



A Comparative Study of Traditional Instruction & Virtual Reality Simulation on Intravenous Cannulation Training among Nursing Students in Nagpur

Pallavi Bobade ^a and Abhilasha Shambharkar ^{b*}

^a *Child Health Nursing Department, India.*

^b *Mental Health Department of MKSSS, SNCONW, Nagpur, India.*

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: <https://doi.org/10.9734/cjast/2024/v43i84417>

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/118998>

Original Research Article

Received: 15/05/2024

Accepted: 19/07/2024

Published: 02/08/2024

ABSTRACT

Virtual Reality Simulation (VRS) is an educational tool that allows learners to engage in realistic patient scenarios without exposing actual patients to the risks associated with training. This method is versatile and can be applied to a wide range of clinical topics. The study was conducted is "A Comparative Study of Traditional Instruction & Virtual Reality Simulation on Intravenous Cannulation Training among Nursing Students in Nagpur. The Objective of study were 1. To assess the knowledge and practice of the student nurses on Intravenous cannulation by Traditional Training Instruction and Virtual Reality Simulation. 2. To assess the effectiveness of the Intravenous cannulation by Traditional Training Instruction 3. To assess the effectiveness of the Intravenous cannulation by Virtual Reality Simulation 4. To find out Association between Traditional Training

*Corresponding author: E-mail: shambharkarabilasha@gmail.com;

Instruction Vs Virtual Reality Simulation among the students. Non experimental Comparative Research Design, It is conducted over 60 nursing students. (Group – I 30: - will be taught by traditional instruction, Group -II 30 will be taught by virtual reality simulation) by using non-probability convenience sampling technique. Assessment is done by using Structured Knowledge questionnaire on demographic variables and on Knowledge regarding intravenous cannulation. And Checklist for assessing the practice regarding Intravenous cannulation. The finding reveals that 70% of nursing students in traditional technique had poor level of knowledge and practice, 30% in traditional technique and 10% in IV cannula technique had average level of knowledge score and 90% of nursing students in cannula technique had good level of knowledge score. There is no significance association between demographic variables.

Keywords: Student nurse; traditional instruction; virtual reality simulation; intravenous cannulation.

1. INTRODUCTION

“Virtual Reality Simulation (VRS) is pedagogical fit that permits learners to witness real patient deals without placing patients to the threats essential in learner learning and is adaptable to cases involving a wide variety of clinical content. VRS is a approach, not a technology that uses innovative ways to educate and make scholars learn by furnishing hands- on gests in a variety of ways. The present decade has illustrated the necessity of VRS within the nursing profession too. It's attentively the formal strategy for bridging the gap between hypothesis and practice. The traditional lecture strategy is the system that the instructors conduct knowledge to scholars through oral language” [1-4]. “Lecture strategy includes describing system, interpretation system, speak pronunciation and speech system. instructors use all kinds of tutoring styles in tutoring substantially accompanied with tutoring system” [5].

“Lecture-based instructional approach refers to a traditional classroom teaching model, where the instructor delivers lecture verbally in combination with a projector, visual display surface and writing surface (e.g. a chalkboard or dry-erase whiteboard). This is generally considered as an instructor-centred and content-oriented approach. In other words, Traditional lecture-based instruction is designed to promote learning through practice questions and exercise drills that typically engenders less classroom interaction between the instructor and students, and between students themselves” [6].

“Intravenous (IV) cannulation is a method in which a cannula is placed inside a vein to give venous access. Venous access allows sample of blood, as well as administration of fluids, drugs, parenteral nutrition, chemotherapy, and blood products” [7].

Despite its benefits and frequent use, intravenous cannulation has complications that can seriously hang patient safety similar as clotting, occlusion, leakage, infiltration, extravasation, phlebitis, and infection.

“To maintain a high level of proficiency in intravenous cannulation, it is essential to practice this skill regularly. This is crucial for achieving quick and effective IV access when needed. IV catheter insertion into peripheral veins is one of the most frequently performed invasive procedures in hospitals. However, it can sometimes be challenging, requiring multiple attempts and causing discomfort to patients. The high success rates of nurses in IV cannulation are attributed to their frequent practice of the procedure. Globally, the failure rate for first-attempt peripheral IV cannulation has been found to be 34.83% (132.4 cases)” [8].

“Intravenous (IV) therapy plays a vital role in modern medicine, with millions of patients receiving infusion treatments for life-saving purposes and to correct metabolic disorders through medications, nutrition, solutions, and blood products. Hospitals rely heavily on IV catheters as essential tools to access intravenous sites. Despite being a crucial procedure in nearly every healthcare department, IV cannulation has its disadvantages if not properly managed. Complications from vascular access devices can include IV phlebitis, thrombophlebitis, catheter embolism, bleeding, nerve, tendon or ligament damage, needle stick injuries, and sepsis” [9].

Patient safety is a growing concern for healthcare providers. Nursing professionals face the challenge of delivering the best possible care, as they are primarily responsible for patient care in hospitals. They must be capable of determining the appropriate care for their patients and ensuring that both they and their

patients are protected from the complications and hazards associated with IV devices. IV device insertion is so common across all healthcare settings that it is often perceived as routine, leading to the assumption that it is free from clinical issues. However, inserting IV catheters into peripheral veins remains one of the most frequently performed invasive medical procedures in hospitals. This procedure can sometimes be challenging, requiring multiple attempts and causing significant discomfort to patients [10].

1.1 Need of the Study

In April 2012, a study was published about a Continuing Education Course on Intravenous (IV) Catheter Insertion for experienced registered nurses in Villanova, USA. The course aimed to enhance the confidence, expertise, and knowledge of nurses regarding IV catheter insertion, maintenance, and infection prevention. Despite prior training with a phlebotomist and designated time with the IV team, many experienced nurses lacked confidence in their IV catheter skills.

The one-day continuing education program was attended by 33 experienced nurses. Findings revealed that the course significantly improved the nurses' knowledge and skills. Knowledge enhancement was evident immediately after the course and sustained 8 to 12 weeks later. Improvements in skills related to infection prevention and adherence to policies were also observed. The study concluded that nurses' confidence levels increased following the formal IV course. It suggested that further studies with larger sample sizes should be conducted to validate these results.

The ability to gain peripheral intravenous access is an essential skill for all nurses. While considered one of the simplest invasive procedures, mastering this potentially lifesaving intervention requires refined skills and experience.

Nowhere has the change in content delivery and clinical education methods been more apparent than in the clinical aspects of nursing education (Bodily, 2012). The challenge for nurse instructors is to use simulation and traditional methods as educational tools and to design testing strategies focusing on assessing practices which are supposed the best. Virtual reality and the traditional system for phlebotomy training both have their benefits and drawbacks.

Nurse instructors have the ultimate responsibility to examine these educational tools for further effective outgrowth measures geared towards the enhancement of patient safety and care [11].

1.2 Problem Statement

"A Comparative Study of Traditional Instruction & Virtual Reality Simulation on Intravenous cannulation Training among Nursing Students in Nagpur"

1.3 Objective of the Study

1. To assess the knowledge and practice of the student nurses on Intravenous cannulation by Traditional Training Instruction & Virtual Reality Simulation.
2. To assess the effectiveness of the Intravenous cannulation by Traditional Training Instruction
3. To assess the effectiveness of the Intravenous cannulation by Virtual Reality Simulation
4. To find out Association between Traditional Training Instruction Vs Virtual reality Simulation among the students.

2. METHODOLOGY

Research design: Comparative research design.

Target population: Nursing students.

Accessible population: 2nd year Nursing Students By the second year, nursing students have typically completed their basic coursework and have a solid understanding of fundamental nursing concepts and practices. This foundational knowledge prepares them for more advanced clinical skills, such as IV cannulation.

Setting of study: Nursing Students in Nagpur city" Nagpur hosts several reputed nursing schools and colleges, providing a large and diverse pool of nursing students for study.

Sample size: 60 nursing students. (Group – I 30:- will be taught by traditional instruction Group -II 30 will be taught by virtual reality simulation).

Sampling technique: Nonprobability convenience sampling technique

Variable of the Study:

- **Independent Variable:** Teaching regarding Intravenous insertions by traditional instruction & virtual reality simulation

➤ **Dependent variable:** Improvement in knowledge and practice score regarding iv insertion training among students

Sample criteria: The sample was selected with the following set of criteria.

Inclusion criteria:

- Nursing students willing to participate in study.
- Both male and female nursing students.
- Nursing students who are available during the period of data collection.

Exclusion criteria

- Nursing students who are in leave at the time of study.

Tools for Data Collection:

1. Structured Knowledge questionnaire consist of 2 sections:

Section A: consist of demographic variables of the staff nurses to be participated in the study. Eg: age, Age (In years), Gender, Did you practiced iv insertion, If yes mode of practice , If yes mode of practice, Availability of simulators in your college

Section B: It comprises of 5 questions on Knowledge regarding intravenous cannulation.

2. Checklist for assessing the practice regarding Intravenous cannulation.

3. RESULTS

3.1 Section I

Table 1. Percentage wise distribution of nursing students according to their demographic characteristics n=30

Demographic Variables	No. of nursing students	Percentage (%)
Age(yrs)		
18-20 yrs	12	40
20-22 yrs	18	60
22-24 yrs	0	0
>24 yrs	0	0
Gender		
Male	0	0
Female	30	100
Others	0	0
Taught by intravenous insertion		
Yes	15	50
No	15	50
Mode of practice		
Traditional Method	17	56.7
Virtual Reality Simulation	13	43.3
Availability of simulators in your college		
Yes	3	10
No	27	90

3.2 Section II

Table 2. Assessment with level of knowledge and practice score n= 30

Level of knowledge and practice score	Score Range	Level of Knowledge and Practice Score	
		Traditional Technique	IV Cannula Technique
Poor	0-7	21(70%)	0(0%)
Average	8-14	9(30%)	3(10%)
Good	15-23	0(0%)	27(90%)
Minimum score		4	14
Maximum score		11	22
Mean knowledge score		6.56 ± 1.47	18.60±2.97
Mean % Knowledge Score		28.55 ± 6.42	80.86±12.94

Assessment of level of knowledge and practice regarding intravenous cannulation training of traditional instruction versus reality simulation among nursing students in Nagpur city.

The Table 2 shows that 70% of nursing students in traditional technique had poor level of knowledge and practice, 30% in traditional technique and 10% in IV cannula technique had average level of knowledge score and 90% of nursing students in cannula technique had good level of knowledge score.

Minimum knowledge and practice score in traditional technique was 14 and in IV cannula technique it was 14 and maximum knowledge and practice score in traditional technique was 11 and in IV cannula technique it was 22.

3.3 Section III

Comparison of knowledge and practice score regarding intravenous cannulation of traditional instruction versus virtual reality simulation among

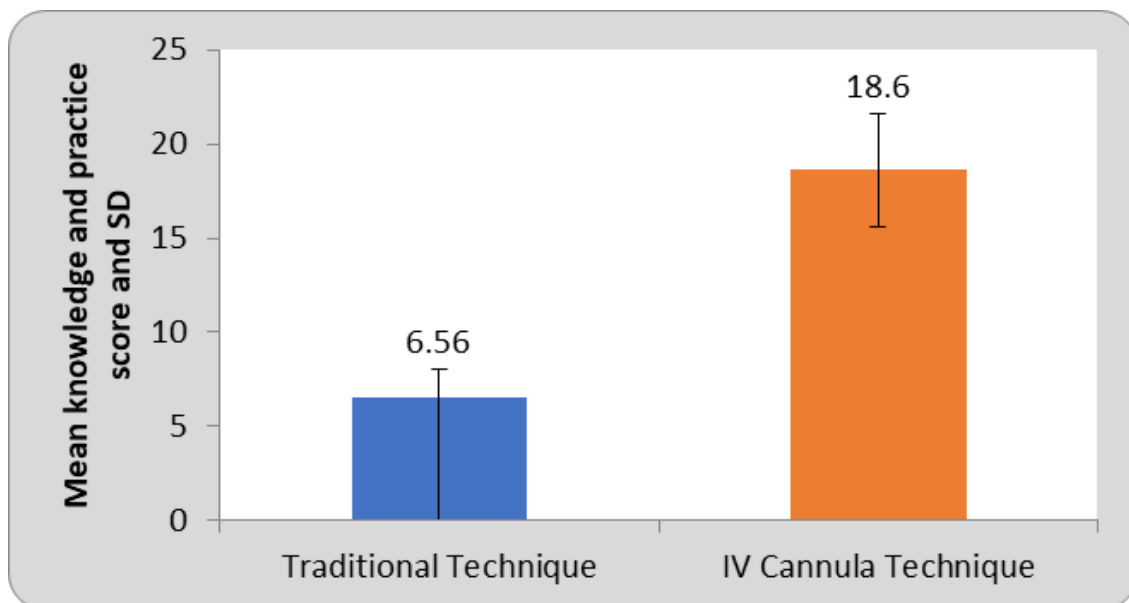
nursing students from selected nursing colleges in Nagpur city.

This table shows the comparison of knowledge and practice scores of nursing students regarding intravenous cannulation. Mean, standard deviation and mean difference values are compared and student's unpaired 't' test is applied at 5% level of significance. The tabulated value for $n=30+30-2$ i.e. 58 degrees of freedom was 2.00. The calculated 't' value i.e. 19.82 are much higher than the tabulated value at 5% level of significance for overall knowledge and practice score of nursing students from selected nursing colleges of the city which is statistically acceptable level of significance. Hence it is statistically interpreted that the Intravenous Cannulation on knowledge and practice regarding intravenous cannulation training among nursing students from selected nursing colleges of the city was effective. Thus the H_1 is accepted.

Mean knowledge and practice score in traditional technique was 6.56 ± 1.47 and in IV cannula technique it was 18.60 ± 2.97 .

Table 3. Significance of difference between knowledge score among nursing students n=30

Technique	Mean	SD	Mean Difference	t-value	p-value
Traditional Technique	6.56	1.47	12.03±0.60	19.82	0.0001
IV Cannula Technique	18.60	2.97			S,p<0.05



Graph 1. Significance of difference between knowledge score among nursing students

3.4 Section D.1

Table 4. Association of level of knowledge and practice score regarding intravenous cannulation in traditional instruction among nursing students in relation to their demographic variables

Demographic variable	Calculated value			Df	Table value	Level of significance	Significance
	t-value	F-value	p-value				
Age	0.05		0.96	28	2.05	p>0.05	NS
Taught by Intravenous Insertion	0.12		0.90	28	2.05	p>0.05	NS
Mode of Practice	0.58		0.56	28	2.05	p>0.05	NS
Availability of stimulators	0.12		0.90	28	2.05	p>0.05	NS

key: s - significant ns:- non-significant

3.5 Section D.2

Table 5. Association of level of knowledge and practice score regarding intravenous cannulation in traditional instruction among nursing students in relation to their demographic variables

Demographic variable	Calculated value			Df	Table value	Level of significance	Significance
	t-value	F-value	p-value				
Age	0.51		0.60	28	2.05	p>0.05	NS
Taught by Intravenous Insertion	1.23		0.22	28	2.05	p>0.05	NS
Mode of Practice	0.46		0.64	28	2.05	p>0.05	NS
Availability of stimulators	0.04		0.96	28	2.05	p>0.05	NS

key: s - significant ns:- non-significant

4. DISCUSSION

The study was conducted on Traditional Instruction Versus Virtual Reality Simulation: A Comparative Study of Phlebotomy Training among Nursing Students in Kuwait. "This quasi-experimental study compared differences in phlebotomy performance on a live client, between a control group taught through the traditional method and an experimental group using virtual reality simulation. The study showed both groups had performed successfully, using the following metrics: number of reinsertions, pain factor, hematoma status, duration of tourniquet application, time to complete the procedure, and successful completion of procedure. Utilizing t-test in comparing the control and experimental groups, no performance

metric was found to be significant. Total time to complete the procedure for both groups had the lowest p value, but was of no significance. Both methods for phlebotomy training were found to be equally effective. Nurse educators are challenged to recognize the advantages and limitations of both methods to pave their way in an enhanced quality phlebotomy program" [12].

5. CONCLUSION

After detailed analysis this study leads to following conclusion. The study reveals that 70% of nursing students in traditional technique had poor level of knowledge and practice, 30% in traditional technique and 10% in IV cannula technique had average level of knowledge score

and 90% of nursing students in cannula technique had good level of knowledge score.

Minimum knowledge and practice score in traditional technique was 14 and in IV cannula technique it was 14 and maximum knowledge and practice score in traditional technique was 11 and in IV cannula technique it was 22.

Mean knowledge and practice score in traditional technique was 6.56 ± 1.47 and in IV cannula technique it was 18.60 ± 2.97 .

The comparison of knowledge and practice scores of nursing students regarding intravenous cannulation. Mean, standard deviation and mean difference values are compared and student's unpaired 't' test is applied at 5% level of significance. The tabulated value for $n=30+30-2$ i.e. 58 degrees of freedom was 2.00. The calculated 't' value i.e. 19.82 are much higher than the tabulated value at 5% level of significance for overall knowledge and practice score of nursing students from selected nursing colleges of the city which is statistically acceptable level of significance. Hence it is statistically interpreted that the Intravenous Cannulation on knowledge and practice regarding intravenous cannulation training among nursing students from selected nursing colleges of the city was effective. Thus, the H_1 is accepted.

There is no significance association between demographic variables.

6. RECOMMENDATIONS

Based on the findings from the study titled "A Comparative Study of Traditional Instruction Versus Virtual Reality Simulation on Intravenous Cannulation Training among Nursing Students," the following recommendations are proposed to enhance the training and educational experiences of nursing students:

1. Integration of Virtual Reality (VR) Simulation into Nursing Curriculum

Enhanced Learning Outcomes: Incorporate VR simulation into the nursing curriculum to complement traditional instruction methods. The study shows that VR simulation provides a more interactive and immersive learning experience, which can improve students' understanding and retention of intravenous (IV) cannulation techniques.

Skill Proficiency: Use VR simulation as a tool for students to practice and refine their IV cannulation skills in a controlled and safe environment. This can lead to greater skill proficiency and confidence before performing procedures on actual patients.

2. Balanced Approach to Training

Blended Learning Model: Implement a blended learning model that combines traditional instruction with VR simulation. This approach can leverage the strengths of both methods, providing comprehensive training that includes theoretical knowledge and practical application.

Customized Training Programs: Develop customized training programs that cater to the varying learning styles and paces of students. VR simulation can offer personalized feedback and allow students to practice at their own pace.

3. Faculty Development and Support

Training for Instructors: Provide training and support for faculty to effectively integrate and utilize VR simulation in their teaching. This includes technical training on using VR equipment and pedagogical strategies to maximize its benefits.

Continuous Professional Development: Encourage continuous professional development for faculty to stay updated with the latest advancements in VR technology and its applications in nursing education.

4. Investment in VR Technology

Infrastructure and Resources: Allocate sufficient resources and budget for the acquisition and maintenance of VR equipment and software. Ensure that the technology is accessible to all students and integrated into the existing educational infrastructure.

Technical Support: Establish technical support teams to assist with the setup, maintenance, and troubleshooting of VR simulation systems. This ensures smooth and uninterrupted learning experiences for students.

5. Ongoing Research and Evaluation

Continuous Evaluation: Conduct ongoing research and evaluation to assess the effectiveness of VR simulation in improving IV

cannulation skills. Use both qualitative and quantitative measures to gather comprehensive data on student performance and learning outcomes.

Feedback Mechanisms: Implement feedback mechanisms where students can provide input on their experiences with VR simulation. Use this feedback to make continuous improvements to the training programs.

6. Enhancing Student Engagement and Motivation

Interactive Learning Environment: Foster an interactive and engaging learning environment through VR simulation. The immersive nature of VR can increase student motivation and interest in mastering IV cannulation skills.

Gamification Elements: Incorporate gamification elements into VR simulation to make learning more enjoyable and competitive. This can include challenges, scoring systems, and rewards for achieving certain skill levels.

7. Addressing Barriers and Challenges

Accessibility and Inclusivity: Ensure that VR simulation is accessible to all students, including those with disabilities. Adapt the technology and instructional methods to meet diverse needs and promote inclusivity.

Cost Management: Explore cost-effective solutions for implementing VR simulation, such as shared resources, partnerships with technology providers, and seeking funding or grants to support the investment.

By following these recommendations, nursing education programs can effectively enhance their training methods, leading to better-prepared nursing graduates who are proficient in IV cannulation and other essential clinical skills.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Keelson, Solomon Abekah, Frank BK, Twenefour, Michael Techie Quaicoe. Students' perception of online learning quality and preference for the online learning model. *Journal of Education, Society and Behavioural Science*. 2023;36(9):46-57. Available:<https://doi.org/10.9734/jesbs/2023/v36i91257>.
2. Atoyebi Oluwatoyin Motunrayo, Samuel Babajide Atoyebi. The link between mathematics teaching strategies and students' anxiety. *Asian Journal of Education and Social Studies*. 2022;33(4):48-57. Available:<https://doi.org/10.9734/ajess/2022/v33i4716>.
3. Yilmaz D, Tekkaya C, Sungur S. The comparative effects of prediction/discussion-based learning cycle, conceptual change text, and traditional instructions on student understanding of genetics. *International Journal of Science Education*. 2011, Mar 15;33(5): 607-28.
4. Plotzky C, Lindwedel U, Sorber M, Loessl B, König P, Kunze C, Kugler C, Meng M. Virtual reality simulations in nurse education: A systematic mapping review. *Nurse education today*. 2021, Jun 1;101:104868.
5. Bodily D et al. CIN Plus: Collaborative practice through simulations in a multiuser virtual environment. *American Journal of Nursing*. 2012;30(2):63-67. Available:<http://www.nursingcenter/Inc/JournalArticle?ArticleID=1308776>.
6. Daniel L et al. The effects of virtual intravenous and patient simulator training compared to the traditional approach of teaching nurses: A research project on peripheral IV catheter insertion. *Journal of Infusion Nursing*. 2011;34(1):55-62. Available:<http://www.nursingcenter/Inc/JournalArticle?ArticleID=1114415>
7. Decker S et al. The evolution of simulation and its contribution to competency. *Journal of Continuing Education in Nursing*. 2008; 39(2):74-80. Feingold CE, Calaluce M, Kallen MA. Computerized patient model and simulated clinical experiences: evaluation with baccalaureate nursing students. *Journal of Nursing Education*. 2004;43(4):156-163.

8. Forsyth D, Jenson C. Virtual reality simulation: Using three-dimensional technology to teach nursing students. CIN: Computers, Informatics, Nursing. 2012; 30(6):312-318. Available:<http://www.nursingcenter/Inc/cearticle?tid=1366278>
9. National Center for Biotechnology Information (NCBI). (n.d.). Intravenous therapy and related complications. Retrieved from NCBI Available:<https://www.ncbi.nlm.nih.gov/books/NBK593209/>
10. Vaismoradi M, Tella S, A Logan P, Khakurel J, Vizcaya-Moreno F. Nurses' adherence to patient safety principles: A systematic review. Int J Environ Res Public Health. 2020, Mar 19;17(6):2028. PMID: 32204403; PMCID: PMC7142993. DOI: 10.3390/ijerph17062028.
11. Lyons MG, Kasker J. Outcomes of a continuing education course on intravenous catheter insertion for experienced registered nurses. J Contin Educ Nurs. 2012, Apr;43(4):177-81. DOI: 10.3928/00220124-20111101-08. Epub 2011 Nov 8. PMID: 22074216.
12. Abeer William et al. Traditional instruction versus virtual reality simulation: A comparative study of phlebotomy training among nursing students in Kuwait, Journal of Education and Practice. 2016;7(9). ISSN 2222-1735 (Paper) ISSN 2222-288X.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of the publisher and/or the editor(s). This publisher and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

© Copyright (2024): Author(s). The licensee is the journal publisher. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
<https://www.sdiarticle5.com/review-history/118998>