Comparing Flipped Classroom with Traditional Instruction for Post-Partum Intra-Uterine Device Training Among Medical Students in a Ugandan Public University: A Quasi-experimental Study

Pebalo Francis Pebolo (pebalopebolo@gmail.com)
Gulu University
Felix Bongomin
Gulu University
Sylvia Awor
Gulu University
Baifa Arwinyo
Gulu Hospital
Sande Ojara
St. Mary's Hospital Lacor
Jimmyy Opee
Gulu University
Ayikoru Jackline
Gulu University
Jerom Okot
Gulu University
Eric Ssenuni
Gulu University
Simple Ouma
The AIDS Support Organization
Annettee Nakimuli
Makerere University

Research Article

Keywords: Flipped classroom, Pedagogy, Traditional method of instruction, Clinical year medical students, Uganda

Posted Date: September 7th, 2023

DOI: https://doi.org/10.21203/rs.3.rs-3225936/v1

Abstract

Introduction:

Available evidence suggests that traditional method of instructions might not be the best for skill development and advanced knowledge acquisition due to their non-interactive nature if compared to flipped classroom (FC). Yet, it remains unclear whether a FC using audio-visual aids outperforms traditional teaching methods for medical students in low-resource settings. Our study aimed to evaluate the preliminary effectiveness of the FC in teaching postpartum intrauterine device (PPIUD) knowledge and insertion skills to undergraduate medical students in clinical rotations.

Methods

A two-arm, quasi-experimental design was used. The FC group underwent a pre-recorded lecture and video on PPIUD insertion, followed by interactive sessions and procedural practice. The traditional group received an hour-long lecture and onsite skills demonstration, followed by skill practice. Paired t tests were used to determine knowledge and skills acquisition in each group and independent samples t tests was be used to compare groups. Stata version 17 and GraphPad Prism version 9 were used for analysis.

Results

A total of 67 students were included in the final analysis, 37 in the traditional group and 30 in the FC group. There was a significant improvement in post-test scores compared to pre-test scores in both groups $p < 0.001$. The mean post-test score was higher for FC compared to the traditional teaching methods group although, it was not statistically significant ($p = 0.069$). Certain categories of students performed better with FC, especially those who failed pre-tests $p = 0.021$), in bachelor or of medicine and bachelor of surgery (MBChB) year 3 class ($p = 0.011$), students who joined the university directly from advanced level certificate ($p = 0.018$) and aged younger than 25 years ($p = 0.002$). There was no statistically significant difference in the mean procedure performance score between the intervention and the traditional teaching methods ($p = 0.634$).

Conclusion

The FC had shown a positive impact on the knowledge and skills of medical students indicating its role in reproductive health training in resource-limited settings. Additionally, future studies could investigate how FC can combined with other teaching methods to create a blended learning approach that maximizes the benefits and enhanced learning.

INTRODUCTION

There is a growing body of evidence suggesting that traditional methods of learning such as didactic lectures are not optimal for developing skills, attitudes, and higher-order knowledge acquisition as it lacks interactivity and student-centeredness, and the pace of information delivery can impact the extent to which students can process the material and retain it in their long-term memory(1). This calls for innovation into more interactive and student-centred approach of giving instructions. The ubiquitous presence of audio-visual contents in all types of learning activities, including clinical settings, is a result of the advancements in information and communications technologies(2). Use of audio-visual contents positively affects student learning by appealing to different learning styles(3) and helping them visualize things that may not be illustrated(4, 5). Audio-visual contents enhances students' memory, comprehension, active learning, motivation, and caters for individual difference(6). Audio-visual contents is key in the implementation of the flipped classroom (FC) method of instruction.

The FC mode of instruction supports out-of-class learning and group-based activities, and can be combined with face-to-face instruction that forms the basis of blended learning(7). The effectiveness of the FC has been widely studied and shown to outmatch the traditional lecture-based methods(8). The FC is intended to maximize interactive learning while minimizing direct teaching, allowing learners to take their learning responsibilities(9), at their pace, and direct their efforts to the points that they need (10) .

Despite the high knowledge of e-learning modalities such as the FC, the utilization is low in low-resource settings due to poor internet connectivity and related cost and negative attitudes(11), inadequate resources and lack of skilled professionals (12). The FC contents can help bridge the gaps in procedural learning in already crowded bedside teaching(clerkship) placements in low income countries like Uganda(13).

Medical students in low resource settings experience difficulties in obtaining instruction for procedural skills due to fewer trainers, increasing number of students(14). This has been worsened due to the covid-19 pandemic where semesters have been shortened to catch up the time lost and fewer students are allowed for social distancing requirements (15).

In resource-limited settings, such as Uganda, more extensive research is needed to assess the effectiveness of the FC in undergraduate medical education, particularly in the teaching of theoretical knowledge and practical skills. We aimed to assess the initial effectiveness of the flipped classroom compared to traditional methods of instruction in PPIUD knowledge and insertion skills training among undergraduate medical students in clinical rotations at Gulu University, a public medical school in an upcoming city in Northern Uganda.

METHODS

Study Design

This was a two-arm, before-and-after, quasi-experimental study.

Setting and population

The study was conducted at the Faculty of Medicine, Gulu University, a public university located in Gulu city in Northern Uganda. The city is located 350km North of Kampala, the Capital of Uganda. The target participants for this study were medical students in their clinical rotation; year 3 and 5 (MBChB 3 and 5). There are two tracks for admission to the MBChB program in the university; the direct entry scheme in which students are admitted directly from Advanced-levels (high) schools and hence had no prior medical knowledge or skills, meanwhile the diploma/mature age entry scheme where people with prior health professional training are competitively admitted. Year 3 and year 5 medical students rotate in four (4) major clinical departments; Reproductive health (Obstetrics and Gynaecology), General Surgery, Paediatrics and Child Health and Internal Medicine. Each student is expected to rotate in a given department for 8 weeks in a given academic year. Students in clinical rotations are divided into two rotation lots, Paediatrics/Surgery and Reproductive Health/Internal medicine. PPIUD training is not included in the Gulu University MBChB curriculum hence this study provided a good ground to test the use of the FC in knowledge and psychomotor skills transfer without putting more time pressure on the medical students.

Allocation

Four rotations were possible; MBChB 3 Paediatrics, MBChB 3 Surgery, MBChB 5 Paediatrics and MBChB 5 Surgery. MBChB 3 Surgery and MBChB 5 Paediatric rotations were conveniently allocated to the traditional method of instruction group whereas MBChB 3 Paediatric and MBChB 5 Surgery rotations were allocated to the FC group (Fig. 1). The first two trainings were for the traditional teaching methods group and last two for the FC group. This was designed to reduce contamination in case participants in the traditional teaching group accessed the FC materials. Since the study was being conducted in the Department of Reproductive Health, students currently rotating in Obstetrics and Gynaecology were excluded from the study due to the potential influence of their presence in the department on their decisions in participating.

Recruitment

All participants were invited by a flier posted on their rotation's WhatsApp group. At first, the tradition method of instruction groups was informed of the purpose of the study and for those who accepted to take part a written informed consent was obtained. Thereafter a participant was allocated a unique group number based on clusters as seen in Fig. 1, and then pre-tested before onset of the training.

The recruitment process was similar for participants in the intervention group, except that a pre-test was given as well as a unique group identification number a week earlier before the training. Each participant was asked to provide an email address through which the audio-visual materials were shared. The materials were uploaded into a YouTube account, unlisted and shared the same day after pre-test. This unlisted link allows a restricted access to only people who have the links. The participants were advised not to share the links with others and reminded three times through emails to watch and attend the planned face to face training.

Course content covered in both arms

The PPIUD course content covered a range of topics related to the insertion of IUDs immediately after childbirth. Basic knowledge about PPIUDs including the types of IUDs available, their efficacy rates, indications and contraindications for their use and potential side effects. Counselling skills were taught to enable participants discuss the benefits and risks of PPIUDs with patients and help them make informed decisions. Infection prevention measures such as hand hygiene, decontamination, high level disinfection and sterilization techniques were emphasized. The training materials were based on a manual developed for providers(16) and the lecture was delivered by the principal investigator who is an experienced PPIUD trainer.

Procedural demonstrations cover the steps involved in inserting the intrauterine device (IUD) including assessing the uterine size, positioning the device, and ensuring adequate follow-up care and this was based on PPIUD insertion steps by the Centre for International Reproductive Health Training (CIRHT) (17). The PPIUD training was carried out over the weekends to avoid interfering with the normal academic activities in the faculty.

Traditional teaching methods arm

The teaching and demonstration of PPIUD using traditional methods typically involved didactic lectures, small group discussions, and on-site demonstrations. During the 1-hour didactic lectures, the PPIUD course content was covered. Small group discussions (4–5 participants) enabled participants to ask questions and exchange ideas with their peers, promoting a better understanding of the information presented. On-site demonstrations of PPIUD insertion were carried out using Mama U trainers, which are anatomical models that simulate the female reproductive system. The demonstration was done by 4 midwives who are certified PPIUD trainers and this was based on the OSCE sample stations for contraception and abortion reference materials(17). After demonstration, students were allowed to practice the steps in groups of 10 participants under guidance for 4 hours before they were assessed.

Intervention arm

The same course content as in the traditional methods of instruction was used to create pre-class material for the FC. The produced 32 minutes PowerPoint voiceover and a 16 minutes procedure steps audio-visual content were uploaded into a YouTube account and the unlisted link sent to the students a week earlier through their email addresses. Students were encouraged to find time to watch the materials and answer some of the questions included in the voiceover lecture material to prepare them for the in-class activities. In a planned 30 minutes in-class activities, the objectives of the topics were discussed followed by small group discussions and presentations of questions and answers. The procedure steps recorded video was replayed on a large 75-inch interactive screen and students allowed to practice the procedures. They were free to access the videos while practicing the steps until they are confident in the steps. The practice was done in groups of 10 participants for 4 hours before assessment.

Data collection/measures

Having received a one-day intensive training based on their group assignment (traditional method of instructions or intervention) they had a post-test which composed of MCQs knowledge test, and a PPIUD procedural skills performance checklist. The post test questions were the same as the pre-test this was adapted from(18).

Basic information regarding the student's age, mode of university admission and class were collected with the results of pre-test, post-test, PPIUD procedural skills assessment. The procedural skills assessments step was observed by two assessors who scored independently. The pre-tests and post-tests and procedural assessment tool had no student's identification details except for unique student allocation group and numbers.

Statistical analysis

Paired t tests were performed to determine the differences in knowledge and skills acquisition in each group and independent samples t tests was be used to compare groups. Stata version 17 and GraphPad Prism version 9 was use for analysis in this study. The data was analysed by modified intention to treat basis.

RESULTS

Enrolment

figure 2.

A total of 82 medical students were invited to participate in the study, with 40 assigned to the traditional method of instructions and 42 to the FC. In the traditional method of instructions group, 3 students declined the invitation to participate. In the FC group, 5 students declined the invitation, 1 student did not register for the semester, 4 students did not complete the training, and 2 students forgot their unique identification number and these were all excluded. The remaining 67 were included for the final analysis, 37 in the traditional teaching methods arm and 30 in the intervention group as seen in figure 2.

Table 1: Baseline characteristics of the study participants

Variable	*All (N =67)*	*Standard practice (n=37)*	*Intervention (n=30)*	*P-Value*
Age, mean, years	67	28.4±5.9	27.4±5.1	0.238
Age Group				
20-24 years	23	11	12	0.636
25 -30 years	23	13	10	
> 30years	21	13	8	
Class				
MBChB 3	33	19	14	0.703
MBChB 5	34	18	16	
Mode of entry				
Direct	39	20	19	0.444
Diploma/Mature aged	28	17	11	

The mean age of the students was similar 28.4 and 27.4 for traditional method of instructions and intervention groups respectively. A total of 33 MBChB 3 were included in the analysis, 19 (57.6%) in the traditional method of instructions and 14(42.4%) for intervention group. Of the 34 MBChB 5 included in the final analysis, 28(52.9%) were in the traditional method of instructions group and 16(47.1%) in the intervention group (table 1). Of the 67 participants, 39(58.2%) were admitted through direct entry while 41.8% were through diploma/mature entry scheme. The direct entrants had 20(51.3%) in the traditional method of instructions group and 19(48.7%) in the intervention group, meanwhile for those under diploma/mature age entry, 17(60.7%) were in the traditional teaching methods and 11(39.3%) in the intervention (table 1).

Table 2: Paired sampled t-test comparing pre test scores among the standard practice and intervention groups.

Variable	*Observation (N)*	*Standard practice (n=37), mean±SD%*	*Intervention (n=30), %*	*P-Value*
All	67	53.4±12.9	58.8±11.6	0.039*
MBChB 3	33	47.1± 9.5	54.6±13.7	0.035*
MBChB 5	34	60.0±12.9	62.5±8.4	0.257
Diploma entry	28	53.2±14.8	61.8±11.0	0.056
Direct Entry	39	53.5±11.5	57.1±11.9	0.171
Age20-24 years	23	53.6±10.5	53.7±13.0	0.491
Age25-30years	23	49.614.9	59.0±9.1	0.047*
Age >30 years	21	56.9±12.5	66.3±9.1	0.042*

*****Statistically significant*

The mean pre-test scores were significantly higher among participants in the intervention group (58.83±% versus 53.38±%, p= 0.039). The mean pre-test for MBChB 3 was 47.1 and 54.6 for the traditional teaching methods and intervention group respectively. Similarly, MBChB 5 scored 60 and 62.5 on average and this are not statistically different. Direct entrants had similar scores among the standard practice and intervention group; 53.4 vs 57.1 (table 2).

The mean post-test and pre-test score were 78.5±9.2 and 53.4±12.9 for traditional teaching methods group(A) and 81.6±7.2 and 58.8±11.6 for intervention group(B) respectively, and this was statistically significantly different p <0.001 (figure 3).

Table 3: Comparison of post-test scores among the traditional method of instructions and intervention groups

Variable	*Observation (N)*	*Standard practice (n=37)*	*Intervention (n=30)*	*P-Value*
All	67	78.5± 9.1	81.6± 7.2	0.0693
MBChB 3	33	76.3± 9.8	83.8±6.9	0.011*
MBChB 5	34	80.8±8.1	79.7±7.2	0.667
Diploma entry	28	82.6±8.3	83.6±7.8	0.378
Direct Entry	39	75.0±8.6	80.4±6.8	0.018*
Age20-24 years	23	71.4±6.6	82.3±5.5	0.002*
Age25-30years	23	79.6±9.0	79.5±8.3	0.517
Age >30 years	21	83.5±8.3	83.1±9.2	0.534
scored <50% pre-test	14	75.0± 7.1	85.0±5.0	0.021*
Scored 50 to <75% in pre-tests	44	78.9±9.9	81.0 ±8.2	0.2143
scored 75% or more in pre-tests	9	86.35±6.3	82.0 ±2.7	0.8941

*****Statistically significant*

The students who had the intervention had a higher average post test scores compared to the traditional method of instructions although, this was not a statistically significant difference, p 0.069. The post-test scores were higher for the intervention compared to the traditional method of instructions among those who failed pre-tests (85.0±5.0 Vs 75.0± 7.1, p=0.021), in MBChB 3 class (83.8±6.9 Vs 76.3± 9.8, p=0.011), direct entrant schemes(80.4±6.8 Vs 75.0±8.6 p=0.018) and aged younger than 25 years(82.3±5.5 Vs 71.4±6.6 p=0.002) as seen in table 3 above. Although the mean post test scores among mature/diploma entrants and those whose pre-tests scores are between 50-70% was higher among the intervention, it is not statistically significant p=0.2143 and 0.378 respectively. However, among those who scored more than 75% in the pre-tests, they performed better with the traditional teaching methods p=0.8941. There were similar mean post test scores among those in year 5 class, aged 25-30 years and aged above 30years old (table 3).

Table4: **Comparison of mean PPIUD skills procedure score among the traditional method of instructions and intervention groups.**

Variable	*All (N)*	*traditional teaching methods (n=37) mean ± SD*	*Intervention (n=30) mean ± SD*	*P-Value*
All		79.2±5.9	78.5±5.3	0.634
MBChB 3	33	83.0±11.2	78.1±7.9	0.989
MBChB 5	34	78.8±6.8	75.3±8.0	0.146
Diploma entry	28	81.0± 8.0	81.3±6.8	0.467
Direct Entry	39	77.7±10.6	76.9±6.3	0.601
Age20-24 years	23	76.8±10.3	77.9±5.2	0.368
Age25-30years	23	77.2±10.5	78.8±7.3	0.659
Age >30 years	21	81.1±7.9	81.1±8.0	0.5624
scored <50% pre-test	14	83.2± 5.7	77.2±6.4	0.928
Scored 50 to <75% in pre-tests	44	78.5±10.1	79.1±7.1	0.404
scored 75% or more in pre-tests	9	76.7±11.9	72.3±5.9	0.242

Overall, the mean procedure scores for intervention and traditional teaching methods were similar. For participants in year 5 and those who scored more than 75% in pre-test had better score in the intervention compared to the traditional method of instructions group although these were not statistically significantly, p=0.146and 0.243 respectively. The interrater agreement between assessor 1 and 2 was poor (4.48%) for the expected 5.10%, p=0.059(table 4).

Discussion

The aim of this study was to compare the preliminary effectiveness of the FC versus the traditional method of instructions among medical students in clinical rotation. The results showed that there was significant improvement in post-test scores compared to pre-test scores in both the standard practice and intervention groups. This suggests that the FC is effective in imparting knowledge in undergraduate medical education in Uganda replicating other studies done elsewhere (8, 19, 20) .

The mean post-tests score among those who had FC teaching methods was higher compared to traditional teaching methods, although this was not statistically significant. The disparities in PPIUD skills procedure scores were also not significant between the intervention and traditional method of instruction groups.

However, further analysis showed that the benefits of FC teaching methods were more pronounced among certain groups of students. For instance, students who failed pre-tests, similar to a finding in one study that showed that low achieving had better scores in post-test after the FC usage compared to the traditional methods (21). Also, students who were MBChB 3 class performed better than the MBChB 5 contrary to a finding in which the more senior students performed better in FC methods of instructions(22). Also, direct entrants, and those aged younger than 25 years had higher post-test scores in the intervention group than in the traditional teaching methods group. However, this may be due to the fact that the direct entrants are also young bringing a collinearity. Despite all these, the study suggests that the FC teaching methods may be particularly useful for these groups of students.

On the other hand, among those who scored more than 75% on the pre-tests, the traditional teaching methods were found to be more effective. This suggests that there may be a threshold beyond which the benefits of FC teaching methods may not be as pronounced. Additionally, the study found that there were no significant differences in post-test scores among students in the MBChB 5 class, those aged 25–30 years, and those aged above 30 years old

Regarding the procedural training, the FC procedure videos resulted into lower overall mean post-test scores compared to the traditional teaching methods. However, the study did identify some potentially important trends in PPIUD skills procedure scores, particularly among students in MBChB 5 and those who scored well on the pre-test. While these higher procedural scores among the intervention group did not reach statistical significance, they suggest that this method of giving instruction is comparably effective with the traditional teaching methods and further research is warranted to explore the potential benefits of FC procedure videos in medical education.

Study strengths and limitations

Overall, the study's robust design and inclusion of a mechanism to lessen contaminations strengthened the credibility of the findings, enhancing the confidence in the preliminary effectiveness of FC in undergraduate PPIUD training. It important to note that study had a scope (PPIUD), which may not fully capture the potential effects or benefits of using FC in undergraduate Obstetrics and Gynaecology education. It is possible that the outcomes observed in this limited context may not be representative of the broader impact of FC across various topics and over a longer period of training. Another limitation is related to the fact that this study did not investigate the extent to which the knowledge and skills acquired through FC were retained by the students over time. This information would have provided valuable insights into the long-term impact of FC on knowledge retention and its potential benefits for the students' future clinical practice.

Conclusions

Despite these limitations, the findings of this study have important implications for sexual and reproductive health education. The FC teaching methods can provide students with greater flexibility and accessibility to educational materials, which may be particularly important for students in low income

countries. Furthermore, FC teaching methods may be an effective way to improve student performance, particularly among certain groups of students. Although it should be noted that the method may have some threshold beyond which it is not effective. Therefore, medical schools and educators should consider incorporating the FC teaching methods into their curricula, while also considering the unique needs and learning styles of their students. Additionally, future studies could investigate how different teaching methods can be combined to create a blended learning approach that maximizes the benefits of both the FC and traditional teaching methods.

Declarations

Ethics approval and consent to participate:

Approval to conduct the study was obtained from Gulu University Research and Ethics Committee (GUREC) #GUREC-2022-33. All participants provided written informed consent and were assured that this training and assessment would not contribute to their final marks or be included in their end of semester examination. Administrative clearance was got from the Office of Dean, Faculty of Medicine, Gulu University.

Funding: This research was funded with support from the Center for International Reproductive Health Training at the University of Michigan (CIRHT-UM). The funder had no role in the design of the study and collection, analysis, and interpretation of data and in writing the manuscript.

Acknowledgement: We would like to acknowledge the study participants in general and Dean and Deputy Dean Faculty of Medicine Gulu University for their support during this study. We would like to acknowledge the study participants.

We Thank the Pre-Publication Support Service (PREPSS) for supporting development of this manuscript by providing author training, as well as pre-publication peer-review and copy editing.

Author contributions: All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically and approved the final version.

Consent for publication: Not applicable.

Conflict of interest statement

The authors declare that there is no conflict of interest.

Data availability statement

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request

References

1. Dent J, Harden RM, Hunt D. A Practical Guide for Medical Teachers, E-Book: Elsevier health sciences; 2021.
2. Nicolaou C, Matsiola M, Kalliris G. Technology-Enhanced Learning and Teaching Methodologies through Audiovisual Media. Education Sciences. 2019;9.
3. Alawani A. An investigation About the Usage and Impact of Digital Video for Learning2016.
4. Mikelic Preradovic N, Lauc T, Panev I. The Effect of Medium of Instruction on Undergraduate Student Learning Style in Video - based Learning. 2020.
5. Boer J, Kommers P, Brock B. Using learning styles and viewing styles in streaming video. Computers & Education. 2011;56:727-35.
6. Alessi S, Trollip S. Multimedia for Learning: Methods and Development. 2001.
7. Cheng L, Ritzhaupt AD, Antonenko P. Effects of the flipped classroom instructional strategy on students' learning outcomes: a meta-analysis. Educational Technology Research and Development. 2019;67(4):793-824.
8. Angadi N, Kavi A, Shetty K, Hashilkar N. Effectiveness of flipped classroom as a teaching–learning method among undergraduate medical students – An interventional study. Journal of Education and Health Promotion. 2019;8(1):211-.
9. Fulton K. Upside down and inside out: Flip Your Classroom to Improve Student Learning. Learning and leading with technology. 2012;39:12-7.
10. Abeysekera L, Dawson P. Motivation and cognitive load in the flipped classroom: definition, rationale and a call for research. Higher education research & development. 2015;34(1):1-14.
11. Olum R, Atulinda L, Kigozi E, Nassozi DR, Mulekwa A, Bongomin F, et al. Medical Education and E-Learning During COVID-19 Pandemic: Awareness, Attitudes, Preferences, and Barriers Among Undergraduate Medicine and Nursing Students at Makerere University, Uganda. J Med Educ Curric Dev. 2020;7:2382120520973212-.
12. Frehywot S, Vovides Y, Talib Z, Mikhail N, Ross H, Wohltjen H, et al. E-learning in medical education in resource constrained low- and middle-income countries. Human resources for health. 2013;11:4-.
13. Kagawa MN, Kiguli S, Steinberg WJ, Jama MP. The workplace as a learning environment: Perceptions and experiences of undergraduate medical students at a contemporary medical training university in Uganda. African Journal of Health Professions Education. 2021;13:110-7.
14. Taché S, Mbembati N, Marshall N, Tendick F, Mkony C, O'Sullivan P. Addressing gaps in surgical skills training by means of low-cost simulation at Muhimbili University in Tanzania. Human Resources for Health. 2009;7(1):64.
15. Bongomin F OR, Nakiyingi L, Lalitha R, Ssinabulya I, Sekaggya-Wiltshire C, Ocama P, Byakika-Kibwika P. . Internal Medicine Clerkship Amidst COVID-19 Pandemic: A Cross-Sectional Study of the Clinical Learning Experience of Undergraduate Medical Students at Makerere University, Uganda. Adv Med Educ Pract. 2021;12:253-62.

16. Postpartum Intrauterine Contraceptive Device (PPIUD) Services ; A Reference Manual for Providers: Jhpiego Corporation; 2010.
17. Worku SB. OSCE Sample Stations for Contraception and Abortion (Reference Material): CIRHT; 2019. Available from: https://deepblue.lib.umich.edu/bitstream/handle/2027.42/152423/Student_Assessment_OSCE.docx?sequence=1&isAllowed=y.
18. Abebaw Y, Berhe S, Abebe SM, Adefris M, Gebeyehu A, Gure T, et al. Providers' knowledge on postpartum intrauterine contraceptive device (PPIUCD) service provision in Amhara region public health facility, Ethiopia. PloS one. 2019;14(4):e0214334.
19. Gillispie V. Using the Flipped Classroom to Bridge the Gap to Generation Y. The Ochsner journal. 2016;16(1):32-6.
20. Morgan H, McLean K, Chapman C, Fitzgerald J, Yousuf A, Hammoud M. The flipped classroom for medical students. The Clinical Teacher. 2015;12(3):155-60.
21. Nouri J. The flipped classroom: for active, effective and increased learning – especially for low achievers. International Journal of Educational Technology in Higher Education. 2016;13(1):33.
22. Yin H. Exploring the Effectiveness of a Flipped Classroom with Student Teaching. e-Journal of Business Education and Scholarship of Teaching. 2020;14(1):66-78.

Figures

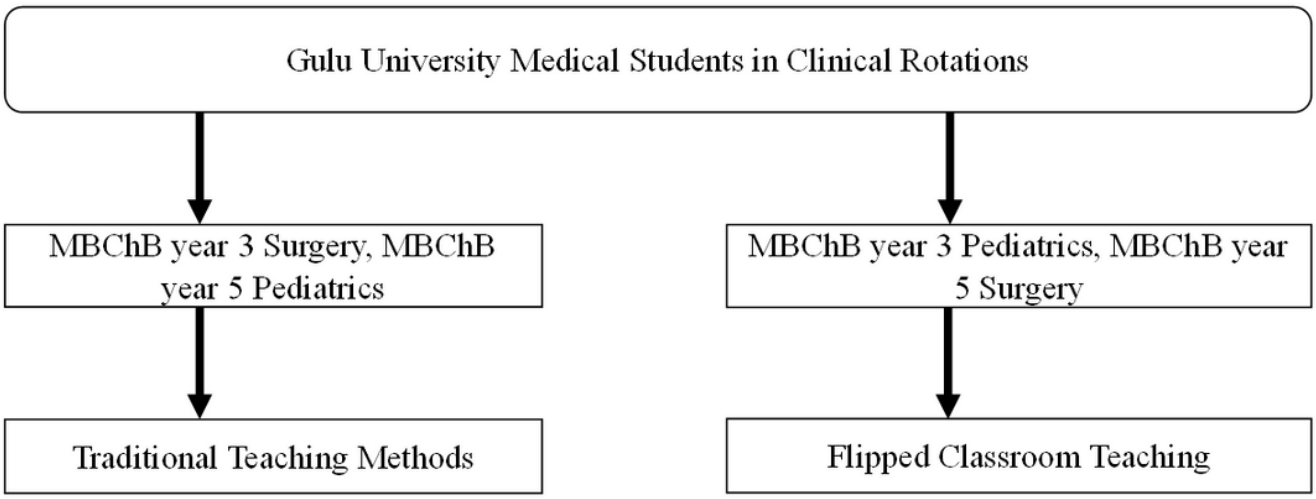

Figure 1

Allocation Based on possible rotation among the medical students in clinical rotation

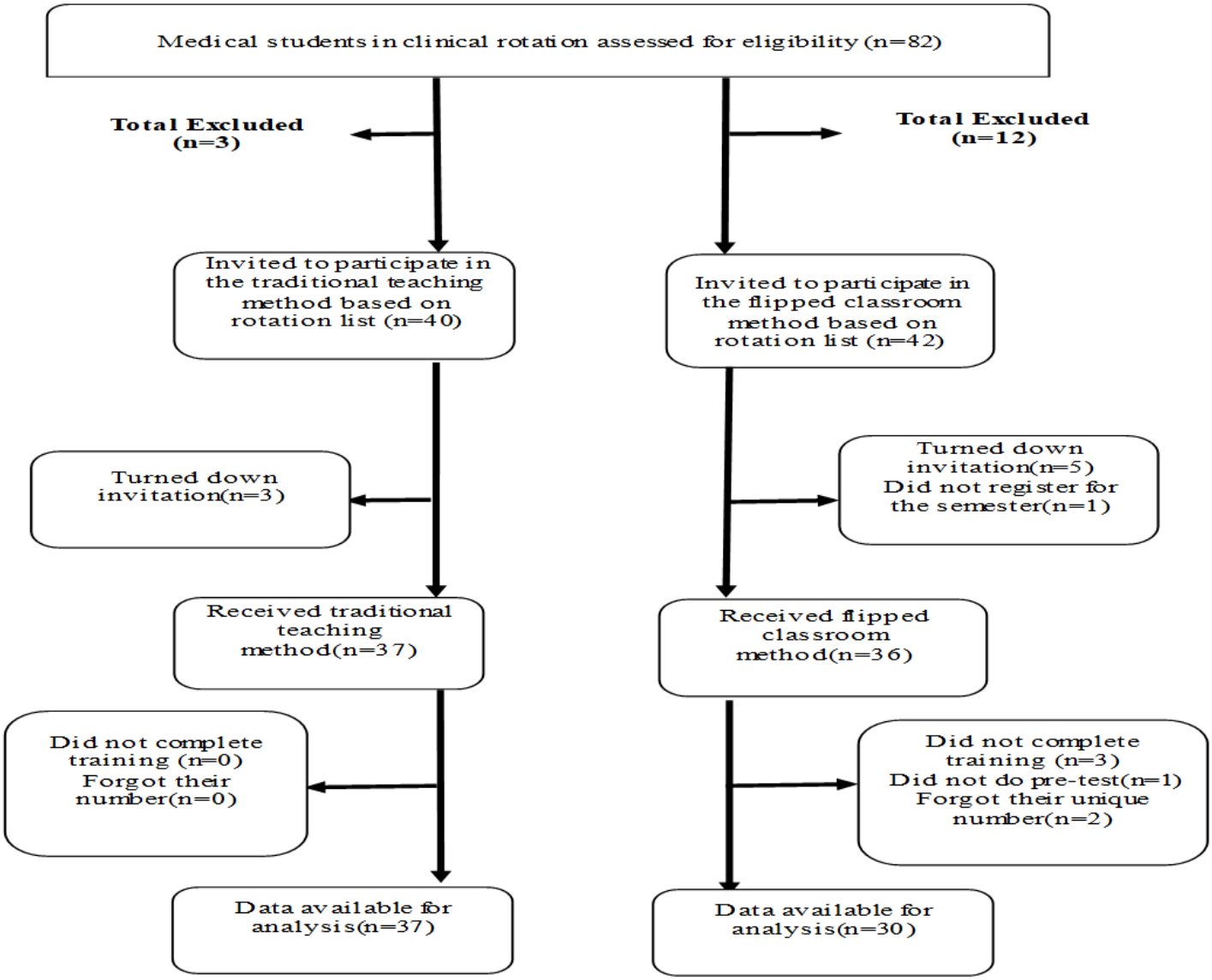

Figure 2

CONSORT Flow diagram showing allocation of the participants

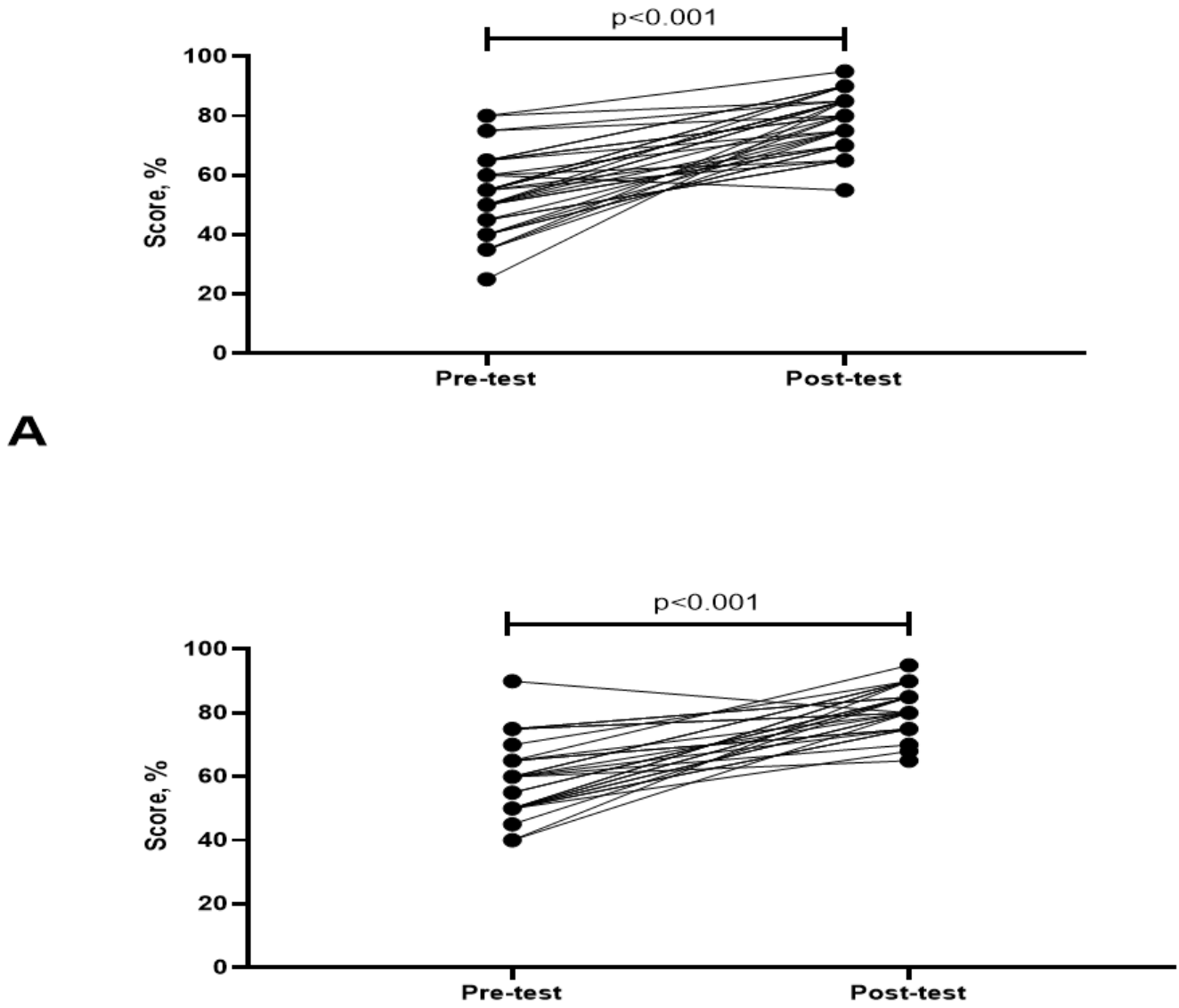

Figure 3

Before and after graph showing pre and post test scores of the participants; A traditional method of instructions group(N=37), B intervention group(N=30)