.00). Teachers participated in this study showed higher regard to the issue of inclusions of SSIs judging by the high mean value. Factors that are perceived to facilitate inclusions as assessed by the survey

include teaching strategies, knowledge of SSIs, resources assessment strategies and different instructional methodologies (item 11, item 12, item 13, item 14 item 23 and item 24) are also positively perceived as issues that may promote inclusion of SSIs in the curriculum.

Table 1: Descriptive statistics of the domains

Domain	Mean
General views of Inclusion	3.94
Views of factors that facilitate inclusion	3.60
Views of factors that impede inclusion	3.00

4.3 Science Teachers Views of the Inclusion of SSIs in the Science Curricula

Table 2 shows the descriptive statistics of the views of the teachers with regards to inclusion of SSIs in the science curricula. The highest mean ($M = 4.46$) which is the highest perceived item include their view about the need of students to learn and enhance their ability to decide their own positions about SSIs in science class about increasing the students' interests in those issues ($M = 4.30$), students need to be concerned with SSIs related to science and technology and the necessity of including SSIs into the science class ($M = 4.28$). The lowest means and hence the lowest perceived items include the science teachers view that it is more appropriate to deal with SSIs in ethics and religion instead of science ($M = 2.79$) and the inclusion of SSIs as a compulsory part of the curriculum ($M = 3.46$).

Table 2: Teachers views of the inclusion of SSIs in the curriculum

Rank (Highest to Lowest)		Strongly Agree / Agree	Mean	SD
5	I want to develop teaching and learning materials on socio-scientific issues for my class	98.50%	4.14	.39
4	If I can get materials on socio-scientific issues, I am willing to use them in the class	92.30%	4.15	.53
6	I am willing to participate in a program that helps teachers deal with socio-scientific issues	87.80%	3.95	.73
3	Introducing socio-scientific issues into science class is necessary	93.10%	4.28	.60
9	I think that it is more appropriate to deal with socio-scientific issues in ethics and religion, social studies classes than in science class (negative)	21.40%	2.79	.89
2	Introducing socio-scientific issues into science classes will increase students interest in these issues	94.70%	4.30	.57
3	Students need to be concerned with socio-scientific issues related to science and technology	96.20%	4.28	.53
1	Students need to learn and enhance their ability to decide their own positions about socio-scientific issues in science class	95.40%	4.46	.58

8	Socio-scientific issues should be a compulsory part of the science curriculum	59.60%	3.46	.90
7	Socio-scientific issues should be an optional part of the science curriculum	73.30%	3.63	.72

4.4 Science Teachers Views of the Factors that Facilitate Inclusion

Table 3 describes the views of science teachers with regards to the factors that facilitate inclusion of SSIs into the curriculum. The highest mean reported ($M = 3.82$) and hence the highest perceived items are the teachers views about having the teaching strategies that allow them to deal with SSIs in science class, the next highest mean ($M = 3.73$) reported is their confidence of using assessment strategies to assess SSIs and having the knowledge necessary to effectively teach SSIs. The lowest mean reported ($M = 3.22$) and hence the lowest perceived items include having enough resources to develop their teaching and learning materials about SSIs.

Table 3: Science teachers' views of the factors that facilitate the inclusion of SSIs

Rank (Highest to Lowest)		Strongly Agree / Agree	Mean	SD
1	I have the teaching strategies that allow me to deal with socio-scientific issues in science classes	79.40%	3.82	.44
4	I have a full understanding of what socio-scientific issues are	59.60%	3.59	.66
6	I have enough resources to develop teaching and learning materials about socio-scientific issues	82.40%	3.22	.73

3	I have the knowledge necessary to effectively teach about socio-scientific issues to my secondary school students	67.20%	3.69	.61
2	I am confident in using assessment strategies to assess socio-scientific issues	69.50%	3.73	.65
5	I have knowledge about different instructional methodologies for effective application of socio-scientific issues in the classroom	58.00%	3.57	1.05

4.5 Science Teachers Views of the Factors that Impede Inclusion

Table 4 describes the views of the science teachers with regards to the factors that impede inclusion of socio-scientific issues (SSIs) into the curriculum. The highest means reported respectively ($M = 3.60$), ($M = 3.39$), ($M = 3.21$) and hence the highest perceived items include the possibility of dealing with socio-scientific issues using various teaching strategies in a “real” classroom situation their belief that students are not mature enough to understand SSIs and their belief that students’ language ability limits their ability to understand SSIs. The lowest means reported respectively ($M = 2.68$), ($M = 2.63$), ($M = 2.72$) and hence the lowest perceived items include not having enough time to deal with SSIs, their belief that science classes addressing SSIs have little influence on the achievement of students with low motivation and that addressing SSIs can confuse students with regards to their religious values.

Table 4: Teachers views of the factors that impede inclusion into the curriculum

Rank (highest to Lowest)		Strongly Agree/ Agree	Mean	SD
8	I do not have enough class time to deal with socio-scientific issues	13.00%	2.63	0.79
2	I believe that students are not mature enough to be interested in and understand socio-scientific issues	47.30%	3.39	0.91
3	I believe that students language ability limits their ability to understand socio-scientific issues	39.70%	3.21	0.95
4	Classes dealing with socio-scientific issues are most likely to be classes for high achieving students	36.60%	2.92	1.05
7	I believe that science classes addressing socio-scientific issues have little influence on the achievement of students with low motivation	22.90%	2.68	0.93
6	Addressing socio-scientific issues in science classes could confuse students about their own religious values	30.50%	2.72	1.01
5	I believe that science classes addressing socio-scientific issues have little influence on the achievement of students with low participation level	38.20%	2.88	1.01
1	Dealing with socio-scientific issues using various teaching strategies is not possible in a “real” classroom situation	64.10%	3.60	0.93

4.6 The Demographic Variables and Science Teachers' Perceptions of SSI

To answer the research question pertaining to the impact of gender, type of school (public versus private), teaching experience, training in SSIs, and attending SSIs professional development training, statistical differences between the respondents based on these demographic variables were evaluated using t-test. An independent samples t-test was used to compare the means of the participants based on their gender (male versus female), type of school (public schools versus private schools), teaching experience (experienced participants versus novice participants), prior knowledge of SSIs (participants that studies SSI courses in university versus participants that did not study them), and if professional development training (PD) (attendance of PD in SSIs versus not attending PD in SSIs). Furthermore, an analysis of variance (ANOVA) was also performed to test for any statistically significant differences between participants based on their major specialization. Each was analyzed against the 3 domains: inclusion, factors facilitating inclusion and factors that impede inclusion.

4.6.1 The Impact of Teacher's Demographic Variables on the Views about Inclusion

Table 5 shows that within the demographic variables there was no statistically significant differences between male and female, public versus private schools and experienced and novice participants, indicating that teachers' views are similar amongst these variables in this domain. However, amongst the variable prior knowledge of SSIs as demonstrated by SSI courses studied at the undergraduate level, there was a statistically significant difference between the two groups ($p \leq 0.03$). There was also a statistically significant difference between the variables of

Professional Development (PD) that was taken versus PD that was not taken ($p \leq 0.00$).

Table 5: The impact of science teachers' demographic variables on the views about inclusion

Inclusion	N	M	SD	T-Test	Sig.
Male	45	3.92	0.21	0.87	0.38
Female	86	3.96	0.27		
Public School	43	3.99	0.27	1.643	0.10
Private School	88	3.91	0.23		
Less than 5 years	29	3.95	0.24	0.24	0.81
Equal or more than 5 years	102	3.93	0.25		
Studied SSI Courses	74	3.99	0.27	3.05	0.03
Did not study SSI Courses	57	3.87	0.19		
PD taken	64	4.06	0.20	5.91	0.00
PD not taken	67	3.83	0.24		

4.6.2 The Impact of Teacher's Demographic Variables on the Views about Factors that Facilitate the Inclusion of SSIs into the Curriculum

Table 6 shows that within the demographic variables there was no statistically significant differences attributed to gender, type of school, the teaching experience of participants. However, prior knowledge of SSIs as exemplified by having studied SSI courses at undergraduate level, there was a statistically significant difference between the two groups ($p \leq 0.02$). There was also a statistically significant significance between the variables of Professional Development (PD) that was taken versus PD that was not taken ($p \leq 0.00$).

Table 6: The impact of science teachers' demographic variables on the views about factors that facilitate the inclusion of SSIs into the curriculum

Facilitate	N	M	SD	T-Test	Sig.
Male	45	3.59	0.53	0.307	0.76
Female	86	3.61	0.40		
Public School	43	3.64	0.43	0.67	0.50
Private School	88	3.58	0.46		
Less than 5 years	29	3.70	0.33	1.36	0.17
Equal or more than 5102 years		3.57	0.47		
Studied SSI Courses	74	3.68	0.47	2.33	0.02
Did not study SSI57 Courses		3.50	0.39		
PD taken	64	3.73	0.44	3.24	0.002
PD not taken	67	3.48	0.41		

4.6.3 The Impact of Science Teacher's Demographic Variables on the Views about Factors that Impede the Inclusion of SSIs into the Curriculum

Table 7 shows that within the demographic variables there was no statistically significant differences attributed to gender, type of school, prior knowledge of SSIs, and professional training (PD) in SSIs. However, amongst the variables teaching experience (experienced versus novice) there was a statistically significant difference between the two groups ($p \leq 0.02$).

Table 7: The impact of science teachers' demographic variables on the views about factors that impede the inclusion of SSIs into the curriculum

Impede	N	M	SD	T-Test	Sig.
Male	45	2.87	0.73	1.67	0.09
Female	86	3.07	0.52		
Public School	43	3.08	0.64	1.00	0.32
Private School	88	2.96	0.59		

Less than 5 years	29	3.24	0.66	2.40	0.02
Equal or more than 5102 years		2.94	0.58		
Studied SSI Courses	74	2.95	0.65	1.10	0.28
Did not study SSI57 Courses		3.07	0.54		
PD taken	64	2.95	0.59	0.93	0.35
PD not taken	67	3.05	0.62		

4.7 The Impact of Science Teachers' Specialization (subject taught) on the Perception of SSIs

In this part, a one-way ANOVA was used to compare the means of participants based on their specializations (four specializations). Participants were divided into four specializations based on their responses, namely General Science, Biology, Chemistry and Physics. The analysis was done across the 3 domains which are inclusion of SSIs, the factors that facilitate the inclusion of SSIs and the factors that impede the inclusion of SSIs into the curriculum.

4.7.1 The Impact of Specialization (subjects taught) Variable on the Science Teachers' Views about Inclusion

Table 8 shows descriptive statistics of the subjects' variables with highest mean found in the chemistry subject ($M = 4.16$) and the lowest mean found in the biology subject ($M = 3.82$). Participants displayed higher perceptions regarding the inclusion of SSIs in the curriculum. Their perceptions mean scores ranged between 3.82 for the biology specialization to 4.16 for the chemistry specialization.

Table 8: Descriptive statistics of the subjects' variable and the domain of inclusion

Subjects	Mean	SD
General Science	3.99	0.23
Biology	3.82	0.24
Chemistry	4.16	0.25
Physics	3.92	0.14
Total	3.94	0.25

Table 9 displayed the result of a one-way ANOVA which was used to determine whether there are any statistically significant differences between the groups based on participants' specializations. The results of this analysis showed that there is statistically significant difference between the participants based on their specialization, $F(3, 127) = 13.19, p \leq 0.00$.

Table 9: One-Way ANOVA of the subjects' variables with regards to inclusion

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.93	3	0.64	13.19	0.00
Within Groups	6.21	127	0.05		
Total	8.14	130			

Since, there is a statistically significant difference between the groups in the views of inclusions based on participants' specializations, a Tukey post-hoc comparison test was used to identify the source of significant differences emerged in ANOVA analysis. Results of the post-hoc test, which are presented in table 10 shows that there is a statistically significance differences between biology teachers and chemistry teachers (Mean Difference = 0.34, $p \leq 0.00$). This is followed by the views of Chemistry teachers and physics teachers (Mean Difference = 0.24, $p \leq 0.00$).

There was also a statistically significant difference between the views of General science teachers and Biology teachers (Mean Difference = 0.17, $p \leq 0.00$), and the General science teachers and the Chemistry teachers (Mean Difference = 0.16, $p \leq 0.04$).

Table 10: Post-Hoc tests of the subjects' variables with regards to inclusion

Subject Taught (I)	Subject Taught (J)	Mean Difference (I-J)	Std. Error	Sig.
General Science	Biology	0.17	0.05	0.00
General Science	Chemistry	0.16	0.06	0.04
General Science	Physics	0.08	0.05	0.51
Biology	Chemistry	0.34	0.05	0.00
Biology	Physics	0.09	0.52	0.24
Chemistry	Physics	0.24	0.06	0.00

4.7.2 The Impact of Subjects Taught Variable on the Factors that Facilitate Inclusion

Table 11 shows descriptive statistics of the subjects' variables with highest mean found in the chemistry discipline ($M = 3.75$) and the lowest mean found in the general science discipline ($M = 3.37$). Their perceptions mean scores ranged between 3.37 for the General Science specialization to 3.75 for the chemistry specialization.

Table 11: Descriptive statistics of the subjects' variable and the domain of factors that facilitate inclusion

Subjects	Mean	SD
General Science	3.37	0.43
Biology	3.64	0.45
Chemistry	3.75	0.43
Physics	3.65	0.39
Total	3.60	0.44

Table 12 displayed the result of a one-way ANOVA which was used to determine whether there are any statistically significant differences between the groups based on participants' specializations. The results of this analysis showed that there is statistically significant difference between the participants based on their specializations, $F(3, 127) = 13.19, p \leq 0.00$.

Table 12: One-Way ANOVA of the subjects' variables with regards to factors that facilitate inclusion

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.26	3	0.75	4.05	0.00
Within Groups	23.66	127	0.19		
Total	25.92	130			

Since, there is a statistically significant difference between the groups in the views of inclusions based on participants' specializations, a Tukey post-hoc comparison test was used to identify the source of significant differences emerged in ANOVA analysis. Results of the post-hoc test, which are presented in table 13 shows that there is significance between General Science teachers and Chemistry teachers (Mean Difference = 0.38, $p \leq 0.01$). This is followed by the views of General Science teachers and Biology teachers (Mean Difference = 0.27, $p \leq 0.04$).

Table 13: Post-Hoc tests of the subjects' variables with regards to factors that facilitate inclusion

Subject Taught (I)	Subject Taught (J)	Mean Difference (I-J)	Std. Error	Sig.
General Science	Biology	0.27	0.10	0.04
General Science	Chemistry	0.38	0.01	0.01
General Science	Physics	0.28	0.11	0.06
Biology	Chemistry	0.11	0.11	0.72
Biology	Physics	0.02	0.10	0.99

Chemistry	Physics	0.09	0.12	0.85
-----------	---------	------	------	------

4.7.3 The Impact of Subjects Taught Variable on the Factors that Impede Inclusion

Table 14 shows descriptive statistics of the subjects' variables with the highest mean found in the biology subject ($M = 3.17$) and the lowest mean found in the chemistry subject ($M = 2.54$). Their perceptions mean scores ranged between 2.54 and 3.17.

Table 14: Descriptive statistics of the subjects' variable and the domain of factors that impede inclusion

Subjects	Mean	SD
General Science	3.10	0.48
Biology	3.17	0.62
Chemistry	2.54	0.23
Physics	2.98	0.74
Total	3.00	0.61

Table 15 displayed the result of a one-way ANOVA which was used to determine whether there are any statistically significant differences between the groups based on participants' specializations. The results of this analysis showed that there is statistically significant difference between the participants based on their specializations, $F(3, 127) = 13.19, p \leq 0.00$.

Table 15: One-Way ANOVA of the subjects' variables with regards to factors that impede inclusion

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6.52	3	2.17	6.63	0.00
Within Groups	41.60	127	0.33		
Total	48.13	130			

Since, there is a statistically significant difference between the groups in the views of inclusions based on participants' specializations, a Tukey post-hoc comparison test was used to identify the source of significant differences emerged in ANOVA analysis. Results of the post-hoc test, which are presented in table 16 shows that there is significance between Biology teachers and Chemistry teachers (Mean Difference = 0.62, $p \leq 0.00$). This is followed by General Science teachers and Chemistry teachers (Mean Difference = 0.56, $p \leq 0.003$). Concluding with the difference between Chemistry teachers and Physics teachers (Mean Difference = 0.43, $p \leq 0.04$).

Table 16: Post-Hoc tests of the subjects' variables with regards to factors that impede inclusion

Subject Taught (I)	Subject Taught (J)	Mean Difference (I-J)	Std. Error	Sig.
General Science	Biology	0.06	0.13	0.96
General Science	Chemistry	0.56	0.16	0.00
General Science	Physics	0.12	0.15	0.83
Biology	Chemistry	0.62	0.14	0.00
Biology	Physics	0.19	0.13	0.49
Chemistry	Physics	0.43	0.16	0.03

To explain the differences in the science teachers' views, a close look at their backgrounds in terms of their prior knowledge (science courses / PD activities) of SSIs are presented in table 17. The results displayed are the percentages of science teachers that attended courses or professional development in each of the specializations taught. With regards to the highest percentages of courses taken they are found in the chemistry subject, where 16.79% of teachers in the chemistry specialization had taken courses at undergraduate level. However, only 11.45% of teachers in the General science specialization had taken courses in SSIs at the

undergraduate level. As for professional development, it is also found that 15.74% of teachers in the chemistry specialization had taken professional development courses.

Only 8.40% of Biology teachers had taken professional development courses in SSIs.

Table 17: Descriptive statistics of the percentages teachers that had taken courses or professional development in each of the specializations

Specializations	Courses Taken	Professional Development
Chemistry	16.79%	15.74%
General Science	11.45%	11.45%
Physics	12.21%	13.27%
Biology	16.03%	8.40%

4.8 Summary of Results

This chapter focused on reporting the findings of the study. First results showed the highest mean was found in the domain of the views of science teachers with regards to the inclusion of SSIs into the curriculum. Science teachers' views showed they agree with the inclusion of SSIs into the curriculum however, the lowest perceived item of inclusion is that SSIs should be compulsory in the science curriculum ($M = 3.46$). Teachers' views also indicated that resources, teaching strategies and knowledge are the top three factors that facilitate the inclusion of SSIs into the curriculum. They also indicated that teaching strategies for real classroom situations, maturity of students and the influence of SSIs on participation levels are the top three factors that may impede the inclusion of SSIs into the curriculum. There were statistically significance differences between the views of the science teachers that studied SSI courses or teachers that did not study SSI courses with regards to inclusion of SSIs into the curriculum and the teachers who have undergone PD courses about SSIs and teachers who have not. There was a significance difference also between the views of the teachers that studied SSI courses or teachers that did

not study SSI courses with regards to factors that facilitate inclusion of SSIs into the curriculum and the teachers who have undergone PD courses about SSIs and teachers who have not. As for the factors that may impede the inclusion of SSIs it was found that there is a statistically significant difference between experienced teachers and novice teachers.

There were also statistically significant differences between the views of teachers with regards to inclusion, factors that facilitate and impede the inclusion of SSIs into the curriculum based on their specializations (subject taught). It was found that chemistry teachers had the highest perceptions in the views about inclusion and the factors that facilitate inclusion and had the highest percentage in PD courses and courses taken in SSIs.

Chapter 5: Conclusion

5.1 Chapter Overview

The purpose of this study is to investigate science teachers' perceptions of the inclusion of SSIs in the curriculum and explore factors that could facilitate and impede the inclusion of these issues in the school curriculum in Al Ain. The aim of this chapter is to discuss the data presented in chapter 4. It also presents comparisons of the results obtained from this study with the ones presented from previous research studies as reported in literature. The findings of the study are then discussed in relation to the research questions and the context of this study. Finally, the chapter concludes with recommendations for further research.

5.2 Domains of the Views of Science Teachers

The three domains that were analyzed in the study include the (1) views of inclusion, (2) views of factors that may facilitate inclusion and the (3) views of factors that may impede inclusion. The highest perceived domain is the views of teachers about inclusion ($M = 3.94$). The science teachers had a general positive view about including SSIs in the curriculum. This agrees with the previous research findings conducted by Lee, Abd-El-Khalick and Choi (2006) where there was a general positive view about addressing SSIs in the curriculum. The context of Lee, Abd-El-Khalick and Choi (2006) study was Korea and Korean secondary science teachers' perception of SSIs. Also, in a study by Yilmaz Kara (2012) in Turkey, 102 pre-service teachers perceived a need to address SSI positively, when asked to answer a questionnaire comprising of Likert type and open ended questions. The pre-service teachers had moderate personal teaching efficacy beliefs related to teaching SSIs.

5.3 Science Teachers' Views of the Inclusion of SSIs in the Curriculum

The science teachers' views of the inclusion of SSIs in the curriculum showed that the highest perceived items include their view of the need of students to learn and enhance their ability to decide their own positions about SSIs in science; about increasing the student's interests in those issues, students need to be concerned with SSIs related to science and technology and the necessity of including SSIs into the science class. These results support the findings reported by Dawson and Venville (2013) where students that were subjected to SSIs had experienced an increase in their argumentation and informal reasoning skills - an indication of the importance of SSIs in maximizing student learning at both conceptual and procedural levels. As indicated by Lee, Abd-El-Khalick and Choi (2006) it is important to include SSI topics in the curriculum because it raises students' decision making skills, it also gives students a better understanding of science and how it relates to solving personal and social problems. Furthermore, Lee, Abd-El-Khalick and Choi (2006) also showed that teachers believe that incorporating SSIs would enhance debating skills and the conceptions of nature of science in students. In the study by Kara (2012), the pre-service biology teachers believed that SSI inclusion may maximize the potential for classroom discussions and debates and hence providing students with opportunities to practice their decision-making skills. Other teachers also noted that students will focus more on problem-solving and applying their factual knowledge to real-life scenarios.

The lowest perceived items in the participants' views of inclusion include items related to incorporating SSIs into religion and ethics classes instead of science ($M = 2.79$). This could be due to teachers' beliefs that in science classes there would be a systematic study of these issues while in religion/ethics classes these issues may be

viewed from religion/ethical perspectives which may not achieve the stated goals of scientific literacy. In religion/ethics classes, teachers' beliefs about these issues may also be transferred to students (as a given) instead of giving students an opportunity to form their own opinions and arguments. However, it is also found that the teachers also view that SSIs should not be a compulsory part of the curriculum ($M = 3.46$). This may be due to the teachers' hesitance in including such topics as a compulsory part of the curriculum and hence become obliged to complete this unit with limited time available and not enough resources to support the teaching and learning of these topics. Other teachers may be hesitant with regards to the influence and resistance of the culture and hence, may include them as an option giving both students and parents an opportunity to cover these topics or choose to not subject their children to such issues. Teachers may also not be confident in discussing such topics with their students especially when introducing such issues and not including their own opinions into the teaching strategies. This may have been the reason as to which they may have chosen the 'safe' side and agreed with having SSIs as an optional part of the curriculum. In the study by Kara (2012), teacher candidates had a concern regarding imposing their own values on students, although this is a naïve response as it means the teachers would believe that students 'absorb' their teachers' views. It may be the case in this study that teachers' views, despite the confidence shown in the ability to include SSIs in the curriculum, tend to adapt the Korean perspective in not to impose their own perspectives on students.

Ozden (2015) explored the views of prospective elementary school teachers about SSIs, it was found that teachers viewed SSIs as being useful for students to consider the ethical problems and interpret the outcomes of SSIs. This indicates that teachers viewed the students as ethical decision makers instead of 'receivers' of information

only. They also believe that SSIs help students gain higher order thinking skills including argumentation, opinion development, scientific process skills and creativity.

5.4 Science Teachers' Views of the Factors that Facilitate Inclusion

When the science teachers' views of the factors that facilitate inclusion were analyzed it was found that the highest perceived items are the teachers views about having the teaching strategies that allow them to deal with SSIs in science class ($M = 3.82$), their confidence of using assessment strategies to assess SSIs ($M = 3.73$) and having the knowledge necessary to effectively teach SSIs. According to these results teachers felt that they have the necessary knowledge of pedagogy to deal with SSIs in their classroom and therefore felt that such pedagogical knowledge is an important issue to be considered as a facilitating factor. However, with the high confidence in their ability to handle SSIs, teachers still have some concerns regarding how to find resources to teach SSIs. The lowest perceived item is having enough resources to develop their teaching and learning materials about SSIs ($M = 3.22$). Teachers seem confident in their own knowledge and strategies of teaching, learning and assessment. These findings contrast with those reported by Lee, Abd-El-Khalick and Choi (2006), where teachers were found to have a low Personal Science Teaching Efficacy (PSTE) which encompasses their content and pedagogical knowledge and strategies to address these issues. They also found that participants felt that it is difficult to assess students especially in moral and ethical issues. Based on the high perceptions shown for items related to the ability to handle SSIs in the classroom, teachers of the present study can be said as having a relatively High Personal Science Teaching Efficacy (PSTE) compared to those reported by Lee, Abd-El-Khalick and Choi (2006). As for the study by Kara (2012), pre-service teachers had a similar

perception as the current study. They perceived themselves as having the content knowledge, and pedagogical expertise needed to teach SSI in high school biology classrooms. They also indicated confidence in their abilities to develop resources related to teaching about SSIs this contrasts with the current study. In this current study, teachers' have a higher PSTE that are similar to the Turkish study of pre-service teachers. This can indicate the naïve approach a teacher may have before experiencing the true nature of teaching and the implications of a real-life experience.

5.5 Science Teachers' Views of the Factors that Impede Inclusion

When the teachers' views of the factors that may impede inclusion were analyzed it was found that the highest perceived items include the possibility of dealing with SSIs using various teaching strategies in "real" classroom situations ($M = 3.6$), their belief that students are not mature enough to understand SSIs ($M = 3.39$), and their belief that students' language ability limits their ability to understand SSIs ($M = 3.21$). In a similar study by Kara (2012) it was found that Turkish pre-service teachers identified that the factors that may act as a barrier to inclusion include lack of time, lack of resources, and classroom difficulties with incorporating strategies including small group discussions, role playing and assessment strategies. As for Lee, Abd-El-Khalick and Choi (2006) it was found that Korean teachers perceived the lack of time and resources where the barriers that impede the inclusion of SSIs into the curriculum. The views of the participants of this study were different than both Korean and Turkish teachers, this could be due to the difference in culture or understanding of SSIs. Teachers of the current study may be relating inclusion of SSIs to the current issues that they may face when teaching their own curriculum. Hence, they may already face issues with dealing with science topics in real-life

situations which has become a necessity in teaching any topic. They may also find that their students are not subjected to these topics regularly which hence, may limit their ability of comprehending these topics due to their maturity level. Another very important factor that teachers may face is the language ability. Students are taught sciences in the English language (which is not their first language) and hence, they may face some problems in comprehending these issues due to their limited command of the language of instruction.

All in all, teachers find that the factors that facilitate the inclusion of SSIs are encircling their pedagogical content knowledge including teaching and assessment strategies and their knowledge of these issues. Furthermore, they did not perceive time, motivation of students and confusion of students regarding religious values as issues that may impede the inclusion of SSIs. Teachers in the current study identified teaching strategies in “real” classroom situations, the maturity of their students and their language ability as factors that may impede the inclusion of SSIs into the curriculum. As the results showed, impeding and facilitating factors were inter-related and interdependent.

5.6 The Impact of Science Teachers’ Demographic Variables on the Perception of SSIs

Teachers’ demographic variables were collected and analyzed against the three domains of inclusion, factors facilitating inclusion and factors impeding inclusion. These variables are the impact of gender, type of school (public versus private), teaching experience, training in SSIs, and attending SSIs professional development training. A t-test and an analysis of variance (ANOVA) were employed to compare

the means pertaining to these demographic variables to test for any statistically significant differences between participants based on these demographic variables.

5.6.1 The Impact of Science Teacher's Demographic Variables on the Views about Inclusion

Within the demographic variables there was no statistically significant differences between male and female, public versus private schools and experienced and novice participants as shown in Table 5, indicating that teachers' views are similar amongst these variables in this domain. However, amongst the variable prior knowledge of SSIs as demonstrated by SSI courses studied at the undergraduate level, there was a statistically significant difference between the two groups. There was also a statistically significant difference between the variables of Professional Development (PD) that was taken versus PD that was not taken. It can be assumed that with teachers who have been subjected to both SSI courses and PD they have a more realistic view of SSIs since they have more experience. Teachers who have been subjected to these topics (either through PD or course or both) may know more about the importance of including such topics in the curriculum, and hence have developed high regards for SSIs. In the study by Kara (2012) of pre-service teachers' perceptions of SSIs, it was also found that there was no difference male and female teacher candidates in terms of perceptions. In the same study the teachers went through professional development activities appeared to promote their perceptions about personal teaching efficacy and how their values may impede the inclusion of SSIs into the curriculum. Hence, enunciating the importance of teacher having professional development or knowledge of SSIs in courses taken at undergraduate level. SSIs are multi-disciplinary in nature and so it is important for teachers to have knowledge of subject matter and related economic, political and social issues.

5.6.2 The Impact of Science Teacher's Demographic Variables on the Views about Factors that Facilitate the Inclusion of SSIs into the Curriculum

Within the demographic variables there was no statistically significant differences attributed to gender, type of school, and the teaching experience of participants.

However, prior knowledge of SSIs as exemplified by having studied SSI courses at undergraduate level, showed a statistically significant difference between the two groups. There was also a statistically significant significance between the variables of Professional Development (PD) that was taken versus PD that was not taken. It can be assumed that teachers who have had real-life experiences, teacher who have had studied SSI courses ($M = 3.68$), and teachers who had taken PD ($M = 3.73$) have a higher view of what are the factors that may facilitate the inclusion of SSIs into the curriculum. This is a repetition of the case of inclusion of SSIs into the curriculum where teachers that have had these experiences had higher perceptions, this can be due to the teachers having a moral-ethical understanding of science and technology and have been given opportunities to examine and reflect on their own positions and values hence, feeling more confident in including SSIs into the curriculum and knowing what may facilitate the inclusion.

To further enunciate the need of SSI courses to be administered in teaching programs, Ozturk and Tuzun (2016) investigated 647 Turkish pre-service teachers that completed an open-ended questionnaire. The questionnaire aimed at exploring the teachers' informal reasoning regarding SSIs, their epistemological beliefs and the relationship between their informal reasoning and epistemological beliefs. Although the teachers had a preference to generating evidence based arguments they did not provide quality evidence to support their claims. As for their reasoning skills, the teachers mostly used supportive argument construction.

5.6.3 The Impact of Science Teacher's Demographic Variables on the Views about Factors that Impede the Inclusion of SSIs into the Curriculum

Within the demographic variables there was no statistically significant differences attributed to gender, type of school, prior knowledge of SSIs, and professional training (PD) in SSIs as shown in Table 7. However, amongst the variables teaching experience (experienced versus novice) there was a statistically significant difference between the two groups. However, due to the small to medium effect size (effect size = 0.48) and hence it may have little educational importance. Although this can be considered to have no impact on policy changes it does agree with the study by Kara (2012), the perceptions of pre-service teachers were studied about the inclusion of SSIs and factors that may impede or facilitate this inclusion, it was noted that of the limitations that of the study is the experience of these pre-service teachers. Teachers who have not yet become in-service and hence have not added needed years to their experience may have not developed a repertoire of resources and experience needed to how instruction might be conducted. In this study, amongst the impeding factors is the “real-life” strategies of addressing SSIs in the curriculum and hence, teachers with less experience may not have the confidence in finding these strategies or have enough information in solving impeding factors such as those mentioned. Hence, teachers with more experience had a lower view of the factors that may impede the inclusion of SSIs, as they have the experience to solve these factors ($M = 2.94$).

5.7 The Impact of Science Teachers' Specialization (subject taught) on the Perception of SSIs

A one-way ANOVA was used to compare the means of participants based on their specializations (four specializations). Participants were divided into four specializations based on their responses, namely General Science, Biology,

Chemistry and Physics. The analysis was done across the 3 domains which are inclusion of SSIs, the factors that facilitate the inclusion of SSIs and the factors that impede the inclusion of SSIs into the curriculum.

5.7.1 The Impact of Specialization (subjects taught) Variable on the Views about Inclusion

The results of the ANOVA analysis showed that there is statistically significant difference between the participants based on their specialization. The highest perceptions were reported by the chemistry teachers ($M = 4.16$) and the lowest perceptions was reported by the biology teachers ($M = 3.82$). Since, there is a statistically significant difference between the groups in the views of inclusions based on participants' specializations, a Tukey post-hoc comparison test was used to identify the source of this significant differences that detected by ANOVA analysis. Results of the post-hoc test, shows that there is a statistically significance differences between biology teachers and chemistry teachers. This is followed by the views of Chemistry teachers and physics teachers. There was also a statistically significant difference between the views of General science teachers and Biology teachers and the General science teachers and the Chemistry teachers. Although it was expected by the researcher that the highest perception would be in Biology as the most known subjects of SSIs are found in Biology, however chemistry teachers were the highest perceiving teachers that promoted inclusion. There are numerous SSI topics that can be explored in each of the subjects including doping in professional sports in Chemistry Education (Stolz, Witteck, Marks and Eilks, 2013). In physics, energy related topics that are linked with sustainability are the socioscientific topics that can be explored (Sakschewski, Eggert, Schneider, and Bögeholz, 2014).

5.7.2 The impact of Subjects Taught Variable on the Factors that Facilitate Inclusion

As for the subject that had the highest perception with regards to the factors that facilitate inclusion, it was chemistry ($M = 3.75$). The result of a one-way ANOVA which was used to determine whether there are any statistically significant differences between the groups based on participants' specializations showed that there is statistically significant difference between the participants based on their specializations. Since, there is a statistically significant difference between the groups in the views of inclusions based on participants' specializations, a Tukey post-hoc comparison test was used to identify the significant differences emerged in ANOVA analysis. Results of the post-hoc test, shows that there is significance between General Science teachers and Chemistry teachers. This is followed by the views of General Science teachers and Biology teachers. This again confirms that that the chemistry teachers have the highest perceptions with regards to inclusion and the factors that may facilitate its inclusion. It is possible that the chemistry teachers may be the most aware and have previously explored teaching SSI topics in their curriculum and realize the necessity of including these topics on science students. The lowest perceived specialization was found to be general science ($M = 3.37$), this may be that most of the teachers that teach general science are of the lower secondary teachers and may have not been subjected to any SSI topics in their more general content. This can also be explained with regards to the prior knowledge as indicated by the courses taken at undergraduate level and PD taken, it was found that chemistry teachers had the highest percentages. The Biology teachers had the lowest PD taken percentage, explaining that the lowest mean amongst the inclusion factor.

5.7.3 The Impact of Subjects Taught Variable on the Factors that Impede Inclusion

As for the subject that had the highest perception in the factors that impede inclusion it was found to be the Biology specialization ($M = 3.17$) as for the lowest perception it is in Chemistry ($M = 2.54$). The result of a one-way ANOVA which was used to determine whether there are any statistically significant differences between the groups based on participants' specializations showed that there is statistically significant difference between the participants based on their specializations. Since, there is a statistically significant difference between the groups in the views of inclusions based on participants' specializations, a tukey post-hoc comparison test was used to identify the significant differences emerged in ANOVA analysis. Results of the post-hoc test, shows that there is significance between Biology teachers and Chemistry teachers. This is followed by General Science teachers and Chemistry teachers. Concluding with the difference between Chemistry teachers and Physics teachers. These results further confirm that chemistry teachers had the lowest perceptions of the factors that impede inclusion and hence, although they are aware of some of these factors but with experience it is easier to overcome these factors. This may also be due to the chemistry teachers being more involved more in PD sessions and taking courses in SSIs. It was found that the highest percentage of teachers that had taken PD or courses at undergraduate level were in the chemistry specialization. This is also in agreement of the factors that may impede the inclusion of SSIs with regards to PD or courses taken (excluding the specialization factor) was found to have the lowest perception of the factors that may impede the inclusion of SSIs, as they have the experience to solve these factors ($M = 2.94$).

5.8 Summary of Discussion

5.8.1 What are Al Ain Science Teachers' Views of Inclusion of SSIs?

Results of this study showed that Al Ain teachers agreed with the inclusion of SSIs into the curriculum. Their highest perceived items include their view about the need of students to learn and enhance their ability to decide their own positions about SSIs in science classes, about increasing the students' interests in these issues, the students' needs to be concerned with SSIs related to science and technology and the necessity of including SSIs into the science class.

5.8.2 What are the Factors that Impede or Facilitate including SSIs in the Al Ain Secondary School Science Classrooms?

Al Ain teachers identified that resources, teaching strategies and knowledge are the top three factors that facilitate the inclusion of SSIs into the curriculum. They also indicated that teaching strategies for real classroom situations, maturity of students and the influence of SSIs on participation levels are the top three factors that may impede the inclusion of SSIs into the curriculum.

5.8.3 What is the Impact of Science Teachers' Demographic Variables (gender, experience, type of school and background) on the Perception of SSIs?

There were statistically significance differences between the views of the teachers based on their prior knowledge as measured by courses related to SSIs studied with regards to inclusion of SSIs into the curriculum and based on teachers who have undergone PD courses about SSIs against those who did not. There was a significance difference also between the views of the teachers that studied SSI courses or teachers that did not study SSI courses with regards to factors that

facilitate inclusion of SSIs into the curriculum and the teachers who have undergone PD courses about SSIs and teachers who have not. As for the factors that may impede the inclusion of SSIs it was found that there is a statistically significant difference between experienced teachers and novice teachers. There were also statistically significant differences between the views of teachers with regards to inclusion, factors that facilitate and impede the inclusion of SSIs into the curriculum based on their specializations (subject taught).

5.9 Recommendations for Further Research

The findings reported in this study showed that SSIs is an important issue in science curriculum as indicated by the views expressed by the participating science teachers. The findings reported here also may contribute to further exploring the interaction of teachers and the science curriculum, especially with their views on adapting the curriculum to better suit the needs of students nowadays. Although this study is small scale and was done in Al Ain, and hence the findings reported here may be interpreted with caution, it can act as a precursor to larger studies that may be done in the region to better understand the views of teachers in including SSIs into the curriculum. To better expand upon this study, the following recommendations may be suggested:

- **Science teachers will develop better understanding of the influence of SSIs on student learning if they are subjected to courses at undergraduate level about the inclusion of SSIs into the curriculum and the different topics linked to the different specializations:** This allows teachers to be more aware of the link between raising scientific literacy, promoting argumentation skills and enhancing their decision-making skills of

students. Teachers also link the different topics to different subjects that they may teach and using effective teaching strategies to increase influence on students' participation level.

- **Professional Development activities on the how to address SSI topics in the curriculum will greatly enrich science teachers' understanding of issues related to SSIs:** Teachers views of the incorporation of SSIs may change based on their increase knowledge of SSIs and how to teach them. This also allows teachers to gain teaching strategies for real classroom situations of including SSIs into their own teaching and how to increase the influence of addressing SSIs in classrooms on students' participation levels.
- **Further study on how science teachers interact with curriculum materials in real-life classrooms situations will benefit teachers' interaction with their students and hence promote scientific literacy among their students:** This can be very effective in learning in real time what the factors that impede of facilitate inclusion may be (not hypothetically). It could also serve as a precursor to further expand that study to incorporate specific strategies that have been proven effective in other international studies and explore them in this region.
- **Further study on how student developed SSIs awareness will contribute to our understanding of difficulties students encounter when learning about SSIs. This can be done to explore what type of skills have been enhanced in students, the participation levels of students and the views of students with regards to the inclusion of SSIs into the curriculum.**

This page is left blank intentionally.

References

- Aikenhead, G. S. (2003, August). Review of research on humanistic perspectives in science curricula. In 4th Conference of the European Science Education Research Association (ESERA), *Research and the Quality of Science Education*. Noordwijkerhout, The Netherlands (august 19-23).
- Albe, V. (2008). Developing and acting upon one's conception of the nature of science: A follow-up study. *Journal of Research in Science Teaching*, 37, 563– 581
- Allchin, D. (1999). Values in science: An educational perspective. *International Journal of Science Education*, 27, 199–214.
- Barrue, C. & Albe, V. (2013). Finding common ground to study and implement character education: Integrating structure and content in moral education. *Journal of Research in Education*, 8(1), 3 – 8.
- Berne, B. (2014). Progression in Ethical Reasoning When Addressing Socio-scientific Issues in Biotechnology. *International Journal of Science Education*, 36(17), 2958-2977.
- Berkman, M. B., Pacheco, J. S., & Plutzer, E. (2008). Evolution and creationism in America's classrooms: a national portrait. *PLoS biology*, 6(5), e124.
- Berkowitz, M., & Simmons, P. (2003). Integrating science education and character education. In D. Zeidler (Ed.), *Journal of Moral Education*, 30, 377–398.
- Bryant, J., & Baggott la Velle, L. (2003). A bioethics course for biology and science education students. *Journal of Biological Education*, 37(2), 91-95.
- Carson, K., & Dawson, V. (2016). A teacher professional development model for teaching socioscientific issues. *Teaching Science*, 62(1), 28.
- Chang Rundgren, S. N., & Rundgren. C.-J. (2010). SEE-SEP: From a separate to a holistic view of socioscientific issues. *Asia-Pacific Forum on Science Learning and Teaching*, 11(1), Article 2.
- Chung, Y., Yoo, J., Kim, S. W., Lee, H., & Zeidler, D. (2016). ENHANCING STUDENTS' COMMUNICATION SKILLS IN THE SCIENCE CLASSROOM THROUGH SOCIOSCIENTIFIC ISSUES. *International Journal of Science & Mathematics Education*, 14(1).
- Chin, C. C., Yang, W. C., & Tuan, H. L. (2016). Argumentation in a socioscientific context and its influence on fundamental and derived science literacies. *International Journal of Science and Mathematics Education*, 14(4), 603-617.

- Dagher, Z. R., & BouJaoude, S. (2011). Science education in Arab states: bright future or status quo?. *Studies in Science Education*, 47(1), 73-101.
- Dawson, V & Venville, G. (2013). Introducing high school biology students to argumentation about socioscientific issues. *Canadian Journal of Science, Mathematics and Technology Education*, 13(4), 356-372. doi: 10.1080/14926156.2013.845322
- Dawson, V. (2007). An exploration of high school (12–17 year old) students' understandings of, and attitudes towards, biotechnology processes. *International Journal of Science Education*, 26, 411–423.
- Day, S. P. & Bryce, T. G. K. (2011). Does the discussion of socio-scientific issues require a paradigm shift in science teachers' thinking? *International Journal of Science Education*, 33(12), 1675- 1702.
- Dickson, M., Kadbey, H. & McMinn, M. (2015). *Els-cdmcom*. Comparing Reported Classroom Practice in Public and Private Schools in the United Arab Emirates. Science Direct. Retrieved 12 December, 2015, from http://ac.els-cdn.com/S1877042815023393/1-s2.0-S1877042815023393-main.pdf?_tid=0e990c3e-9af0-11e5-97fd-00000aacb362&acdnat=1449279333_fea575adcedb1a8a8bc1115dae6361b9
- Driver, R., Newton, P., & Osborne, J. (2000). Establishing the norms of scientific argumentation in classrooms. *Journal of Research in Science Teaching*, 39, 253–282.
- Duschl, R. A. (2007). *Quality argumentation and epistemic criteria*. In *Argumentation in science education* (pp. 159-175). Springer Netherlands.
- Eastwood, J. L., Sadler, T. D., Zeidler, D. L., Lewis, A., Amiri, L., & Applebaum, S. (2012). Contextualizing nature of science instruction in socioscientific issues. *International Journal of Science Education*, 34(15), 2289-2315. doi: 10.1080/09500693.2012.667582
- Edge, H. L. (1986). *Is Parapsychology a Science? Foundations of Parapsychology*.
- Ekborg, M., Ottander, C., Silfver, E. & Simon, S. (2013). Embodying Science: A feminist perspective on learning. *Journal of Research in Science Teaching*, 38, 282– 295.
- Foong, C.-C., & Daniel, E. G. S. (2013). Students' argumentation skills across two socio-scientific issues in a Confucian classroom: Is transfer possible? *International Journal of Science Education*, 35(14), 2331-2355. doi: 10.1080/09500693.2012.697209
- Gay, Mills, & Airasian (2011). *Educational research: Competencies for analysis and applications* (10th edition).

- Goldfarb, T., & Pritchard, M. (2000). Ethics in the science classroom: An instructional guide for secondary school science teachers with model lessons for classroom use. *International Journal of Science Education*, 23, 247–261.
- Goodrum, D., Hackling, M., & Rennie, L. (2001). The status and quality of teaching and learning of science in Australian schools. *International Journal of Science Education*, 10, 17–27.
- Gutierrez, S. B. (2014). Integrating Socio-Scientific Issues to Enhance the Bioethical Decision-Making Skills of High School Students. *International Education Studies*, 8(1), p142.
- Hand, B., Alvermann, D., Gee, J., Guzzetti, B., Norris, S., Phillips, L., et al. (2003). Message from the “Island Group”: What is scientific literacy? *Journal of Research in Science Teaching*, 40, 607–615.
- Hodson, D. (2003). Time for action: Science education for an alternative future. *International Journal of Science Education*, 25, 645–670.
- Ideland, M., Malmberg, C., & Winberg, M. (2011). Culturally equipped for socio-scientific issues? A comparative study on how teachers and students in mono and multiethnic schools handle work with complex issues. *International Journal of Science Education*, 33(13), 1835-1859. doi: 10.1080/09500693.2010.519803
- Kara, Y. (2012). Pre-service biology teachers’ perceptions on the instruction of socio-scientific issues in the curriculum. *European Journal of Teacher Education*, 35(1), 111-129. doi: 10.1080/02619768.2011.633999
- Karahan, E. (2015). Case Studies of Secondary School Teachers Designing Socio-Scientific Issues-Based Instruction and Their Students’ Socio-scientific Reasoning. *The university of Minnesota*. Retrieved from http://conservancy.umn.edu/bitstream/handle/11299/174863/Karahan_umn_0130E_15931.pdf?sequence=1&isAllowed=y
- Khishfe, R. (2012). Relationship between nature of science understandings and argumentation skills: A role for counterargument and contextual factors. *Journal of Research in Science Teaching*, 49(4), 489-514.
- Khishfe, R. (2014). Explicit nature of science and argumentation instruction in the context of socioscientific issues: An effect on student learning and transfer. *International Journal of Science Education*, 36(6), 974-1016. doi: 10.1080/09500693.2013.832004
- Khishfe, R., Alshaya, F. S., BouJaoude, S., Mansour, N., & Alrudiyan, K. I. (2017). Students’ understandings of nature of science and their arguments in the context of four socio-scientific issues. *International Journal of Science Education*, 39(3), 299-334.

- Kolstø, S. D., Bungum, B., Arnesen, E., Isnes, A., Kristensen, T., Mathiassen, K. & et al. (2006). Science Students' Critical examination of Scientific Information Related to Socioscientific Issues. *Journal of Youth and Adolescence*, 21, 632-655.
- Lederman, N. G., Abd-El-Khalick, F., Bell, R. L., & Schwartz, R. S. (2002). Views of nature of science questionnaire: Toward valid and meaningful assessment of learners' conceptions of nature of science. *Journal of research in science teaching*, 39(6), 497-521.
- Lee, H., Abd-El-Khalick, F. & Choi, K. (2006) Korean science teachers' perceptions of the introduction of socio-scientific issues into the science curriculum. *Canadian Journal of Science, Mathematics and Technology Education*, 6(2), 97-117. doi: 10.1080/14926150609556691
- Lee, H., Yoo, J., Choi, K., Kim, S.-W., Krajcik, J., Herman, B. C., & Zeidler, D. L. (2013). Socioscientific issues as a vehicle for promoting character and values for global citizens. *International Journal of Science Education*, 35(12), 2079-2113. doi: 10.1080/09500693.2012.749546
- Levinson, R., & Turner, S. (2001). Valuable lessons: Engaging with the social context of science in schools. *Journal of Research in Science Teaching*, 39, 35–62.
- Levinson, R., (2006). Towards a theoretical framework for teaching controversial socio-scientific issues. *International Journal of Science Education*, 28(10), 1201-1224.
- Morris, H. (2014). Socioscientific issues and multidisciplinary in school science textbooks. *International Journal of Science Education*, 36(7), 1137-1158. doi: 10.1080/09500693.2013.848493
- Ottander, C. & Ekborg, M. (2012). Students' experience of working with socioscientific issues: A quantitative study in secondary school. *Journal of Research in Science Teaching*, 39(10), 1016– 1031.
- Özden, M. (2015). Prospective Elementary School Teachers' Views about Socioscientific Issues: A Concurrent Parallel Design Study. *International Electronic Journal of Elementary Education*, 7(3), 333.
- Ozturk, N., & Yilmaz-Tuzun, O. (2016). Preservice Science Teachers' Epistemological Beliefs and Informal Reasoning Regarding Socioscientific Issues. *Research in Science Education*, 1-30.
- Raven, S., Klein, V., & Namdar, B. (2016). Making Critical Friends. *The Science Teacher*, 83(2), 23.
- Reiss, M. (1999). Teaching ethics in science. *International Journal of Science Education*, 34, 115–140.

- Reiss, M. (2007). In D. Corrigan, J. Dillon, & R. Gunstone (Eds.), The re-emergence of values in science education. *Journal of Research in Science Teaching*, 38, 1038–1056.
- Rennie, L. (2005). Science awareness and scientific literacy. *Journal of Research in Science Teaching*, 51(1), 10–14.
- Ritchie, S. M., Tomas, L. & Tones, M. (2011). Writing stories to enhance scientific literacy. *International Journal of Science Education*, 33(5), 685-707. doi: 10.1080/09500691003728039
- Roberts, D. (2007). Scientific literacy/Science literacy. In S. Abell & N. Lederman (Eds.), *Journal of Research in Science Teaching*, 21, 1–15.
- Roth, W.M., & Barton, A.C. (2004). Rethinking scientific literacy. *Handbook of research on science education* Mahwah, NJ: Lawrence Erlbaum Associates. New York: Routledge Falmer.
- Roth, W., & Lee, S. (2002). Scientific literacy as collective praxis. *International Journal of Science Education*, 11, 1– 24.
- Rudsberg, K., Öhman, J. & Östman, L. (2013). Analyzing students' learning in classroom discussions about socioscientific issues. *International Journal of Science Education*, 25(6), 645– 670.
- Rundgren, S. N. C. (2011). Post It!--A Cross-Disciplinary Approach to Teach Socioscientific Issues. *Teaching Science*, 57(3), 25-28.
- Sadler, T. D. (2004). Informal reasoning regarding socioscientific issues: A critical review of research. *Journal of research in science teaching*, 41(5), 513-536.
- Sadler, T. D., (2009). Promoting effective science teacher education and science teaching: a framework for teacher decision-making. *International Journal of Science Education*, 7(4), 821-847.
- Sadler, T. D., Barab, S. A., & Scott, B. (2007). What do students gain by engaging in socioscientific inquiry?. *Research in Science Education*, 37(4), 371-391.
- Sadler, T. D., Chambers, F. W., & Zeidler, D. L. (2004). Student conceptualizations of the nature of science in response to a socioscientific issue. *International Journal of Science Education*, 26(4), 387-409. doi:10.1080/0950069032000119456
- Sadler, T. D. & Donnelly, L. A. (2006). Socioscientific argumentation: The effects of content knowledge and morality. *International Journal of Science Education*, 28(12), 1463-1488. doi: 10.1080/09500690600708717

- Sadler, T. D., Romine, W. L., & Topçu, M. S. (2016). Learning science content through socio-scientific issues-based instruction: a multi-level assessment study. *International Journal of Science Education*, 38(10), 1622-1635.
- Sadler, T. D., & Zeidler, D. L. (2004). The morality of socioscientific issues: Construal and resolution of genetic engineering dilemmas. *Journal of Research in Science Teaching*, 39, 341– 368.
- Sadler, T. D., & Zeidler, D. L. (2005b). The significance of content knowledge for informal reasoning regarding socioscientific issues: Applying genetics knowledge to genetic engineering issues. *Journal of Research in Science Teaching*, 37(5), 426– 440.
- Sakschewski, M., Eggert, S., Schneider, S., & Bögeholz, S. (2014). Students' Socioscientific Reasoning and Decision-making on Energy-related Issues— Development of a measurement instrument. *International Journal of Science Education*, 36(14), 2291-2313.
- Saunders, K. (2009). Engaging with controversial science issues—a professional learning programme for secondary science teachers in New Zealand. *International Journal of Science Education*, 21, 745–754.
- Saunders, K. J. & Rennie, L. J. (2013). A pedagogical model for ethical inquiry into socioscientific issues in science. *International Journal of Science Education*, 22(6), 645– 664.
- Solomon, J. (1993). *Teaching Science, Technology and Society. Developing Science and Technology Series*. Taylor and Francis, 1900 Frost Road, Suite 101, Bristol, PA 19007.
- Solomon, J. (1994). Knowledge, values and the public choice of science knowledge. *STS education: International perspectives on reform*, 99-110.
- Stolz, M., Witteck, T., Marks, R., & Eilks, I. (2013). Reflecting socio-scientific issues for science education coming from the case of curriculum development on doping in chemistry education. *Eurasia Journal of Mathematics, Science and Technology Education*, 9(4), 361-370.
- Tal, T., & Kedmi, Y. (2006). Teaching socioscientific issues: classroom culture and students' performances. *Cultural Studies of Science Education*, 1(4), 615-644.
- Tekbiyik, A. (2015). The use of jigsaw collaborative learning method in teaching socio-scientific issues: the case of nuclear energy. *Journal of Baltic Science Education*, 14(2), 237-253.

- Topcu, M. S., Sadler, T. D. & Yilmaz-Tuzun, O. (2010). Preservice science teachers' informal reasoning about socioscientific issues: The influence of issue context. *International Journal of Science Education*, 32(18), 2475-2495. doi: 10.1080/09500690903524779
- Topcu, M. S., Yilmaz-Tuzun, O., & Sadler, T. D. (2011). Turkish preservice science teachers' informal reasoning regarding socioscientific issues and the factors influencing their informal reasoning. *Journal of Science Teacher Education*, 22(4), 313-332. doi: 10.1007/s10972-010-9221-0
- UAE Interact. (n.d.) Education. Retrieved from <http://www.uaeinteract.com/society/education.asp>
- Yager, R. E. (1992). Viewpoint: What we did not learn from the 60s about science curriculum reform. *Journal of Research in Science Teaching*, 29(8), 905-910.
- Zeidler, D. (1997). The role of fallacious thinking in science education. *Journal of Research in Science Teaching*, 34, 483-496.
- Zeidler, D. L., & Keefer, M., (2003). Science teachers' social conscience and the role of controversial issues in the teaching of science. *Journal of Research in Science Teaching*, 40(3), 319-333.
- Zeidler, D. L., & Sadler, T. D. (2008). Social and ethical issues in science education: A prelude to action. *Science & Education*, 17(8), 799-803.
- Zeidler, D. L., Sadler, T. D., Applebaum, S., & Callahan, B. E. (2009). Advancing reflective judgment through socioscientific issues. *Journal of Research in Science Teaching*, 46(1), 74-101. doi: 10.1002/tea.20281
- Zeidler, D., & Keefer, M. (2003). The role of moral reasoning and the status of socioscientific issues and discourse in science education. In D. Zeidler (Ed.), *Journal of Research in Science Teaching*, 23, (pp. 7-38).
- Zeidler, D. L., & Nichols, B. H. (2009). Socioscientific issues: Theory and practice. *Journal of Elementary Science Education*, 21(2), 49-58.
- Zeidler, D., Herman, B. C., Ruzek, M., Linder, A. & Lin, S.S. (2013). Cross-cultural epistemological orientations to socioscientific issues. *Journal of Research in Science Teaching*, 50(3), 251-283. doi: 10.1002/tea.21077

Appendix A – Survey

Teachers' Perceptions of Socio-scientific Issues (SSIs)

تصورات المعلمين حول القضايا الاجتماعية العلمية

The purpose of this survey is to collect information on science teachers' perceptions of the Socio-Scientific Issues (SSI), which are defined in this study as issues that raise controversies within communities and include issues such as human cloning, genetically manufactured food, environmental pollution, radioactive waste disposal and many more (Lee, Abd-El-Khalick and Choi, 2006). The information to be collected will be used to provide recommendations on the status of socio-scientific issues, with the prospect of improving student learning about these issues. For this purpose, you are not required to write your name or reveal your identity. All responses will be treated confidentially and for the research purpose only.

Please note that your participation in this study is on a **voluntary** basis and you may withdraw yourself at any time if you are unable to complete this instrument.

الهدف من هذه الاستبانة هو جمع معلومات من معلمي مادة العلوم حول القضايا الاجتماعية العلمية، المعرفة بالدراسة على أخص القضايا التي تثير جدلاً واسعاً في المجتمعات الإنسانية، منها: الاستنساخ البشري، والمواد الغذائية المعدلة وراثياً، والتخلص من النفايات المشعة، وغيرها الكثير، وفقاً لما ذكره (Lee, Abd-El-Khalick and Choi, 2006). ستستخدم معلومات الاستبانة لتقديم توصيات بشأن تلك القضايا الاجتماعية العلمية، وتحسين تعلم الطلاب حول هذه القضايا، وبناء عليه فأنت لست بحاجة لكتابة اسمك أو الكشف عن هويتك. وغني عن الذكر أن المعلومات الواردة في هذه الاستبانة ستعامل بسرية تامة، ولخدمة أغراض الدراسة فقط، لذا يرجى الإجابة عنها بمصادقية وموضوعية تامة حتى يتحقق الهدف المرجو منها.

لطفًا: المشاركة تطوعية، ولك القرار بالتوقف في أي وقت أو عدم الرد على الأسئلة التي لا ترغب/لا ترغبين بالإجابة عليها.

- استيفاءك بيانات الاستبيان يعني بالضرورة قراءة المعلومات الواردة فيه، والموافقة على المشاركة.
- شاكركم لكم - مقدما - مشاركتكم البناءة للوصول إلى أفضل النتائج.

First, kindly in the biographical information before proceeding to place (√) on the column that best reflects your position on the socio-scientific issues presented in the statements.

أولاً، يرجى تعبئة المعلومات الشخصية قبل البدء في قراءة الاستبانة، ووضع علامة (√) في الخانة التي تعكس موقفكم من القضايا المقدمة.

Part 1: Respondent Background

1. Gender:
 - a) Female
 - b) Male

١. الجنس:
أ. أنثى
ب. ذكر

2. Please choose the type of school you currently work in:

٢. الرجاء اختيار نوعية المدرسة التي تعمل بها:

 - a. Public School
 - b. Private School

أ. مدرسة حكومية
ب. مدرسة خاصة

3. Level/class taught:

٣. المراحل الدراسية التي تدرسها

 - a. Kindergarten
 - b. Primary School (Grade 1 to 5)
 - c. Middle School (Grade 6 to 8)
 - d. Secondary School (Grade 9 to 12)

أ. مرحلة الروضة
ب. مرحلة الابتدائية (الصف الأول للخامس)
ت. مرحلة المتوسطة (الصف السادس للثامن)
ث. مرحلة الثانوية (الصف التاسع للثاني عشر)

4. Subject taught:

٤. المادة العلمية التي تدرسها:

 - a. General Science
 - b. Biology
 - c. Chemistry
 - d. Physics

أ. العلوم العامة
ب. الأحياء
ت. الكيمياء
ث. الفيزياء

5. Teaching experience (in years):

٥. عدد سنوات الخبرة التدريسية:

1	I want to develop teaching and learning materials on socio-scientific issues for my class أريد تطوير مواد التعليم والتعلم في القضايا الاجتماعية العلمية لصفّي					
2	If I can get materials on socio-scientific issues, I am willing to use them in the class إذا كان في إمكاني الحصول على المواد المتعلقة بقضايا اجتماعية علمية، فأنا على استعداد لاستخدامها في الصف					
3	I am willing to participate in a program that helps teachers deal with socio-scientific issues أنا على استعداد للمشاركة في البرنامج الذي يساعد المعلمين للتعامل مع القضايا الاجتماعية العلمية					
4	Introducing socio-scientific issues into science class is necessary إن تقديم القضايا الاجتماعية العلمية في مادة العلوم ضرورية					
5	I think that it is more appropriate to deal with socio-scientific issues in ethics and religion, social studies classes that in science class أعتقد أنه من الأنسب طرح القضايا الاجتماعية العلمية العلمية في مادة الدين أو الدراسات الاجتماعية بدلاً من مادة العلوم					
6	Introducing socio-scientific issues into science classes will increase students interest in these issues إن تقديم القضايا الاجتماعية العلمية في مادة العلوم، يزيد من اهتمام الطلاب بها.					
7	Students need to be concerned with socio-scientific issues related to science and technology الطلاب في حاجة ماسة إلى أن يكونوا مهتمين بالقضايا الاجتماعية العلمية المتعلقة بالعلوم والتكنولوجيا					
8	Students need to learn and enhance their ability to decide their own positions about socio-scientific issues in science class يحتاج الطلاب إلى التعلم وتعزيز قدراتهم لتحديد موقفهم من قضايا اجتماعية علمية في صفوف مادة العلوم					

9	Socio-scientific issues should be a compulsory part of the science curriculum يجب أن تكون القضايا الاجتماعية العلمية جزءا إلزاميا من مناهج العلوم					
10	Socio-scientific issues should be an optional part of the science curriculum ينبغي أن تكون القضايا الاجتماعية العلمية جزءا اختياريا من مناهج العلوم					

عنصر	Item	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
11	I have the teaching strategies that allow me to deal with socio-scientific issues in science classes عندي استراتيجيات التدريس التي تسمح لي بالتعامل مع القضايا الاجتماعية العلمية في دروس العلوم					
12	I have a full understanding of what socio-scientific issues are عندي فهم كامل لماهية القضايا الاجتماعية العلمية					
13	I have enough resources to develop teaching and learning materials about socio-scientific issues عندي ما يكفي من الموارد لتطوير مواد التعليم والتعلم حول القضايا الاجتماعية العلمية					
14	I have the knowledge necessary to effectively teach about socio-scientific issues to my secondary school students عندي المعرفة اللازمة لتقديم تدريس فعال للقضايا الاجتماعية العلمية لطلابي في المرحلة الثانوية					
15	I do not have enough class time to deal with socio-scientific issues ليس عندي الوقت اللازم للتعامل مع القضايا الاجتماعية العلمية					

16	<p>I believe that students are not mature enough to be interested in and understand socio-scientific issues</p> <p>لا أعتقد أن الطلاب حققوا النضج الكافي ليكونوا مهتمين، أو وقادرين على فهم القضايا الاجتماعية العلمية</p>					
17	<p>I believe that students language ability limits their ability to understand socio-scientific issues</p> <p>أعتقد أن القدرة اللغوية للطلاب ستعوقهم عن فهم القضايا الاجتماعية العلمية</p>					
18	<p>Classes dealing with socio-scientific issues are most likely to be classes for high achieving students</p> <p>من الأرجح أن يكون التعامل مع القضايا الاجتماعية العلمية في فصول الطلاب المتفوقين</p>					
19	<p>I believe that science classes addressing socio-scientific issues have little influence on the achievement of students with low motivation</p> <p>أعتقد أن دروس العلوم التي تتناول القضايا الاجتماعية العلمية ليس لها تأثير في الطلاب ذوي التحصيل العلمي الضعيف</p>					
20	<p>Addressing socio-scientific issues in science classes could confuse students about their own religious values</p> <p>إن معالجة القضايا الاجتماعية العلمية في مادة العلوم يمكن أن تشوّش قيم الطلاب الدينية الخاصة.</p>					
21	<p>I believe that science classes addressing socio-scientific issues have little influence on the achievement of students with low participation level</p> <p>أعتقد أن دروس العلوم التي تتناول القضايا الاجتماعية العلمية ليس لها تأثير في الطلاب ذوي مستوى المشاركة المتدني</p>					

22	Dealing with socio-scientific issues using various teaching strategies is not possible in a "real" classroom situation إن تقديم القضايا الاجتماعية العلمية باستخدام استراتيجيات التدريس المختلفة، أمر غير ممكن تحقيقه في وضع الفصول الدراسية الحالي					
23	I am confident in using assessment strategies to assess socio-scientific issues لدي ثقة في استخدام استراتيجيات التقييم لتقييم قضايا اجتماعية علمية					
24	I have knowledge about different instructional methodologies for effective application of socio-scientific issues in the classroom عندي معرفة عن منهجيات تعليمية مختلفة للتطبيق الفعال للقضايا الاجتماعية العلمية في الفصول الدراسية					

Part 3: Open Ended Questions

القسم الثالث: الأسئلة المفتوحة

This section of the survey contains open ended questions related to various issues concerning the socio-scientific issues. Kindly answer them with as much clarity as possible.

هذا القسم يحتوي على أسئلة مفتوحة تتعلق بموضوع الدراسة. يرجى الإجابة عنها بوضوح

Question 1: What does the phrase socio-scientific issues mean to you?

السؤال الأول: ماذا تعني لك "القضايا الاجتماعية العلمية"؟

Question 2: What sorts of difficulties usually arise or you may foresee when you deal with SSI issues in your classroom?

السؤال الثاني: ما الصعوبات التي يمكن أن تواجهها حال طرح هذه القضايا في صفك؟

Question 3: What kinds of SSIs do you believe could be introduced into Science classrooms?

السؤال الثالث: ما أنواع القضايا الاجتماعية العلمية التي ترى إمكانية طرحها في صفوف مادة العلوم؟

Thank you!

شكراً!

Appendix B – Abu Dhabi Educational Council Approval



Date: 22 nd May 2016	التاريخ: 22 مايو 2016
Ref:	الرقم:
To: Public Schools Principals,	السادة / مديري المدارس الحكومية
Subject: Letter of Permission	الموضوع: تسهيل مهمة باحثين
Dear Principals,	تحية طيبة وبعد،،،
The Abu Dhabi Education Council would like to express its gratitude for your generous efforts & sincere cooperation in serving our dear students.	يطيبٌ لمجلس أبوظبي للتعليم أن يتوجه لكم بخالص الشكر والتقدير لجهودكم الكريمة والتعاون الصادق لخدمة أبنائنا الطلبة.
You are kindly requested to allow the researcher/ Sara Samir El Arbid , to complete her research on: Teachers Perceptions of Socio-scientific Issues (SSI's)	ونود إعلامكم بموافقة مجلس أبو ظبي للتعليم على موضوع الدراسة التي سيجريها الباحث/ سارة سمير العريبد، بعنوان: Teachers Perceptions of Socio-scientific Issues (SSI's)
Please indicate your approval of this permission by facilitating her meetings with the sample groups at your respected schools.	لذا، يرجى التكرم بتسهيل مهمة الباحثة ومساعدتها على إجراء الدراسة المشار إليها.
For further information: please contact Mr Helmy Seada on 02/6150140	للاستفسار: يرجى الاتصال بالسيد/ حلمي سعدة على الهاتف 02/6150140
Thank you for your cooperation.	شاكرين لكم حسن تعاونكم
Sincerely yours,	وتفضلوا بقبول فائق الاحترام والتقدير،،،
 محمد سالم محمد الظاهري المدير التنفيذي لقطاع العمليات المدرسية	



صندوق بريد: ٣١٠٠٥، أبوظبي - إ.ع.م. هاتف: ٠٠٠٠ ٦١٥ ٩٧١٢، فاكس: ٠٥٠٠ ٦١٥ ٩٧١٢، البريد الإلكتروني: info@adec.ac.ae
P.O.Box. 36005, Abu Dhabi - U.A.E., Tel: +971 2 615 0000, Fax: +971 2 615 0500, Email: info@adec.ac.ae