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Challenges to use of case studies in radiological safety and security education

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Abstract
Introduction: There are scarce research publications on education methods. Also, there is reluctance to participate into research involving nuclear security education. There has been many calls for case studies and needs for a catalogue of case studies among educators especially from developing countries. This study aim was to expand research and publications in radiological and Nuclear Security education also, make a wider use of Case studies in radiological safety and Nuclear Security education. Identify factors affecting research and publication in Nuclear Security education and also, factors hindering use of and developing case studies in radiological safety and Nuclear Security education.
Methods: A self-filled questionnaire by 52 educators of radiological physics and safety and Nuclear Security education from different nationalities, who are members of Int'l Nuclear Security Education Network (INSEN) which is affiliated to the IAEA.
Results: 80% of participants were from academic education institutions and 20% from training and policy institutes
96% of participants are interested in research on Nuclear Security education/training
88% are willing to participate into research on Nuclear Security education/training.
80% indicate a need for a workshop on research methods in Nuclear Security education/training
92% are interested in Case studies in Nuclear Security Education/training.
88% are willing to participate in Workshops on developing and using case studies in Nuclear Security education/training.
Conclusion: There is a need to foster research in Nuclear Security education; also, there is need for workshops on research methods in Nuclear Security education. There is a need for Case studies in Nuclear Security education and Workshops on fostering use of Case studies in Nuclear Security education are a high demand commodity.

Keywords: Nuclear security, research. Case studies

Introduction
Case studies are stories: – Real or realistic, complex and contextually rich situations, it can be 'Retrospective'
or a narrative that provides a complete history of an incident and it's outcome – Students assess why the outcome occurred and come up with alternative, possibly better, solutions or; 'Decision-forcing' case studies: in which Stops short of revealing the outcome, students experience the complexities and uncertainties experienced by the original decision makers (Problem--based learning) then Students to assess the range of possible actions and later critique where the actual outcome is revealed.
Case studies have been used in education for more than 100 years, first widespread usage by Harvard Law and Business School [1]: – An exemplar of the complexity of real--- world problems; Now widely used across a range of fields: – Science, Engineering, medicine, international relations and diplomacy; and it's a Sizeable educational literature on the merits and use of case studies.
The major goal of higher education is to equip students as members of a critical community of learners, with an ability to solve and reason problems – Memorizing and later reproducing facts is not sufficient, students must be able to apply this knowledge and expertise in flexible and innovative ways – (Real--life experiences can be broken down and analyzed in the classroom).
There is a consensus by academics [2] for the need for templates to use while conducting training and educational workshops on nuclear security culture prepared by experts in

education in order to have the best impact and retained knowledge by participants at end.

Nuclear security educators face many challenges in proceeding into such careers. They need to be equipped with knowledge and skills to use educational resources for such activities. One important resource is case studies. Case studies are short stories about actual or fictional events involving radioactive sources or nuclear materials which were compromised by being into out of control, theft or smuggled. Training on use might be needed. Description of such needs is important to continue to provision of resources to support nuclear security educators.

The International Atomic Energy Agency (IAEA) [3] defines nuclear security as 'the prevention and detection of, and response to, theft, sabotage, unauthorized access, illegal transfer or other malicious acts involving nuclear material, other radioactive substances or their associated facilities' (IAEA, 2008, p. 3). Also, Nuclear security culture is commonly defined as 'the assembly of characteristics, attitudes and behavior of individuals, organizations and institutions which serves as a means to support and enhance nuclear security' (International Atomic Energy Agency, 2008, p. 3).

Studies have found that 'the use of case studies ranks as the classroom method considered the most effective for developing critical thinking skills' (Leonard & Cook, 2010) [4]: – Distinguish pertinent from peripheral information – Define the context and parameters of the problem at hand – Identify solutions, strategies and recommended actions. Student centric, with active learning shown to remove promoting deeper retention of information/knowledge : – Some claim that case studies 'mimics' the process by which many of us learn (Kolodner, 2000) [5].

Use of Case studies in education have been under research by educators and there are plethora of findings supporting its positive impact on knowledge retention and students involvement [6-10].

Moran M and Hobbs C in 2018 [2] research revealed three significant obstacles to advancement: perceived demand, resources and institutional support. In terms of institutional demand, it is significant that prior exposure to security issues is not currently a requirement of employment in the nuclear sector, where such training is usually provided if deemed necessary on the job. There is a relative lack of awareness regarding the importance of nuclear security education in comparison with nuclear safety education, means that there has been little incentive for nuclear security education to be included in already crowded curricula in departments like physics and engineering.

While safety is an intrinsic part of any technical course in science or engineering, little if any attention has traditionally been given to security. As such, scientists and engineers going into the nuclear sector typically engage with a strong pre-existing culture of safety, embedded during their studies, but little if any awareness of security issues. Without exposure during the formative years, it will take much greater effort to establish a security culture within this group during their professional lives.

With regard to resources, the conception, design and implementation of a new course – be it a training workshop, a single academic module or an entire graduate-level program – require significant investment in terms of staff time and teaching resources (classrooms, AV equipment etc.). Even to incorporate aspects of nuclear security into existing courses requires considerable resources.

However, in many organizations in academia and industry alike, there is an acute shortage of resources. In all the countries under study, universities are competing for limited and often decreasing government funding while those within industry are ever vigilant for ways to cut expenditure and streamline resources.

These factors, combined with often-harsh economic conditions, mean that the ability of staff to propose and implement new courses is limited. In the academic sector, for example, this shortage of resources means that finding other cost economic educational methods is mandatory, as such case studies will save time, efforts and costs compared to traditional methods of real demonstrations or real

Aim

This work aims to quantify perception of academics involved in education of nuclear physics, nuclear safety or security on how case studies can promote nuclear security education,

Objectives

1. Describe challenges nuclear security educators face for using case studies.
2. Describe needs of nuclear security educators for training on case studies
3. Describe factors affecting research publication in nuclear security education

Methods

A questionnaire was developed on the needs assessment for increasing research publications, and the need for Case studies in Nuclear Security education.

The questionnaire was sent by email to members of INSEN.

Received filled questionnaires were entered into excel and descriptive statistics were concluded.

Results

52 participants from different academic and research institutes and training and policy centers.

Research in Nuclear Security Education

80% of participants were from academic education institutions and 20% from training and policy institutes.

Only 68% participated in a research on Nuclear Security education/training during past 12 months.

Only 48% participated in publishing a research on Nuclear Security education/training during past 12 month.

Only 20% published 1 research and only 4% published 3 or 4 papers.

96% of participants are interested in research on Nuclear Security education/training

88% are willing to participate into research on Nuclear Security education/training.

80% indicate a need for a workshop on research methods in Nuclear Security education/training

96% will attend if any research methods workshop is planned.

80% willing to participate in research methods workshops in Nuclear Security as a participant While, 52% willing to act as lecturers.

On priority research topics in Nuclear Security Education

Nuclear Security culture and its educational methods, barriers in Nuclear Security culture education; motivation factors in Nuclear Security culture Insiders identification and prevention methods
Organizational culture and S&S culture
Risk assessment and self-assessment
Qualitative research in Nuclear Security education.

How to foster research on Nuclear Security Education

Collaboration with state agencies
Support to PDC series on topic e.g. curriculum development.
Finding gates for collaboration between academics and regulators and operators
Bringing experts from other industries
Engaging academics on benefits of research, how to publish workshops.

Use of Case studies in Nuclear Security Education

Only 52% indicated use of CS in past 12 month
Only 36% indicated that they attended a workshop on using case studies in Nuclear Security education/training.
Mode Frequency of attending was 1
92% are interested in Case studies in Nuclear Security Education/training.
88% are willing to participate in Workshops on developing and using case studies in Nuclear Security education/training.

Priority topics in case studies

To know more on success stories of using case studies in Nuclear Security education /training
Opportunities for international workshops on using case studies in Nuclear Security education/training.
To know more on Resources available of using case studies to know more on case studies from other industries such as nuclear industry, aviation, banking and mining.
Training on Use of existing case studies developed by Experts.
Training on developing new case studies
84% indicated that there is a need for workshops on developing and using case studies.
92% also indicated they are willing to participate in such workshops
76% willing as a participant;
And 32% as a lecturer.

Case studies topics requested

RA sources Security
Transport and Nuclear Security
Insider threat
Cyber/information security
NM theft and sabotage

Conclusions

There is a need to foster research in Nuclear Security education
There is need for workshops on research methods in Nuclear Security education
There is a need for Case studies in Nuclear Security education
Workshops on fostering use of Case studies in Nuclear Security education are a high demand commodity.

Appendix 1

Survey on challenges hindering use of Case Studies and Research in Nuclear Security Education/training

Dear Members of International Nuclear Security Education Network members;
Nuclear Security Education and Training is an integral part for the development and maintenance of Nuclear Security and Nuclear Security culture. Use of case studies and fostering Research on Nuclear Security Education and Training would help sharing experiences and highlights successes and to foster efforts in such context.
This survey aims to foster use of case studies and applications in Nuclear Security education and training, also to foster research on education and training in Nuclear Security, by identifying challenges for research and publication in the context of nuclear security education and training.

1. Name:
2. Institution:
3. Country:
4. Main Duties:
    a. Education
    b. Training
    c. Administrations
    d. Operations
    e. Other

A: Research on Nuclear Security Education and training

5. During the past 12 month, have you participated in a research on Nuclear Security education/Training?
    a. Yes
    b. No
6. During the past 12 month, have you published a research on Nuclear Security Education/Training?
    a. Yes
    b. No
7. If yes, How Many:
8. Are you interested in research on Nuclear Security Education/Training?
    a. Yes
    b. No
9. Are you willing to participate in a research on Nuclear Security Education/Training?
    a. Yes
    b. No
10. If not: Why?
    a. Not have time
    b. Not on my scope of work
    c. Not an institutional goal
    d. Need to know priority research gaps on Nuclear Security Education/Training
    e. Need to know some basics of research methodology
    f. Need to have peers collaboration
    g. Need to know more on scientific writing
    h. High costs of publishing
    i. Others:
11. Do you think that there is a need for a workshop on research methods in Nuclear Security education / Training?
    a. Yes
    b. No

12. Would you participate in such workshop if there is any?
    a. Yes
    b. No
13. If yes, would you like to participate as a :
    a. A lecturer, or
    b. As a Participant.
14. In your opinion, what are the priority topics on research on Nuclear Security Education/Training?
    a.
    b.
    c.
    d.
15. In your opinion, how to foster research on Nuclear Security Education/Training?
    a.
    b.
    c.
    d.

B: Use of Case studies in Nuclear Security Education and training

16. During the past 12 month, have you used case study in a Nuclear Security education/Training?
    a. Yes
    b. No
17. During the past 12 month, have you attended a workshop on using case studies in Nuclear Security Education/Training?
    a. Yes
    b. No
18. If yes, How Many
19. Are you interested in case studies as an educational tool in Nuclear Security Education/Training?
    a. Yes
    b. No
20. Are you willing to participate in a workshop on developing and using case studies in Nuclear Security Education/Training?
    c. Yes
    d. No
21. If yes, what are the needs for using Case studies in Nuclear Security education /training?
    a. Training on Developing new case studies
    b. Training on Use of existing case studies developed by Experts.
    c. To know more on Resources available of using case studies
    d. To know more on success stories of using case studies in Nuclear Security education /training
    e. to know more on case studies from other industries such as nuclear industry, aviation, banking and mining.
    f. Opportunities for international workshops on using case studies in Nuclear Security education/training.
    g. Other
22. Do you think that there is needs for a workshop on develop and use of case studies in Nuclear Security education/Training?
    a. Yes
    b. No
23. Would you participate in such workshop if there is any?
    a. Yes
    b. No
24. If yes, would you like to participate :
    a. As a Participant, or
    b. As a Lecturer.
25. In your opinion, what are the priority topics on case studies in Nuclear Security Education/Training?
    a.
    b.
    c.
26. In your opinion, how to foster development and use of case studies in Nuclear Security Education/Training?
    a.
    b.
    c.

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