

THE EFFECTIVENESS OF THE FEMALE REPRODUCTIVE (FEREP) BOARD GAME ON 10TH GRADE STUDENTS' CONCEPTUAL UNDERSTANDING AND ATTITUDES TOWARDS THE LEARNING OF THE MENSTRUAL CYCLE

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Abstract: The menstrual cycle is a fundamental concept that links to the concept of pregnancy and birth control. However, students not only have miss conceptions, but many have negative attitude toward the learning of this concept. This may be due to the fact that the existing tools generally used to deliver this concept fail to effectively promote active learning, are making it boring and difficult for learners. This study therefore developed a board game to actively educate high school students on the integrative concept as it has been repeatedly found that board game can help promote active learning and enhance student understanding in science concepts, but no board game on this concept were reported. A one-group pre-test and post-test design was conducted to explore the effectiveness of the board game with 118 tenth graders. The finding showed the board game can promote both conceptual understanding and positive attitude toward learning this topic. More specifically, there was a statistically increase in conceptual understanding of concept, particularly in the menstrual cycle, pregnancy and birth control. Also, students' expressed attitudes toward learning menstrual cycle based on a questionnaire were found to become more positive after playing the game. It is therefore recommended that the use of this board game can be useful for educating adolescences which can be used either formally in classroom or, perhaps, informally at home.

Keywords: Understanding, Attitude, Menstrual cycle, Board game

Introduction

The biology of the menstrual cycle, which control and regulate depends on the coordination of the ovarian and the pituitary hormones, is related to the concept of pregnancy and birth control (Norman, 2014). The knowledge of menstrual cycle and its application can promote the girls' understanding about how to take care of their bodies and also to prevent themselves from sexually transmitted diseases and unwanted pregnancies. For the boys, menstruation education may help them to understand the behavior toward women, their intimate relationships, and the reproductive decision making (Beausang & Razor, 2000).

However, some studies found that students have misconceptions about menstrual cycle (Yip, 1998). Moreover, many findings showed that the attitudes of both boys and girls toward menstruation are likely to be negative. Girls feel uncomfortable to learn about menstruation in classroom and boys feel unrelated (Allen, Kaestle, & Goldberg, 2011; Beausang & Razor, 2000; Peranovic & Bentley, 2016). It is possible that above problems have occurred because the existing interventions that generally used to enhanced student understanding of the menstrual cycle such as picture, textbooks, and animation, which can provide fully information or can show the dynamic of hormonal regulation in menstrual cycle, are unlikely to effectively promote student active learning as well as do not help them to see the link between menstrual cycle, pregnancy and birth control.

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Moreover, almost of these interventions are depended on individual study rather than group interaction and that limits possible discussion between genders concerning this topic. (Senger, Oki, Trevisan, & Mclean, 2012; Yip, 1998). Thus, this study aimed to develop a learning innovation on the female reproductive hormone to educate students on this integrative concept as well as to promote positive attitudes towards learning menstruation. This was done using an educational board game which turns students' role in learning. In other words, students become more active in participation within friendly learning environment. It intended to promote the self-construction of knowledge and engage students in more enjoyable learning environment. (Gil-Perez et al., 2002; Spiegel et al., 2008). Additionally, according to the published literature, no educational board games on the integrative concept of menstrual cycle, pregnancy, and birth control have been established.

Research Objectives

This study aimed to explore the effects of a female reproductive (FEREP) board game intervention on enhancing students' conceptual understanding on menstrual cycle, pregnancy, and birth control and on promoting positive attitudes towards learning menstrual cycle. The study is led by the following research questions:

1. Is there any statistically significant difference in students' understanding of menstrual cycle, pregnancy and birth control, compared between before and after participating in the learning activity using the developed board game?
2. How does attitude towards the learning about the menstrual cycle of male and female students change after playing the board game?

Conceptual Framework

The conceptual framework displays the instructional methods using the developed board game with the grade 10th students throughout this study. Students' understanding on menstrual cycle, pregnancy, and birth control and their attitudes towards the learning of the menstrual cycle, which are the dependent variables, were measured to explore the effectiveness of the female reproductive (FEREP) board game intervention at the end of the teaching period.



Figure 1: Conceptual Framework of The Study

Literature Review

Menstrual cycle, Pregnancy, and Birth control

The Basic Education Core Curriculum B.E. 2551 (A.D. 2008) of Thailand requires upper secondary school students to acquire basic human body systems. One of which that is taken in this research is some part of the endocrine system which is about the hormonal regulation of female reproductive system which involves three interrelated concepts consisting of menstrual cycle, pregnancy and birth control. Female reproductive cycle or the menstrual cycle is the physiological process that occurs naturally when teenage girls reach a reproductive-age stage. The two main phases and two main events within 28 days (approximately) of menstrual cycle consist of menstruation, follicular phase, ovulation, and luteal phase (Menstrupedia, 2017;

Reece, Taylor, Simon, & Dickey, 2012). Accordingly, pregnancy and birth control involve in different phases of the menstrual cycle due to the regulation of the coordination of the ovarian and the pituitary hormones and its physiological processes. According to the menstrual cycle, pregnancy has high opportunity to occur naturally within the period of ovulation and the beginning of the luteal phase. In contrast, it has less opportunity to occur naturally within the menstruation period and the follicular phase. After the ovulation, the released egg can live within 24 hours, if the sperms in the uterus can meet the egg within this period, it has high probability to fertilize and develop to be a zygote and implant in the uterus lining so that the female becomes pregnant. On the other hand, if the sperm does not meet and fertilize with the egg within 24 hours, the egg is degenerated and pregnancy does not occur naturally. However, pregnancy still can occur through the assisted reproductive technology includes GIFT and ZIFT which can process in the beginning of the luteal phase and IVF which can process in the middle of the luteal phase (American pregnancy association, 2017). Furthermore, pregnancy is less likely to occur in the follicular phase because an egg cell is still in the process of development within the follicle. Similar to the phase of menstruation, the mature egg cell is already degenerated and fertilization could not occur therefore the pregnancy is less likely to occur naturally. According to birth control, natural family planning can prevent pregnancy by avoiding sexual intercourse at least 5 days before and after the ovulation period. In other words, it has a low fertilization rate of having sexual intercourse in 7 days before and after the first day of having menstruation. For preventing pregnancy, in the ovulation and luteal phase, condom could be used to keep sperms and egg apart. Moreover, emergency contraceptive pills could be used after having sexual intercourse within 48 hours for blocking sperms from entering the uterus as they induce cervical mucus become stickier as well as interfere with implantation of a zygote as they cause changes in the endometrium.

Students' Knowledge Levels and Misconception about Menstrual Cycle

According to the literature that is available, some studies provide evidence that students' knowledge levels and understandings of reproductive physiology and the menstrual cycle are very low, while some students also contained misconceptions about the biological processes of menstruation (Donati, Medda, Spinelli, & Grandolfo, 2000; du Toit, 1987; Sydsjö, Selling, Nyström, Oscarsson, & Kjellberg, 2006; Yip, 1998). For example, in the study of Sydsjö et al. (2006), students' knowledge of the time of ovulation, conception, sexual hormones, and contraceptive pill was less established. Male students had no reasonable idea of the time of ovulation which takes place 14 days before the first day of menstruation. Furthermore, the students had misconception that a contraceptive pill can prevent pregnancy by preventing the production of hormones that the fetus needs. Yip (1998) also found that students had misconceptions relating to the time of conception and the condition of the uterine lining. They understood that the egg is released when the uterine lining is the thickest, ovulation just occurs after menstruation, egg is available at all times but conception could only occur at specific conditions of the uterus, implantation would occur if the uterine lining is very thick, well supplied with blood or has recovered after menstruation. In addition, Yip suggested that the students had misconception because they only remembered the text or pictures without deep understanding.

Students' Attitude toward Menstruation

Several studies on psychology, health, and sex education provide evidence that both females and males have some negative attitude toward menstruation (Wong et al., 2013). Previous studies indicate that attitudes toward menstruation of females vary (Brooks-Gunn & Ruble, 1986). However, there exists evidence that females hold negative attitude toward menstruation. For example, girls explained that menstruation is a taboo subject even within their own families. They feel unable to discuss menstrual issues (FAWE Uganda, 2003). Furthermore, Marvan and Bejarano (2005) found that many young female students had negative feelings during the classes, the most common being nervous, and they felt embarrassed or were teased by boys in the class when the girls were singled out for menstrual education.

Although males do not experience menstruation, they possess more negative attitudes towards menstruation than female do (Brooks-Gunn & Ruble, 1986). As the study by Cheng, Yang, and Liou (2007) with Taiwanese student, the results indicated that more males than females felt that menstruation was

bothersome, something they did not like, and it was to be feared. Although some males felt open to discuss about menstruation, almost all felt uncomfortable about openly discussing menstruation (Allen et al., 2011; Peranovic & Bentley, 2016), and felt it was unimportant for them to know or talk about (Peranovic & Bentley, 2016).

Existing Tools for Teaching Menstrual Cycle in High School

The concept of the menstrual cycle is taught in the upper secondary level. The general learning approach is still delivered in a passive manner and the isolated teaching in biology classrooms hinders the meaningful connection in integrative concepts. For example, using pictorial and textual information, Yip's (1998) study probed certificate-level students' understanding of the menstrual cycle by analyzing their performance on a multiple-choice item in a Hong Kong public examination. He found many students who had problems in relating the time of conception to the condition of the uterine lining because they only remembered the text or pictures without deep understanding.

Moreover, Ho and Parmar (2014) proposed a circular diagram which can represent a set of the cycle time and readily shows the cyclic nature of the events in organized layers. Similar to Yip's findings, the result in this latter study shows that students have no difficulty in remembering the picture and gain some superficial understanding. However, it does not provide any links among menstrual cycle, pregnancy, and birth control. Using integrating multimedia and animations, Senger et al. (2012) used a set of computer graphics to show the menstrual cycle and hormonal regulations to patients. The result shows that participants gain more knowledge. However, each of the animations only shows a single concept and it depends solely on individuals rather than group interaction and that limits possible discussion between different genders.

In Thailand, the teaching strategies are various. However, over 80% of teaching approaches in secondary school appear in a form of lectures with some text and diagrammatic pictures. Other strategies are probably classroom discussion, case study analysis, small group work, video presentation, storytelling, etc. In addition, there are games used to teach this topic but the number is very low (Ministry of Education & UNICEF, 2017).

Board Game in Biology Education

The roles of educational board games become clearer as students become more active in participation of the construction of knowledge (Gil-Perez et al. 2002). Board games not only promote active learning through interaction with other players but also engage students in more enjoyable learning environment (Jones, Tincher, Odeng-Otu, & Herdman, 2015; Richardson & Birge, 1995; Spiegel et al., 2008). Some researchers found that educational board games were helpful for learning, make complex educational concepts approachable to learners (Dorn, 1989; Killi, 2007; Michael & Chen, 2005; Susi, Johannesson, & Backlund, 2007).

A number of board games were developed to teach biology concepts in order to enhance student understanding of biology concept, promote student active learning, and provide more enjoy learning environment. For example, Rose (2011) developed "Race to Glucose" to assist pharmacy students in learning metabolic pathways to help students increase their learning enjoyment, their familiarity with pathway reactions, intermediates, and regulation, and their understanding of how individual pathways relate to one another and to selected physiological states. Spiegel et al. (2008) developed Discovering the Cell to promote active learning among secondary students from Brazilian public and private schools, and the results indicate the suitability of the game as an alternative strategy to help teach complex cell and molecular biology themes to secondary-level students.

Furthermore, Automatic Nervous System (ANS) Board Game was developed to assist pharm D students in learning autonomic nervous system (ANS) pharmacology. After playing the board game, students have better understanding about the ANS system as a whole and how effects at one receptor affect the system downstream (Jones et al., 2015). Moreover, Kaledo was developed to promote nutrition education and to improve dietary behavior of adolescence (9–19 years old) in Campania and the result showed that Kaledo improved nutrition knowledge and dietary behavior of the participant. (Viggiano et al.,

2015). However, based on available literatures, there have no the board game on educating students in the integrative concept of menstrual cycle, pregnancy, and birth control was established before.

Methodology

This quantitative study was conducted using one-group pre-test and post-test design. The participants were 118 tenth grade students (21 male and 97 female) in a public school of Thailand. The female reproductive board game (FEREP) was developed to educate students on the integrative topic of menstrual cycle, pregnancy and birth control. The components of the board game consist of a board, 7 types of cards (Estrogen, Egg cell, Zygote, Embryo, Endometrium, Challenge, QA), a dice, player pieces. The number of player in each round are 4-6 players. The basic rules of FEREP are following the monopoly game. FEREP contains 2 rounds with different missions. In the first round, the players attempt to complete the cycle as fast as they can, without playing with challenge cards.

This round aims to help the players become familiar with the basic rules relating to the concept of menstrual cycle. In addition, it also aims to prepare the players for the second round which have more rules of playing with challenge cards. For second round, the game becomes more challenging with a new mission, competing with challenge cards. The players attempt to use the challenge cards not only to get the Zygote and Embryo card for completing implantation but also to interfere other players from getting implantation. This round aims to educate the players on the integration of the menstrual cycle, pregnancy, and birth control.

Accordingly, students will be able to learn the concepts through playing the game. (As showed in Table 1). Accordingly, lesson plan was developed for the implementation of the FEREP board game. It consisted with 4 main steps including *Concept Introduction*: introduce the concept of menstrual cycle by explaining the hormones, organs, and the basic of hormonal regulation that involve in the menstrual cycle; *Concept Delivery*: introduce the components, explain the rules as well as demonstrate how to play the board game and student play the board game in first round; *Concept Integration*: students play the board game to see the link among the menstrual cycle, pregnancy, and birth control as well as apply the knowledge of the menstrual cycle to solve the related problems about pregnancy and birth control; *Conclusion*: facilitate students to make the conclusion by linking to the rules of the board game.

Data collection and data analysis

To investigate students' conceptual understanding improvement from playing the developed board game, a menstrual cycle test consisting of 15 items; 8 fill-in-the-blank items, 4 multiple choice questions and 3 checklist items, was used in collecting data. The maximum total score was equal to 29 marks. The test assesses conceptual understanding of the content of menstrual cycle, pregnancy, birth control, application of the content, and connection among them. The participants completed the test both before and after participating in the intervention. The difference of pre- and post-test mean scores in each subtopic were analyzed using either paired simple t-test or Wilcoxon signed-ranks test depending on the normal distribution of the data itself. To answer the second research question, a students' attitude questionnaire was constructed to explore the students' attitude toward learning menstrual cycle. The questionnaire contains 2 parts;

Part 1 Student gender; to explore gender of the participants, Part 2 Students' attitude toward learning menstrual cycle; this part was developed to explore students' attitude toward learning menstrual cycle before and after the intervention. There contain 5 statements that were put in a five-point Likert scale from strongly disagree to strongly agree.

The participants were completed the students' attitude questionnaire after the intervention.

The data obtained from the students' attitude questionnaire was statistically tested by comparing their rating scores before and after intervention using Wilcoxon signed rank test.

Table 1: The integrative concepts of the female reproductive (FEREP) board game

Time	Roles of player	Concept integration	
		Menstrual cycle	Pregnancy & Birth control
Day 1-3	Players act as a growing follicle <i>*For the second round</i> all players discard all of cards	<i>Menstruation phase</i> -Sharp drop of hormones -Endometrium becomes menstruation	-
Day 4-13	Players act as a growing follicle and attempt to collect the estrogen cards to induce LH peak (the ovulation will occur)	<i>Follicular phase</i> -FSH and Estrogen coherently regulate -The follicle and an egg cell grow and develop	-
Day 14-16	The follicle players become a corpus luteum players and their egg can fertilize by putting the sperm card and can turn to be Zygote card. In addition, the corpus luteum players who have ZIFT and GIFT card also have opportunity to get pregnant. However, the others can put down the Condom and ECPs card to prevent the pregnancy.	<i>Ovulation</i> -LH peak induce follicle releases an egg	-Fertilization -GIFT -ZIFT -NFP* -Condom -ECPs*
Day 17-23	The corpus luteum players attempt to collect the endometrium cards for implant their embryo to become pregnancy. In addition, the corpus luteum players who have IVF card also have opportunity to get pregnant. However, other players can put down the Condom and ECPs card to prevent the pregnancy.	<i>Luteal phase</i> -Corpus luteum releases estrogen and progesterone -Endometrium thickness	-Implantation -IVF -ECPs* -NFP*
Day 24-28	Not-pregnant players begin to lose the estrogen cards in their hand before enter the new cycle.	<i>Luteal phase</i> Sharp drop of hormones	- NFP*

* NFP = Natural family planning, ECPs = Emergency contraceptive pills

Results

Students' understanding of the menstrual cycle, pregnancy, and birth control

The comparison of students' understanding scores, before and after the intervention, indicated a statistically significant increase in all subtopics after the FEREP board game intervention. For each subtopic, the mean scores, before the intervention, of the menstrual cycle concept was 5.51 (SD =2.045), while the mean value after the intervention increased to 10.52 (SD = 3.904), $t = 15.859$, $p = 0.000$. Furthermore, the results of Wilcoxon signed ranks test show the mean scores, before the intervention, of the pregnancy and birth control concept was 6.65 (SD = 2.516), while the mean value after the intervention increased to 8.94 (SD = 1.335), $Z (118) = 7.631$, $p = 0.000$.

Table 3: Comparison of students' understanding of the integrative concept of menstrual cycle before and after the female reproductive hormone board game intervention (N = 118)

	N	df	Pretest		Posttest		t	Z	Sig.
			Mean	SD	Mean	SD			
Menstrual cycle	118	117	5.51	2.045	10.52	3.904	15.859		0.000
Pregnancy & birth control	118	117	6.65	2.516	8.94	1.335		7.631	0.000
Overall	118	117	12.16	3.457	19.46	4.437	17.797		0.000

Students' attitude toward learning menstrual cycle

The results obtained from Wilcoxon signed ranks test (showed in Table 4) indicated that there was a statistical decrease in both male and female students' opinion towards being shy. However, a statistical decrease in students' opinion towards inappropriateness and a statistical increase in the application of learning were found in female student only. Among male students, there was a statistical decrease only in students' opinion towards being shy after playing board game as the mean score was 2.19 (S.D. = 1.08) in the pre-intervention stage and it decreased to 1.71 (S.D. = 0.85), $Z = 2.428$, $p = 0.015$ in the latter stage. Among female students, positive attitude towards gender appropriateness and the application of the learning was found to be statistically significant. More specifically, female students' opinion towards being shy was a statistical decrease after playing board game as the mean score was 1.98 (SD = 0.89) decreased to 1.41 (SD = 0.69), $Z = 5.796$, $p = 0.000$. Female students' opinion towards inappropriateness of learning was a statistical decrease after playing board game as the mean score was 1.90 (SD = 0.92) decreased to 1.60 (SD = 0.97), $Z = 3.565$, $p = 0.000$. Female students' opinion towards the discussing with different gender was a statistical decrease after playing board game as the mean score was 2.02 (SD = 0.85) decreased to 1.48 (SD = 0.75), $Z = 5.359$, $p = 0.000$. Moreover, in the post-intervention stage, their opinion towards the application of learning as everyone should learn was a statistically increased from 4.40 (SD = 0.72) to 4.86 (SD = 0.38), $Z = 5.718$, $p = 0.000$. Their opinion towards the application of learning as it could be applied in daily life was a statistically increased from 4.34 (SD = 0.78) to 4.81 (SD = 0.42), $Z = 5.289$, $p = 0.000$.

Table 4: Comparison of students' attitude toward learning menstrual cycle before and after the female reproductive hormone board game intervention (N = 118)

Statements	Gender	N	Before		After		Z	Sig.
			Mean	S.d.	Mean	S.d.		
Gender appropriateness								
1) Shy to learn in classroom	Male	21	2.19	1.08	1.71	0.85	2.428	0.015*
	Female	97	1.98	0.89	1.41	0.69	5.796	0.000*
2) Shy to learn with different gender	Male	21	1.81	0.98	1.48	0.98	1.474	0.140
	Female	97	1.90	0.92	1.60	0.97	3.565	0.000*
3) Discussion with different gender is not suitable	Male	21	2.29	1.15	1.90	1.22	1.634	0.102
	Female	97	2.02	0.85	1.48	0.75	5.359	0.000*
Application								
4) Everyone should learn	Male	21	4.10	0.70	4.38	0.87	1.540	0.124
	Female	97	4.40	0.72	4.86	0.38	5.718	0.000*
5) Can apply in daily life	Male	21	4.05	0.97	4.24	1.09	1.265	0.206
	Female	97	4.34	0.78	4.81	0.42	5.289	0.000*

Discussion

The results of the students' conceptual understanding part showed that after playing FEREP, students demonstrated a statistically significant increase in conceptual understanding of both the menstrual cycle and the pregnancy and birth-controls. This conceptual development attributed by the educational innovation is another evidence showing the effectiveness of board games in science education. This finding is in agreement with previous studies that many board games were developed to enhance student understanding of biology concepts ranging from molecular biology, biochemistry to food science. For example, in Jones et al. (2015), they a board game called "*Automatic Nervous System (ANS) Board Game*" was developed to assist students in learning autonomic nervous system (ANS) pharmacology and the results showed that students have better understanding about the ANS system as a whole. Rose (2011) also developed "*Race to Glucose*" board game to assist pharmacy students in learning metabolic pathways and the results showed that students considered "*Race to Glucose*" to be an enjoyable and helpful tool for learning intermediates, regulation, and inter-pathway relationships. Furthermore, Spiegel et al. (2008) developed "*Discovering the Cell*" to promote active in the learning to the secondary students and to provide an interactive opportunity to learn and enjoy biology.

The results indicate the suitability of the game as an alternative strategy to help teach complex cell and molecular biology themes as well as offers an opportunity to learn cell biology in an interactive and enjoyable manner. Moreover, "*Kaledo*" which is board game that developed to promote nutrition education and to improve dietary behavior of adolescence. The result showed that "*Kaledo*" improved nutrition knowledge and dietary behavior of the participant (Viggiano et al., 2015). Although there exist other educational board games in biology education, FEREP is one of few educational innovations that integrates physiological concepts in it. In fact, it appears to be the very first attempt that draws the integrative concept of the menstrual cycle, hormonal regulation, pregnancy, and birth-control technologies in high school education. Although the results themselves only serve as another reassurance that board games can be applied in effective learning of biology, among other recent findings, this study claims its originality in the field of the menstrual cycle and its interrelated concepts. Focusing on the comparison of the students' attitudes before and after playing the board game, the statistic results indicated that there was a statistical decrease in both male and female students' opinion towards being shy to learn.

However, a statistical decrease in students' opinion towards inappropriateness and a statistical increase in the application of learning were found in female student only. Among male students, there was a statistical decrease only in students' opinion towards the feeling of being shy after playing board game. This could be linked to the results of previous studies that more males than females felt that menstruation was bothersome, something they did not like, and felt it was unimportant for male to know or talk about menstruation (Cheng et al., 2007; Peranovic & Bentley, 2016). These maybe the cause that most of male students do not received the benefit of knowledge of the menstrual cycle as much as female do.

Taking a closer look to female students, positive attitude towards gender appropriateness and the application of the learning was found to be statistically significant. More specifically, female students' opinion towards being shy and inappropriateness of learning and discussing with different gender statistically decreased after playing board game.

Based on previous studies on the female attitudes toward the menstruation, girls explained that menstruation is a taboo subject even within their own families. They feel unable to discuss menstrual issues (FAWE Uganda, 2003). Many young female students had negative feelings during the classes, the most common being nervous, and they felt embarrassed in the class (Marvan & Bejarano, 2005). Similarly, female students indicated that they felt embarrassed discussing menstruation in group situations (Beausang & Razor, 2000).

These above results showed that playing the board game could reduce the students' feeling shy to learn about menstrual cycle in the classroom, with or even without different gender peers, as well as having academic discussion about the menstrual cycle with different gender as it could break down the taboo cultural and create an environment for open and clear communication about menstrual cycle which resulted in contribute to positive attitude toward the learning of the menstrual cycle. This finding could be resulted

from the playful and immersive nature of board games that tend to involve the students and increase relaxing learning environment (Spiegel et al., 2008) which help to reduce the feeling shy.

Furthermore, female student opinion towards the application of learning that everyone should learn and it could be applied in daily life also statistically increased after playing the board game. This may due to the rules of board game that help them to see the link between hormonal regulation in menstrual cycle and pregnancy and birth-controls and that make them think the menstrual cycle is important and have benefit for their future life. Other reasons maybe due to the simulated situations along playing the game which facilitated the students to experience with the use of knowledge and linked the situations to their real life. This simulated real-life situation characteristic of game was pointed out by the previous studies that games provide the opportunity to apply previously gained knowledge in a new context (Gredler, 2004) and games make it possible to create learning experiences in situations where it is not possible or practical to offer the experience in a real-world setting (Galarneau, 2005).

Conclusion

The FEREP board game is the learning innovation on the integrative topic of the menstrual cycle, pregnancy and birth control. This study developed an educational board game to actively educate students to learn with excitement as well as to provide comfortable environment for academically constructing conversation on this sensitive concept among learners. The study reveals that students who participated in the FEREP activity achieved a higher level of conceptual understanding in all subtopics (the menstrual cycle, pregnancy and birth control). Furthermore, both male and female students' attitudes toward the learning become more positive as there was a decrease in the feeling of being shy and the sense of inappropriateness to learn the menstrual cycle and there was an increase in the sense of application of the learning. Although both male and female students tended to agree that this topic is applicable to everyone in terms of direct use in daily life, only among female participants, a statistical shift in perception towards a more positive direction was identified. The deliver that fails to effectively promote active learning and cannot break down cultural inappropriateness can lead students to have misconceptions as well as negative attitude toward the learning. This combination of learner-centered and lecture delivery, coupled with the FEREP board game, should be a great tool for helping students understand the menstrual cycle in high school-level biology courses and providing comfortable-to-discuss environment.

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