
GYNECOLOGY

Application of a Rod USB Digital Microscope for Pelvic Examination Demonstration for Fourth Year Medical Students: An assessor-blinded randomized trial

Patsira Warinsiriruk, M.D.*,
Yada Tingthanatikul, M.D.*,
Anusorn Adirekkittikun,*
Jittima Manonai Bartlett, M.D.*.

* Department of Obstetrics & Gynaecology, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok 10400, Thailand

ABSTRACT

Objectives: To evaluate the students' satisfaction of the fourth year medical students learning the pelvic examination and the benefits of the rod USB digital microscope compared with the traditional method.

Materials and Methods: The fourth year medical students were recruited after commencing gynecologic rotation and were randomly assigned to receive the traditional method and the rod USB digital microscope assisted method on pelvic examination demonstration. There was only one trainer performing all demonstration session and all participants were not informed to which group they were assigned. The validated 5-question students' satisfaction questionnaire was used to evaluate the participants' satisfaction by assessor-blinded, randomized trial and the validated 5-question rod USB digital microscope questionnaire was used to evaluate its benefits. The primary outcome was students' satisfaction of pelvic examination learning with the rod USB digital microscope.

Results: There were 35 students in the study group (21 female, 14 male, aged 22.14 ± 0.36 years) and 35 students in the control group (25 female, 10 male, aged 22.12 ± 0.33 years). The overall satisfaction score of the study group was significantly higher than that of the control group (4.88 ± 0.12 vs 3.69 ± 0.69) ($p < 0.001$). Regarding the benefits of the instrument, the overall mean score was 4.75 ± 0.24 , and the highest score was the use for medical student teaching (mean score 4.97 ± 0.17).

Conclusion: The rod USB digital microscope could be applied to pelvic examination demonstration with high satisfaction of the fourth year medical students.

Keywords: Rod USB digital microscope, pelvic examination demonstration, medical students.

Correspondence to: Yada Tingthanatikul, M.D., Department of Obstetrics and Gynaecology, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok 10400, Thailand. Tel: +6622012805, Fax: +6622011416, Email address: yada.ting@gmail.com

การประยุกต์กล้องยูเอสบีดีจิติดอลขนาดเล็ก เพื่อการสอนแสดงและการตรวจภายใน สำหรับนักศึกษาแพทย์ชั้นปีที่สี่: การวิจัยแบบสุ่มโดยปกปิดผู้ประเมิน

ภัทสิรา วารินศิริรักษ์, ญาณดา ดิงธนาริกุล, อนุสร อติเรกกิตติคุณ, จิตติมา มโนนัย บาร์เลตต์

บทคัดย่อ

วัตถุประสงค์: เพื่อเปรียบเทียบความพึงพอใจในการเรียนการสอนของนักศึกษาแพทย์ชั้นปีที่สี่ คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี ที่ผ่านการเรียนการสอนวิชานรีเวชวิทยาแบบปกติ กับการเรียนการสอนโดยใช้กล้องยูเอสบีดีจิติดอลขนาดเล็กในการตรวจภายในสตรี

วัสดุและวิธีการ: ศึกษาโดยนำกล้องยูเอสบีดีจิติดอลขนาดเล็กมาประยุกต์ใช้สอนแสดงการตรวจภายในสตรีสำหรับนักศึกษาแพทย์ชั้นปีที่สี่ที่ผ่านการเรียนการสอนวิชานรีเวชวิทยา ในการพัฒนาประยุกต์สิ่งประดิษฐ์รูปแบบการวิจัยแบบสุ่ม และมีกลุ่มควบคุม โดยแบ่งกลุ่มนักศึกษาแพทย์สองกลุ่ม กลุ่มละ 35 คน โดยกลุ่มควบคุมสอนแสดงการตรวจภายในสตรีแบบปกติ และกลุ่มศึกษาสอนแสดงการตรวจภายในสตรีโดยใช้กล้องยูเอสบีดีจิติดอลขนาดเล็กซึ่งเชื่อมต่อกับคอมพิวเตอร์และแสดงภาพสู่จอคอมพิวเตอร์ นักศึกษาทั้งสองกลุ่มได้ตอบแบบสอบถามความพึงพอใจหลังเรียน นำแบบสอบถามทั้งสองกลุ่มมาเปรียบเทียบความพึงพอใจหลังเรียน

ผลการศึกษา: นักศึกษาแพทย์กลุ่มศึกษา 35 คน (หญิง 21 คน, ชาย 14 คน, อายุ 22.14 ± 0.36 ปี) และ กลุ่มควบคุม 35 คน (หญิง 25 คน, ชาย 10 คน, อายุ 22.12 ± 0.33 ปี) นักศึกษาแพทย์กลุ่มศึกษามีคะแนนความพึงพอใจโดยรวมสูงกว่ากลุ่มควบคุมอย่างมีนัยสำคัญ (4.88 ± 0.12 และ 3.69 ± 0.69) ($p < 0.001$) ประโยชน์ของกล้องยูเอสบีดีจิติดอลขนาดเล็กมีคะแนนรวม 4.75 ± 0.24 และคะแนนสูงสุดได้แก่ ทำให้การเรียนการสอนของนักศึกษาแพทย์สัมฤทธิ์ผล (คะแนนเฉลี่ย 4.97 ± 0.17)

สรุป: กล้องยูเอสบีดีจิติดอลขนาดเล็กสามารถใช้ประยุกต์ในการเรียนการสอนการตรวจภายในและมีความพึงพอใจในระดับสูงของนักศึกษาแพทย์

คำสำคัญ: กล้องขยายแบบดิจิทัล ยู เอ ส บี ชนิดแท่ง, การสอนแสดงการตรวจภายในสตรี, นักศึกษาแพทย์

Introduction

Pelvic examination is an essential component of women's annual health check up. This procedure typically consists of visual inspection of external genitalia, insertion of a speculum, performing of any tests of cytology and then bimanual palpation to determine the size and characteristic of uterus and ovaries⁽¹⁻⁴⁾.

Teaching how to perform a pelvic examination is challenging; it requires the integration of technical and communication skills. There are several teaching methods to help in introducing the pelvic examination to medical students^(5,6). Traditional lectures have some benefits such as efficient use of time for both instructors and students. The pelvic examination demonstration for medical students during their early clinical encounters has been an ideal teaching method to develop clinical and communication skills along with substantiating appropriate ethical practices with real patients. In addition, medical students could learn how to do suitable sensational examinations which would benefit their future patients to gain better standards of care⁽⁷⁻¹³⁾.

In our institute, all of the fourth year medical students are taught the standard pelvic examination through the demonstration consisting of use of a speculum and bimanual examination, and practicing a Papanicolaou smear on an actual patient. Typically, after inserting a speculum, the students have to take turns looking through the speculum to see the cervix and observe how to perform the Papanicolaou smear. However, this approach seems to be inconvenient for the patient, the instructor and also the students. The medical students are usually unable to have a proper observation, which inevitably affects their confidence to perform subsequent pelvic examination independently.

In order to improve the teaching and demonstration of these basic techniques of pelvic examination to medical students, we designed a rod USB digital microscope as a teaching aid for pelvic examination demonstration. By applying this instrument, the tasks of pelvic examination

demonstration can be displayed through the monitor connected to a laptop computer. Students can have a better look at the cervix, vaginal wall, and learn the necessary steps to perform a Papanicolaou smear in real time. The objective of this study was to evaluate the students' satisfaction among the fourth year medical students learning the female pelvic examination, as well as the added benefits of the rod USB digital microscope compared with the traditional method of learning.

Materials and Methods

An assessor-blinded, randomized control trial was conducted in a university hospital from June to December 2015. This study was approved by the Ethical Clearance Committee on Human Rights Related to Researches Involving Human Subjects of Faculty of Medicine Ramathibodi Hospital, Mahidol University.

Device

The rod USB digital microscope type 200X 2.0 MP Endoscope 6 is a new technology that has been applied as a pelvic examination teaching aid (Fig. 1). The rod USB digital microscope is a tubular imaging system consisting of an optical lens and an image sensor with a 3X zoom, an illumination mechanism, and an image transfer control circuit that can be connected to a computer on real time. The user can display the images captured by the rod USB microscope on computer screen, print them, or send them through the internet. Additionally, by applying the rod USB digital microscope for teaching medical students, the Ramathibodi vaginal sleeve for digital camera with a medical grade stainless 8 mm in diameter was invented to cover the camera to maintain sterility. To test the efficacy of the device, three gynecological staffs utilized the index of item objective congruence (IOC) to validate the rod USB digital microscope as a tool.

Participants

Participants were the fourth year medical students recruited after commencing an Obstetrics & Gynaecology rotation.

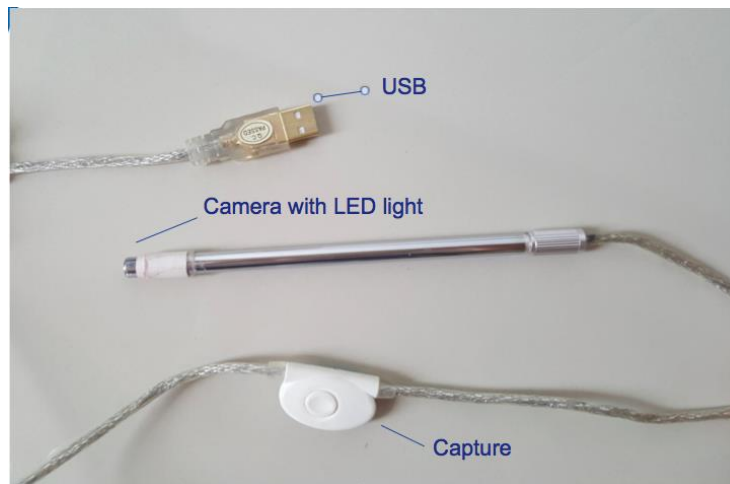


Fig. 1. Rod USB Digital Microscope.

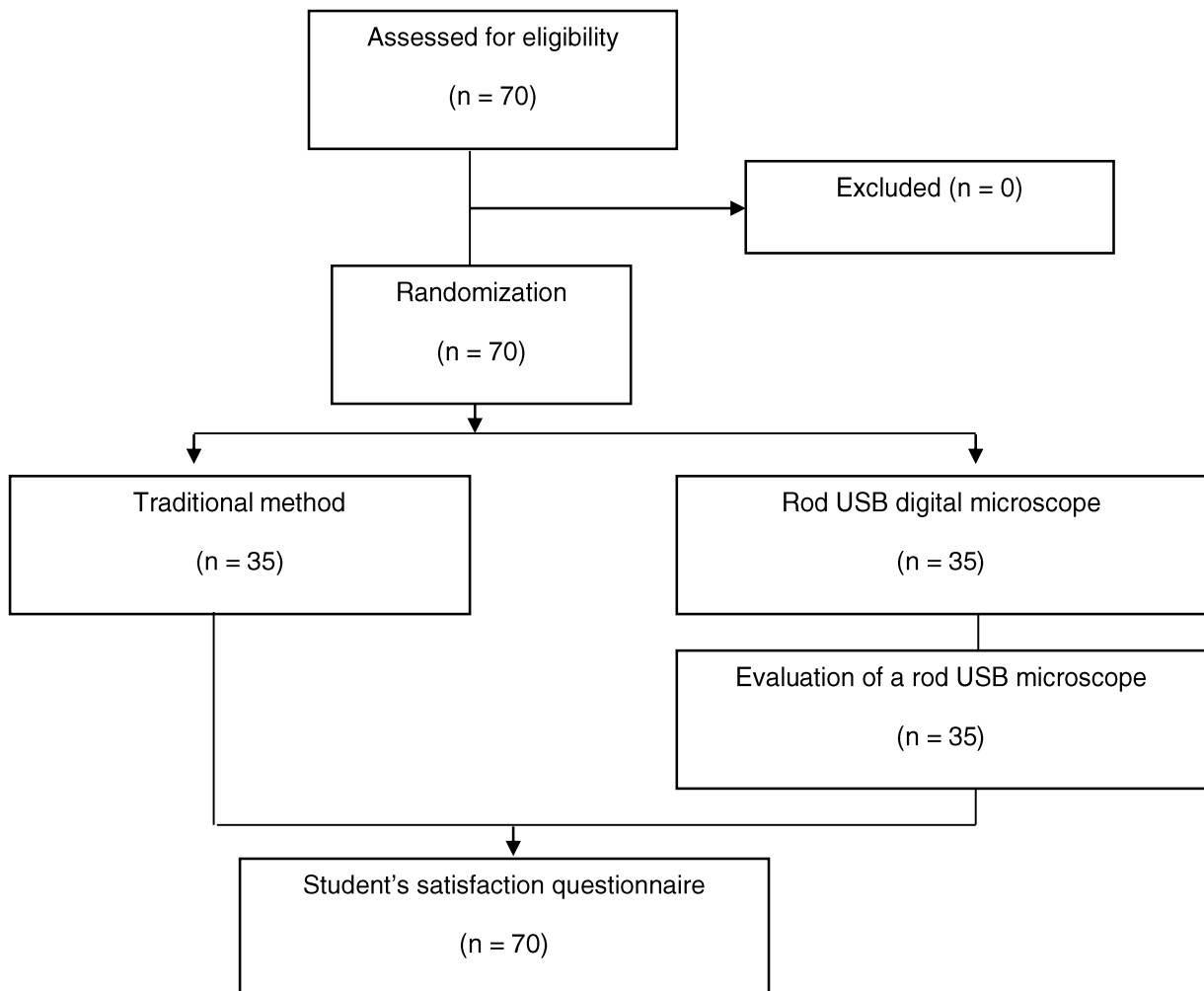


Fig. 2. Flow chart design.

Inclusion criteria

The fourth year medical students in Faculty of Medicine, Ramathibodi hospital, Mahidol University, Thailand from June to December 2015 in their fourth week of gynecologic rotation who agreed to participate in the study.

Exclusion criteria

The fourth year medical students who could not fully attend the procedure and complete the questionnaire.

All eligible participants gave written consent before entering the study. The third person performed a random number table generated independently from the investigator and put in the sealed envelope. The students were individually randomized by picking up a sealed envelope with number inside to divide them in each group they were assigned. This process was been in the fourth week of rotation class.

Intervention

During the fourth year of study, all medical students are given a lecture on the fundamental and technical skills involved with pelvic examination. Thereafter, the students participate in two learning sessions, which are a pelvic examination demonstration by an instructor and practicing a pelvic examination on a patient at the out patient clinic. Conventionally, the instructor (gynecologist) performs pelvic examination by applying speculum into a patient's vagina while teaching and discussing. All of the medical students in each group (6 medical students) observe pelvic examination by looking through the speculum one by one. To assign participants in each group, randomized assigned number were kept in sealed envelopes and opened individually. This process was been in the fourth week of rotation class.

Prior to the learning session, participants were asked about their demographic data and past experiences regarding the pelvic examination. Afterwards a standardized instructor demonstrated

to the participants how to perform a pelvic examination on a real patient. This procedure consisted of speculum and bimanual examination and a Papanicolaou smear. The students in the study group were demonstrated with the rod USB digital microscope inserted through the speculum. The images were displayed on the computer screen and all of the students in study group could see them on the computer screen at the same time. For the students in control group, they could see one by one through the speculum. Promptly, after the learning session, participants in both groups were asked to fill in a students' satisfaction questionnaire. Participants in the study group also completed a questionnaire to evaluate of the rod USB digital microscope assisting in the pelvic examination learning session. The data was collected by one blinded assessor who did not know in which group the students were and was not in learning session to eliminate the bias.

Outcomes

The primary outcome was based on students' satisfaction of pelvic examination learning which was assessed immediately after applying the new methods of teaching. Participants were asked to complete the validated Thai version of students' satisfaction questionnaire. Students' satisfaction was evaluated after completed teaching session by the questionnaire: 10 questions, 5 rating scale⁽¹⁴⁾.

The index of item objective congruence (IOC) was used to validate the questionnaire and the instrument by three gynecologists. The questionnaire was clear by 1.00; the standard measure was 0.50-1.00 by evaluation using the index of item objective congruence (IOC)⁽¹⁵⁾.

The questionnaire was made in order to assess the students' satisfaction of traditional method and rod USB digital microscope by using Likert scaling⁽¹⁴⁾. Additionally, a blank was provided for students to give additional comments if necessary.

The secondary outcome was to develop the device. According to the contamination problem while the inserting rod USB digital microscope into vagina, we invented Ramathibodi vaginal sleeve for digital camera with 8 mm in diameter to apply a camera into vagina to maintain sterility. The device was modified according to the authors' consideration to affirm that the users' needs are met and it consistently provides the intended benefit in actual-use conditions in pelvic examination demonstration. Verification and validation were done by measurement of IOC for the clearly displayed pictures, high repeatability and patient's safety.

Sample size calculation

Pilot study was done by 50 students (25 students each group) for students' satisfaction to calculate the size of population. The students who were satisfied with the traditional method were 10 from 25 students and the rod USB digital microscope method were 24 from 25 students. The sample size was calculated from the formula for comparing proportion with Z_{α} set as 1.96 and Z_{β} set as 1.28 with power of 90% and added with 10% of calculated number of participants who might be excluded due to data loss. Therefore, 35 students were needed in each group.

Statistical analysis

Pearson Chi-Square and Fisher Exact test, percentage were used for categorical data. Mann-Whitney U test was used for non-parametric data. Kolmogorov-Smirnov test was used to check normal distribution. Student's t-test was used to compare score in overall satisfaction and satisfaction in each teaching method. A p value of less than 0.05 was set as statistically significant. All data were analyzed using STATA version 14.0 software

Results

Firstly, the device was tested by 10 participants for its efficacy.

Then we proceeded to the clinical setting.

A total of 70 fourth year medical students in the faculty of Medicine, Ramathibodi hospital, Mahidol University, Thailand from June to December 2015 in the fourth week of gynaecologic rotation. There were 35 students in the study group (21 female, 14 male, aged 22.14 ± 0.36 years) and 35 in the control group (25 female, 10 male, aged 22.12 ± 0.33 years). The number that ever seen pelvic examination before were no significantly difference (4 (11.42%) vs 5 (14.28%) p-value = 1.00) (Table 1).

Table 1. Characteristics of students in traditional method and rod USB digital microscope groups.

	Traditional method (n = 35)	Rod USB Digital Microscope (n = 35)	p value
Age (years) ^a Mean ± SD	22.12 ± 0.33	22.14 ± 0.36	0.76
Gender ^b number (percent)	Female 25 (71.4%) Male 10 (28.57%)	Female 21 (60%) Male 14 (40%)	0.45
Number that ever seen pelvic examination before ^b number (percent)	4 (11.42%)	5 (14.28%)	1.00

^a t-test

^b Chi-square

Evaluation of Rod USB digital microscope

The overall for satisfaction of the rod USB digital microscope were high (4.75 ± 0.24) (Table 2). The top three highest satisfaction scores of rod USB digital microscope were 1. educational equipment, 2. adaption for diagnosis and treatment for Gynaecologic disease and 3. capturing for display.

Student's satisfaction

Most of the medical students showed high satisfaction with the rod USB digital microscope.

There was significant of overall satisfaction between the rod USB digital microscope and traditional method (95%CI = 0.45-1.91, $p < 0.001$). Satisfaction score of the rod USB digital microscope and the traditional method are shown in Table 3. Compared with the traditional method, the rod USB digital microscope had a significant higher satisfaction score than the traditional method; appropriated technology, students' interest, appropriateness of education atmosphere, approach to point of Papanicolaou smear, however no significant difference in duration of examination of both method.

Table 2. Evaluation of the rod USB digital microscope (n = 35).

Questionnaire (Rod USB digital Microscope)	Mean	Specificity
1. Appropriated size	4.65	0.59
2. Appropriated for vaginal examination	4.37	0.81
3. Captured images to display	4.86	0.36
4. Advantage for pelvic examination teaching and learning	4.97	0.17
5. Adapted for diagnosis and treatment of Gynaecologic disease	4.91	0.28
Overall	4.75	0.24

* Normal distribution of data SD = standard deviation

Table 3. Student's satisfaction questionnaire (n = 70)

Questionnaire	Traditional method (n = 35)	Rod USB Digital Microscope (n = 35)	Mean difference (95% CI)	p value
1. Duration of examination	4.37 ± 0.81	4.69 ± 0.63	0.86 - 1.01	0.069
2. Appropriated technology	2.68 ± 0.68	4.89 ± 0.32	0.50 - 0.60	< 0.001
3. Student's interest	3.31 ± 0.90	4.83 ± 0.51	0.62 - 0.75	< 0.001
4. Appropriateness of education atmosphere	3.9 ± 1.15	4.97 ± 0.17	0.71 - 0.86	< 0.001
5. Approach to point of Pap smear	4.2 ± 0.96	5 ± 0.0	0.78 - 0.91	< 0.001
Overall	3.69 ± 0.69	4.88 ± 0.12	0.45 - 1.91	< 0.001

Comparison of student's satisfaction score according to gender

The overall of satisfaction score in both male and female medical students are higher than traditional method (Table 4). The satisfaction of male and female have no statistically significant in difference ($p = 0.2529$, 95%CI = -0.18 - 0.61). But

there were higher score of male students' satisfaction than female in appropriated technology, appropriateness of education atmosphere, approach to point of Papanicolaou smear. However, the satisfaction of duration of examination and students' interest in female student are significantly higher than male students ($p < 0.001$).

Table 4. Comparison of student's satisfaction scores according to gender (n = 70).

Questionnaire	Mean \pm SD		p value	95%CI
	Female	Male		
Traditional method (n = 35) Female = 25 male = 10				
1. Duration of examination	4.40 \pm 0.82	4.10 \pm 0.74	0.264	-0.27 - 0.95
2. Appropriated technology	2.84 \pm 0.55	2.30 \pm 0.82	0.031	0.05 -1.03
3. Student's interest	3.56 \pm 0.92	2.70 \pm 0.48	0.009	0.23 -1.49
4. Appropriateness of education atmosphere	3.80 \pm 1.22	4.40 \pm 0.84	0.167	-1.46 - 0.26
5. Approach to point of Pap smear	4.32 \pm 0.80	3.90 \pm 1.29	0.250	-0.31 - 1.15
Overall	3.78 \pm 0.63	3.48 \pm 0.92	0.607	-0.85 - 1.45
Rod USB Digital Microscope (n = 35) Female = 21 Male = 14				
1. Duration of examination	5.00 \pm 0.00	4.21 \pm 0.80	< 0.001	0.43 - 1.14
2. Appropriated technology	4.81 \pm 0.40	5.00 \pm 0.00	0.087	-0.4 - 0.03
3. Student's interest	5.00 \pm 0.00	4.43 \pm 0.76	0.001	0.24 - 0.90
4. Appropriateness of education atmosphere	4.95 \pm 0.22	5.00 \pm 0.00	0.422	-0.7 - 0.07
5. Approach to point of Pap smear	4.95 \pm 0.22	5.0 \pm 0.0	0.422	-0.7 - 0.07
Overall	4.94 \pm 0.07	4.72 \pm 0.38	0.253	-0.18 - 0.61

Discussion

The aim of this study was to evaluation medical students' satisfaction in learning pelvic examination with rod USB digital microscope. Teaching aid is one of the tools to satisfy the students in learning and teaching process⁽¹⁶⁾. Rod USB digital microscope is a teaching aid to motivate and satisfy the students in learning. The highest satisfaction in the questionnaire were the advantage of rod USB digital microscope for pelvic examination learning and teaching in a clear point

of Papanicolaou smear, real time during learning and capturing images for display.

In this study, we found that the students as a whole significantly prefer learning with the rod USB digital microscope to the traditional method, especially understanding the point of Papanicolaou smear while practicing training from monitor display effecting learning and teaching achievement.

From the study, male and female students preferred learning by the rod USB digital microscope to

the traditional method. However the satisfactions of female students were significantly higher in appropriation of examination duration and interest in the rod USB digital microscope than male students. Nevertheless, male students were interested in adapting technology for a teaching aid to make them understand the point of Papanicolaou smear from computer screen connected to the rod USB digital microscope as a real time. The results among male and female students were compared in order to investigate the relationship between new technology and identity categories. Regarding the use of rod USB digital microscope connected to the computer in teaching pelvic examination, this study found that male had more preference than female on the point of appropriated technology. The earlier studies of Chen, Collis and Shashaani, found that male students, compared with their female peers, had more access to computers, felt more confident with their computer skills, and showed more positive attitude toward computers⁽¹⁷⁻¹⁹⁾. As the result of positive attitude toward computers, male preferred learning using computer as a teaching aid to female. Moreover, male students felt more comfortable to look in the vagina through monitor than through the speculum.

According to findings of duration in pelvic examination, the rod USB digital microscope and the traditional method were not significantly different.

From the additional free comment, most students commented that the rod USB digital microscope was very useful not only in education but also for diagnosis cervical abnormality. In addition, they can capture the images and make recording for self-study. The rod USB digital microscope is a cheap instrument for any hospital all over the country. The rod USB digital microscope doesn't cause pain to the patients because of its small size.

The strength of this study was that the medical education studies were rarely found and this study would benefit the further study to use the simple technology in teaching pelvic examination to help the medical students understand point of Papanicolaou smear clearly. Rod USB digital microscope could be

helpful to diagnosis gynecologic disease. Moreover, the questionnaire and the device were validated by three gynecological staffs by using IOC (Index of item objective congruence).

There were some limitations in this study. Due to clinical performance evaluations were not performed. Further studies should be performed with clinical performance evaluation and larger population.

Conclusion

In conclusion, the rod USB digital microscope could be applied for pelvic examination demonstration with high satisfaction score of the fourth year medical students. The findings of this study suggested that the rod USB digital microscope should be applied to pelvic examination demonstration class. In addition, low price innovation may be used in further diagnosis of the gynecological disease and study.

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Potential conflicts of interest

The authors declare no conflict of interest.

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