SNAPPS Case Presentations in a Thai Internal Medicine

Ambulatory Care Rotation

BY

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THESIS

Submitted as partial fulfillment of the requirements
For the degree of Master of Health Professions Education
In the Graduate College of the
University of Illinois at Chicago, 2014
Chicago, Illinois

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ACKNOWLEDGEMENT

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LIST OF ABBREVIATIONS

ANOVA   Analysis of Variance

SNAPPS   **Summarize** history and physical findings, **Narrow** the

differential, **Analyze** the differential, **Probe** preceptor

about uncertainties, **Plan** management, and **Select** case-related

issues for self-study

SUMMARY

Purpose: SNAPPS is a learner-centered approach to clinical case presentations that was shown, in American studies, to facilitate the expression of clinical reasoning and uncertainties in the outpatient setting. The purpose of this study was to replicate these studies in an Asian medical school.

Methods: We conducted a quasi-experimental trial comparing the SNAPPS technique to the usual-and-customary method of case presentations (usual) for fifth-year medical students in an ambulatory internal medicine clerkship rotation at Khon Kaen University, Thailand. The experimental time was 3 weeks; one week shorter than the US study. There were 12 outcomes measured at the end of the rotation including, the number of basic attributes, completeness of summary thoroughness, number of differential diagnoses, number of justifications in the differential diagnoses, expression of uncertainties, student-initiated management discussion, student-initiated reading selections, total presentation time, summary time, discussion time, number of supportive evidence, and student-initiated diagnosis discussion. The last three outcomes were new for this study.

Results: SNAPPS users (90 case presentations), compared with the usual group (93 presentations), had more diagnoses in their differentials (1.81 vs. 1.42) and more differential justifications (0.90 vs. 0.78), more student-initiated diagnosis discussions (76.7% vs. 59.1%) and student-initiated reading selections (6.67% vs. 0%), and included more supportive attributes for the differential (2.39 vs. 1.22). Thai students expressed fewer uncertainties and selected fewer readings than in the American study.

Conclusions: The use of the SNAPPS technique among fifth-year Thai medical students during their internal medicine ambulatory care rotation did facilitate the

expression of their clinical reasoning. While the SNAPPS technique was applicable

across cultures with regards to expressing clinical reasoning, the Thai students were

still reluctant to express their uncertainties, likely because of different procedural and

Thai cultural barriers.

1. INTRODUCTION

SNAPPS is a learner-centered approach for clinical case presentations that has been shown to facilitate the expression of clinical reasoning and uncertainties in the outpatient setting where time is limited.[1-3] The SNAPPS acronym for case presentations stands for: **Summarize** history and physical findings, **Narrow** the differential, **Analyze** the differential, **Probe** preceptor about uncertainties, **Plan** management, and **Select** case-related issues for self-study. The original 2009 SNAPPS study was conducted with third-year medical students in a family medicine ambulatory care clerkship at Case Western Reserve University School of Medicine.[2] Students were randomly assigned to three experimental groups; (1) SNAPPS training group, (2) feedback training group (i.e., learning generally about getting good feedback), and (3) usual-and-customary group. SNAPPS users were better than the students in the other two groups in revealing their clinical reasoning and expressing their uncertainties. Presentation time in the SNAPPS group was not different from the usual-and-customary group but, was one minute longer than for the feedback-trained group.

In Thailand, as in other Asian countries, medical school begins after high school and lasts six years, the first three years of which focus on basic medical sciences and the last three years on clinical application. This is different from the United States (USA) where medical school begins after a four-year college degree and lasts four years, that is, two pre-clinical and two clinical years. Thai medical students are younger and opportunities for faculty development for the preceptors are rare. Also Asian culture and traditions are different from America.[4] The educational

culture in the US is more individualistic and outgoing[5], where students do more independent work and express more openly their knowledge and thinking. Thai or Asian students on the other hand are typically silent during lectures and conferences and less likely to discuss their knowledge or thinking in front of others.[6] There is no published data on the use of SNAPPS outside the USA. It would be useful to have additional confirmatory evidence of the positive effects of SNAPPS in other cultural and specialty settings. Thus, the purpose of this study was to test the effects of SNAPPS by replicating the original American study in an Asian medical school during internal medicine rotations.[7]

2. METHODS

The study was a modified version of the 2009 study by Wolpaw et al in the USA.[2] Because Khon Kaen University (KKU) does not have family medicine ambulatory care rotations, we conducted the study during the outpatient portion of internal medicine rotations.). We only compared the SNAPPS technique with the usual-and-customary method of case presentations, instead of the three study groups, because the feedback group in the Wolpaw study had similar results to the usual-and-customary group.

2.1 Design: We conducted a quasi-experimental trial, comparing the performance of fifth-year medical students (M5) using the SNAPPS technique for case presentations to M5s using the usual-and-customary method during their internal medicine rotations at the KKU Faculty of Medicine. M5 students at KKU complete three-week clerkships in internal medicine ambulatory care that are part of a combined medicine-surgery12-week block rotation. There are four 12-week rotations per year. A 12-week rotation consists of four blocks (A1, 2 and B1, 2). Students, stratified by their GPAs, were randomly assigned to the blocks and rotations by the Department of Academic Affairs at KKU. See Box 1 for details. During the outpatient portion of the rotation and under the supervision of a preceptor, the students see patients with common ambulatory problems. One preceptor supervises and teaches approximately 4 to 5 students during morning sessions. As in the Wolpaw study, students give individual case presentations (one-on-one) to the preceptors.[2]

Four groups of students were enrolled in the study, one intervention group and three comparison groups. The first group of students in the study, and their

preceptors, used the usual-and-customary method of case presentation during Block-1; they constitute a baseline group (hereafter Gr-1: M5-Usual-Block1). The second group of students and preceptors was trained to use SNAPPS during Block2; this is the intervention group (Gr-2: M5-SNAPPS-Block2). Two other comparison groups were added to verify any possible maturation effect. The third group, during Block3, did case presentations without having been introduced to the SNAPPS technique and were compared with the first group to account for any maturation in the second (SNAPPS) group. The preceptors, who had already undergone training for the SNAPPS technique, were instructed not to use the technique with this group. Finally, a second maturation comparison group (Gr-4) was used, in parallel to the first group of M5, consisting of M6 students who were now a year later in their training, with no prior exposure to any SNAPPS training; they were also compared with M5 students for any maturation effect between the fifth and sixth years. The M6 group was the first group of the academic year that corresponded to the same time period as the first group of M5 students. The M6 students complete a 12-week rotation in internal medicine, similar to the M5 students with groups of 4-5 students working with one preceptor. We collected data from the M6 students throughout the 12 weeks. The four study and comparison groups are presented in Box 2. The ethics committees from Khon Kaen University and the University of Illinois at Chicago approved the study. Informed consent was obtained from both students and preceptors prior to study participation.

2.2 Preceptors: All the physicians who served as internal medicine ambulatory care clerkship preceptors at KKU Faculty of Medicine were eligible and invited to participate in the study.

2.3 SNAPPS Group: For Group-2 (the SNAPPS intervention group), as in the Wolpaw study, the principal investigator (KS) provided individualized SNAPPS training sessions for the preceptors and a 45-minute group training session for the students on the first day of the rotation. The training sessions included: (i) viewing an 11-minute instructional video presentation explaining and demonstrating the SNAPPS technique, (ii) participating in one, English-written, scripted role-play of a SNAPPS case presentation with one student acting and the others observing, (iii) asking clarification questions, and (iv) receiving a three-by-five inch laminated card highlighting the six steps of the SNAPPS technique.[2]

In addition, students met with the principal investigator (KS) each Monday for a 30-minute group session to reinforce the use of the SNAPPS technique. The principal investigator presented some patient findings and asked one student to practice a SNAPPS presentation, followed by feedback and group discussion regarding any unclear issues about SNAPPS. Similar to the introductory session, one student did a presentation and the others observed and commented.

2.4 Usual-and-customary Group: The preceptors and students in Group-1 did case presentations in the ambulatory care clerkship as usual, with no particular training provided.

2.5 Audiotaping and Coding: During the last week of the three-week ambulatory rotation, students received a tape recorder and instructions on how to audiotape as many case presentations as possible during this final week. To guarantee confidentiality, students received cassette tapes labeled with an identification number,

known only to the study administrator. The principal investigator reminded the preceptors in all the groups that students would be audiotaping their case presentations during the final week of the rotation.[2]

The principal investigator (KS) listened directly to all the (non-transcribed) audiotapes and coded the content of the presentations according to the 12 outcome variables presented below. He was blinded to the identity of the students and preceptors as well as to group assignment.[2] A research assistant assigned a random number for each recording using a table of random numbers. The identification code was known only to the research assistant and broken as to group assignment after the principal investigator completed all the coding. The first 10 recordings were independently coded by another trained coder, also blinded to subject and group identity, to verify inter-rater agreement. If the inter-rater agreement (intraclass correlation coefficient) was greater than 0.80, then the remaining presentations would be coded by the principal investigator only. Otherwise a second coder would be used until an acceptable level of agreement was achieved. The number of diagnoses in the differential diagnosis in each presentation was used to calculate the inter-rater agreement; this variable was chosen because it best represented overall clinical thinking.

2.6 Outcomes: Based on the original study[2], 9 outcomes (dependent) variables were measured related to expressing clinical reasoning and uncertainties as well as time and conciseness of the presentations. This is one less variable than in the Wolpaw study; comparing and contrasting of pairs of diagnoses was not measured because students did not exhibit this behavior in the Wolpaw study. The 9 outcomes are (first column in Table 1):

(1) Summary thoroughness - basic attributes: number out of 9 basic attributes of the chief complaint and history of present illness mentioned by the students, that is, patient characteristics, onset, site, severity, course, quality, context, associated manifestations, and aggravating/alleviating factors. For example, if a student mentioned during the case presentation that it was "a 35 year-old-Thai man with abdominal pain in the epigastrium for 2 days and the pain was burning and relieved with foods," then we tallied 5 basic attributes.

(2) Summary thoroughness - completeness: contains (1) or not (0) both history of present illness and physical exam findings;

(3) Number of diagnoses in the differential diagnosis (DDx): total number of diagnostic hypotheses expressed by the students; for example, if the student mentioned "peptic ulcer, acute infective diarrhea, and acute pyelopnehritis," then 3 diagnoses were tallied.

(4) Justification: number of justified diagnoses. Any given diagnosis (DX) could be supported by patient findings, knowledge of the disease, reference to the literature, or past experience. For example, the student may have mentioned 3 diagnoses but only justified 2 of the three; then 2 diagnoses were tallied as justified.

(5) Expression of uncertainties: number of student-initiated questions about uncertainties or areas needing clarification;

(6) Patient management plan: whether or not a management plan was discussed. We classified management discussion as either (i) student-initiated or (ii) no management discussion occurred or preceptor-initiated discussion.

(7) Identification of case-based learning issues for further study: number of student-initiated reading selections;

(8) Presentation length: start-to-end time in minutes; and

(9) Conciseness: minutes for the summary portion (chief compliant, history of present illness, physical exam, labs, imaging).

Not only was this study done in a different cultural setting but three new outcome measures were added: (10) discussion time, (11) number of basic attributes used to support the differential diagnosis and, (12) method of student-initiated diagnosis discussion. The discussion time was calculated by subtracting the summary presentation time (variable 9) from the total presentation time. The number distinct basic attributes used (maximum 9) to support the diagnoses in the differential was tallied. This outcome shows the extent to which the students used basic clinical findings to support their differential diagnoses, that is, one of the elements in variable 4 (justification). The method of diagnosis discussion was classified if there was discussion on the diagnosis or not in the presentation and categorized as either (i) student-initiated discussion or (ii) no diagnosis discussion or preceptor-initiated discussion.

2.7 Data Analysis: The data for each dependent variable for overall group differences were analyzed using one-way ANOVA for all ratio-scaled variables and chi-square or Fisher exact tests for nominal-scaled variables. The normal distribution and equality of variance were tested using Shapiro-Wilk test and Bartlett's test, respectively. If the variable was not normally distributed or the variances were not equal, Kruskal-Wallis test was used to test differences among groups. If there were differences in outcomes overall, the differences between pairs of groups were tested. Significance was set at 0.05 with no Bonferronni adjustments because the comparisons were planned and

theoretically based. To determine whether a possible improvement in performance could be simply due to more presentation time, correlations between total presentation time and the outcome variables were calculated for the experimental and comparison groups using Spearman rho coefficients.

2.8 Sample Size Calculations: Based on data from the 2009 Wolpaw study[2], sample size calculations were done for each variable. The most stringent requirement for sample size was student-initiated management plan that required 27 subjects per group for 80% power and 95% confidence. Given a possible loss of usable tapes, five additional subjects were added per group, for a total of 32 subjects solicited per group.

3. RESULTS

There were a total of 303 presentations: 71, 90, 93, and 49 presentations, respectively for groups 1 to 4. There were fewer presentations in group 1 and 4 because it was the first block of the academic year and both preceptors and students were not familiar with audiotaping. Some forgot to record their presentations and others had technical difficulties with their tape recordings. The numbers of students in each group were 56, 56, 53, and 42, respectively, for an overall average of 1.45 presentations per student. The intraclass correlation coefficient for the two raters was 0.91 for the numbers of differential diagnosis per presentation (Variable 3) for 10 randomly selected presentations. The remaining 293 presentations were coded by one coder (KS). During the role-play session, there were very few questions asked by the students in the SNAPPS group. The two most common questions were the number of diagnoses to include in the differential during each presentation and how to express reading selections.

All the case presentations contained both history and physical examination findings. Except for the number of students expressing uncertainties, 10 of the 12 outcome variables were significantly different across the four study groups (ANOVA p-values <0.001, Table 1).

3.1 Main Effects: M5-SNAPPS-Block2 students (Gr. 2) used on average more supportive basic attributes (2.39 vs. 1.22, p=.001; ES=1.17), had more diagnoses in their differentials (1.81 vs. 1.42, p=.016; ES=0.39), and included more readings in

their presentations (6.67% vs. 0, p=0.039; ES=0.67) than the M5-Usual-Block3 students (Gr. 3; see Tables 1 (Gr2: M5-SNAPPS-Block2 and Gr.3: M5-Usual-Block3) and Table 2 (column 1 for details).

M5-SNAPPS-Block2 case presentations (Gr. 2) were not longer than those of their peers (12.01 min. vs. 11.19 (M5-Usual-Block3) and 12.57 (M5-Usual-Block1); all p-values >0.463, Table 1). They were approximately 3-and-a-half minutes longer than those of M6-Usual-Block1 students (Gr. 4; 12.01 vs. 8.35, p=<0.001; ES=3.93), including summary time (4.14 vs. 3.14, p= <0.001; ES=1.05) and discussion time (7.87 vs. 5.20, p=0.002; ES=2.78).

3.2 Maturation Effects: The non-SNAPP users (Gr. 3: M5-Usual-Block3) were not different from those at the beginning of the rotation (Gr. 1: M5-Usual-Block1); all p-values were greater than .185 (Table 2), thus the differences between M5-SNAPPS-Block2 (Gr. 2) compared with M5-Usual-Block3 (Gr. 3) were not due to maturation. The same differences observed between the M5-SNAPPS-Block2 (Gr. 2) and M5-Usual-Block3 (Gr. 3) were also present between M5-SNAPPS-Block2 (Gr. 2) and Block1 (Gr. 1), except for more differential justification among SNAPPS users (.90 vs. .61, p=.001; ES=0.29).

Finally, M5-SNAPPS-Block2 students (Gr. 2) reported on average more basic attributes (3.21 vs. 2.65, p= 0.003; ES=0.56), identified more supportive evidence (2.39 vs. .61, p=<0.001; ES 1.78), had more diagnoses in their differential (1.81 vs. 1.24, p=0.003;ES=0.57) and more justified differential diagnoses (.90 vs. .54, p=<0.001;ES=0.36), and initiated more diagnosis discussions (76.67% vs. 51.02%, p=0.015; ES 0.26) and management (43.33% vs. 20.41%, p=0.049;ES=0.23) discussions than M6-Usual-Block1 students (Gr. 4).

There was a significant negative correlation between total presentation time and the number of presentations containing student-initiated diagnosis and management discussions for students in the M5-SNAPPS-Block2 (Gr. 2) and M5-Usual-Block3 (Gr. 3). There was a significant positive correlation between total presentation time and the number of supportive findings, number of differential diagnoses, and number of students who selected readings for students in the M6-Usual-Block1 (Gr. 4). See Table 3 for details.

4. DISCUSSION

The results from this study indicate that the use of the SNAPPS technique fostered the expression of clinical reasoning for Thai medical students during internal medicine ambulatory care rotations. SNAPPS users, compared with other M5 and M6 students using the usual-and-customary method of case presentations (1) had more supportive evidence, (2) entertained and justified more differential diagnoses, (3) initiated more diagnosis and management discussions, and (4) set more reading selections. There was no significant maturation effect found for the M5 students. Finally, the SNAPPS users outperformed the more senior M6 students in expressing their clinical reasoning during case presentations.

Overall, the percentage of presentations containing student-initiated diagnosis and management discussion ranged between 51 to 77% and 20 to 44%, respectively. The relatively low percentages for these two outcomes suggest that the preceptors led the diagnosis and management discussions, particularly with the M5-non-SNAPPS users (Gr. 1) and M6 students (Gr. 4; Table 1). The lack of difference between M5-Usual-Block1 (Gr. 1) and Block3 (Gr. 3) also suggest that the preceptors did not encourage the use of SNAPPS in the M5-Usual-Block3 comparison group (Table 2).

The presentation time for the Thai students was longer than for the American students in the 2009 Wolpaw study[2], that is, 12.01 (SD= 6.05) minutes compared with 5.65 minutes (SD=2.45). Presentation time did not differ among the M5 students, regardless of experimental groups, but was longer compared with M6 students. The M6 were more concise in their delivery but did not show their reasoning nearly as much and had fewer student-initiated diagnosis discussions. The M6 students were

more practical and time conscious than M5s. They were behaving like busy interns and spent less time on discussion or presentation.

The results from the present study with Thai medical students were similar to those from the original 2009 Wolpaw SNAPPS study with American students[2] (e.g., numbers of basic attributes, numbers of differential diagnosis, and numbers of justified diagnosis), except that Thai medical students expressed uncertainties much less often than their American counterpart (6.67% vs. 84.38%). The number of student-initiated reading selections was also quite low (6.67% vs. 51.61%) for the Thai students. There are many possible explanations for these divergent results, either because of procedural differences in the conduct of the study or cultural differences across the American and Thai settings. For the students in the Thai study, the experimental period was shorter (3 vs. 4 weeks); the orientation materials were in English, a language that may not be readily familiar to all the Thai students; less training time (2 Monday training sessions vs. 3 Monday training sessions); and more students per group, with possibly less attention being given to individual student needs. Though the students were given a card outlining the steps of the SNAPPS technique, they may not have used it to guide their case presentations. For the Thai preceptors, the experimental period was also shorter than in the US study; some preceptors may have forgotten the SNAPPS steps. The Thai preceptors appeared to dominate the case presentations, as evidenced by small percentage of presentations containing student-initiated discussions. When preceptors led the presentations, the students may have been reluctant to express their uncertainties because in the Thai culture there is great respect towards teachers and elders, such that asking questions would be viewed as impolite. Thus students remained quiet during case discussions, particularly if the preceptors, who have great authority in the Thai culture, played a

dominant role during the presentation.

This was a quasi-experimental comparison trial where the students were randomized to rotations but not to the experimental groups. Consequently students mature in their knowledge and skills during their clerkship rotations and any differences among experimental groups could have been attributed to their natural growth during the clerkship. However, the results showed that differences with the SNAPPS group were not due to simple maturation over time.

The positive results from the SNAPPS group may be simply due to their longer presentation time. From the correlational analyses, both the experimental (Gr. 2) and comparison (Gr. 3) groups had negative correlations between presentation time and the number of student-initiated diagnosis and management discussions (Table 3) but the SNAPPS users had better outcomes regarding the number of diagnoses in their DDx, number of basic attributes used to support their DDx, and more student-initiated selection of readings.

While Thai medical students who used SNAPPS for case presentations in an ambulatory internal medicine rotation expressed their clinical reasoning more often then comparison students, they did not differ from comparison students in the expression of uncertainties or in the selection of readings (i.e., only 6.67% of the presentations contained expressions of uncertainties). Consequently, we recommend some modifications to the implementation of SNAPPS for Thai medical students and their preceptors. The training sessions should have fewer students in each group to allow attention to individual student needs and to give more opportunities to practice SNAPPS. The preceptors should have more extensive SNAPPS training and attend the students' orientation and practice sessions each week. This would provide more feedback to the preceptors and encourage them to share their expectations directly

with the students. These sessions, when attended by students and preceptors, would provide a shared forum for emphasizing the importance of students leading each step of the SNAPPS case presentation. This should help to shift the preceptor's role to that of a guide and strengthen the students' role in initiating the expression of their uncertainties and reading selections with the preceptors. This is an important cultural change. Having students and preceptors train and practice together should facilitate the implementation of the true spirit of SNAPPS; that is, a student-led case presentation where both diagnostic thinking and uncertainties are made explicit to all.

5. CONCLUSIONS

The use of the SNAPPS technique among fifth-year Thai medical students during their internal medicine ambulatory care rotation did facilitate the expression of their clinical reasoning. While the SNAPPS technique was applicable across cultures with regards to expressing clinical reasoning, the Thai students were reluctant to express their uncertainties. The different procedural and Thai cultural barriers that may account for the findings could likely be overcome with more, and simultaneous, training of students and preceptors. This would provide an agenda for further research.

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Box I

BLOCKS (A, B) DURING AN INTERNAL MEDICINE-SURGERY ROTATION FOR

FIFTH-YEAR MEDICAL STUDENTS AT KKU

	Ambulatory internal medicine (3 weeks)	Inpatient internal medicine (3 weeks)	Surgery (6 weeks)
1. Week 1-3	Group A1	Group A2	Group B1, B2
2. Week 4-6	Group A2	Group A1	Group B1, B2
3. Week 7-9	Group B1	Group B2	Group A1, A2
4. Week 10-12	Group B2	Group B1	Group A1, A2

BOX II

STUDY GROUPS, CASE PRESENTATION METHODS, AND STUDY COMPARISONS

Year*	Study group	Case presentation method	Study comparisons
Fifth year (M5)	Gr-1: M5-Usual-Block1 (weeks 1-12)	Usual-and-customary	
	Gr-2: M5-SNAPPS-Block2 (weeks 13-24)	SNAPPS	SNAPPS effect: Gr-2 vs. 3
	Gr-3 M5-Usual-Block3 (weeks 25-36)	Usual-and-customary	Maturation between beginning of rotation (Gr-1:M5-Usual-Block1) and the time of the SNAPPS intervention (Gr-3: M5-Usual-Block3)
Sixth year (M6)	Gr-4 M6-Usual-Block1 (weeks 1-12)	Usual-and-customary	Maturation between fifth (M5) and sixth (M6) year

* Different students in fifth and sixth years.

TABLE I
MEANS (AND SD) OF THE OUTCOMES FROM THE CASE PRESENTATIONS, ACCORDING TO THE FOUR STUDY GROUPS

Outcomes	SNAPPS N = 90	G1 N = 71	G3 N = 93	G4 N = 49	p-values
1. Total presentation time in minutes	12.01 (6.05)	12.57 (8.23)	11.19 (6.59)	8.35 (6.09)	<0.001
2. Summary time in minutes	4.14 (1.71)	4.23 (2.07)	4.18 (1.40)	3.14 (1.54)	<0.001
3. Discussion time in minutes	7.87 (5.51)	8.33 (7.66)	7.01 (6.04)	5.20 (5.45)	0.006
4. Number of basic attributes*	3.21 (1.09)	3.32 (0.91)	3.19 (0.95)	2.65 (1.03)	0.002
5. Number of diagnoses (Dx) in differential (DDx)	1.81 (0.97)	1.38 (0.85)	1.42 (0.83)	1.24 (0.97)	0.001
6. Number of basic attributes in support of the DDx	2.39 (2.20)	1.37 (1.59)	1.22 (1.38)	0.61 (1.04)	<0.001
7. Number of Dx justified in the DDx	0.90 (0.45)	0.61 (0.49)	0.78 (0.51)	0.54 (0.50)	<0.001
8. Number (%) containing students expressing uncertainties	6 (6.67)**	1 (1.41)	1 (1.08)	1 (2.04)	0.153
9. Number (%) containing student-initiated diagnosis discussion	69 (76.67)	48 (67.61)	55 (59.14)	25 (51.02)	0.010
10. Number (%) containing student-initiated management discussion	39 (43.33)	28 (39.44)	41 (44.09)	10 (20.41)	0.026
11. Number (%) containing student-initiated reading selections	6 (6.67)	0	0	0	0.002
12. Number (%) containing summary thoroughness – completeness	90 (100)	71 (100)	93 (100)	49 (100)	

*The only outcome variable that was normally distributed and ANOVA test of differences used; all the other outcome variables were not normally distributed and Kruskal-Wallis test of differences used;
** Number (percentage); SNAPPS: Group-2: M5-SNAPPS-Block2; G1: Group-1: M5-Usual-Block1; G3: M5-Usual-Block3; G4: M6-Usual-Block1; Numbers in each column indicated numbers of presentation.

TABLE II
SIGNIFICANCE LEVELS (P-VALUES) FOR THE OUTCOMES BETWEEN
GROUP PAIRS

Outcomes	M5-SNAPPS-Block2 vs. M5-Usual-Block3	M5-Usual-Block1 vs. M5-Usual-Block3	M5-SNAPPS-Block2 vs. M6-Usual-Block1
Total presentation time, minutes	0.463*	0.999	**<0.001****
Summary time, minutes	0.999	0.999	**<0.001**
Discussion time, minutes	0.442	0.999	**0.002**
Basic attributes	0.999	0.999	**0.003**
DDx	**0.016**	0.999	**0.003**
Basic attributes to support DDx	**0.001**	0.773	**<0.001**
Justified Dx in the DDx	0.428	0.185	**<0.001**
Express uncertainties	NS***	NS	NS
Student initiated Dx discussion	0.072	0.999	**0.015**
Student initiated management	0.999	0.999	**0.049**
Student initiated reading assignment	**0.039**	1	0.207

*All p-values adjusted for multiple comparisons using the Bonferroni procedure.
** Bold: statistically significant results.
***NS: no significant differences, based on ANOVA test.

TABLE 3
SPEARMAN RHO CORRELATION COEFFICIENTS BETWEEN TOTAL PRESENTATION TIMES AND 8 OUTCOME VARIABLES, ACCORDING TO STUDY GROUPS (P-VALUES IN PARENTHESIS)

Outcomes	G1	SNAPPS	G3	G4
1. Number of basic attributes	-0.011	0.103	-0.092	0.004
	(0.927)	(0.334)	(0.382)	(0.782)
2. Number of differential diagnoses	0.054	0.074	-0.110	**0.373**
	(0.655)	(0.491)	(0.293)	**(0.011)**
3. Number of supportive evidence	0.005	-0.092	-0.135 (0.199)	**0.414**
	(0.965)	(0.387)	-0.014	**(0.003)**
4. Number of justified differential	0.098	-0.091	(0.894)	0.169
diagnoses	(0.414)	(0.393)	0.020	(0.261)
5. Number containing expressing	0.105	0.103	(0.846)	-0.043 (0.769)
uncertainties	(0.385)	(0.335)	**-0.433**	-0.012 (0.933)
6. Number containing student-initiated	**-0.239**	**-0.217**	**(<0.001)**	0.018
diagnosis discussion	**(0.050)**	**(0.040)**	**-0.257**	(0.901)
7. Number containing student-initiated	-0.137	**-0.329**	**(0.013)**	**0.395**
management discussion	(0.253)	**(0.002)**	Not available	**(0.005)**
8. Number containing student-initiated	0.029	-0.191		
reading selections	(0.810)	(0.072)		

Note. SNAPPS: G1: Group-1: M5-Usual-Block1; Group-2: M5-SNAPPS-Block2; G3: M5-Usual-Block3; G4: M6-Usual-Block1; Bold: statistically significant results.

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