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Implementation of medical research module and the effect to medical students' knowledge and perceptions

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ABSTRACT

Research activity is one of the requirements for medical students in order to finish their study. Therefore, it needs to examine the knowledge and perceptions of medical students about medical research. The research design was an experimental one-group pretest-posttest design, involving 86 medical students, with the statistical tests using the Wilcoxon Signed-Rank Test. After the module implementation, the students' knowledge about research had improved in the concept of theoretical basis, the concept of research methodology, and the biostatistics methods. However, there was no improvement in bioethical knowledge. Close relations between the result of pre- and post-research modules implementation were shown in the knowledge about theoretical basis, about research methodology, and the perception of workloads in college have ($p<\alpha$). There were significant changes in knowledge ($Z=-2.867$, $p=0.004$) and perceptions ($Z=-1.964$, $p=0.050$) of the medical students pre- and post-research module. Giving research modules early, along with social and academic support for medical students, would improve their knowledge and positive perceptions towards research.

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1. INTRODUCTION

Under the regulation of Minister of Education and Culture Republic of Indonesia number 3 years 2020 concerning the national higher education standards, research activity is referred to as one of the standard requirements that aim to reach and guarantee as well as promote good quality of learning. Researching is an activity systematically done following scientific ethics and methods [1]. Writing a scientific work or thesis is one of the requirements for university students in order to examine their study achievement in developing science and technology, which have a benefit to increase the community welfare and a nation's competitiveness. For an undergraduate/bachelor's degree, the knowledge about research conduction is a must for every student as a guide for thesis writing. Research with a suitable method with adequate knowledge comprehended by the students becomes the basis of a well-produced work. The knowledge about research also promotes the students to actively conduct research on the field, this knowledge belongs to pedagogical knowledge [2], [3].

The development of evidence-based medicine (EBM) as the new paradigm for medical practice is by integrating research evidence with the clinical practice provided [4]. Hence, the need for medical research study and the involvement in research are important in medical education. The conduction of medical research will enrich the science, present innovations, and assist in understanding patients as well as clinical

practice of medical students. This resulted in the needs for a research curriculum for medical studies [5], [6] and a research on the development of students' ability to think critically, to solve problems, and to interpret literature well [7], [8]. Being a researcher as a career option, a desire to master skills, and involvement in previous research will raise interests and attitudes in research [7], [9]. Students' involvement in research is linked to scientific productivity in a short and long run [10]. Worries about financial, time, academic workloads, good guidance, a higher degree and career competitiveness become the factors that affect students' involvement [5], [7], [10].

In the Medical Education Study Program of the Faculty of Medicine Tanjungpura University, a research module is given in semester two as an introduction and preparation for the students to propose thesis outlines at the beginning of semester four. Knowledge transfer about research in the earliest will improve students' ability to think systematically, to be exposed to ethics as an integral part of research and medical treatment, and to build self-discipline, commitments, and purposes of performing treatments [11]. This module is constructed with three credits of study loads to be done in three weeks. In the research module, the targeted learning outcomes are the knowledge about the basis of medical research, medical research methodology, medical biostatistics, and medical research ethics. The effects of research modules in order to improve medical students' knowledge has yet to be explored, and a study towards students' perceptions about research activity in medical school to reach the goals of basic education about research is needed.

2. RESEARCH METHOD

The research was conducted during the implementation of the research module in the even semester of academic year 2020/2021, spanning from 24 May 2021 to 11 June 2021, using experimental one-group pretest-posttest design. This research method is used to examine the knowledge and perceptions of the students regarding research activities in the medical school before and after the research modules were implemented. The subjects were decided by using voluntary sampling method [12], which involved 98 students from the Medical Education Study Program of Faculty of Medicine Tanjungpura University, West Kalimantan, Indonesia batch year 2020. During the research conduction, one student did not take part in the pretest, and 11 students did not take part in the posttest, so the total number of the participants was 86 students. Ethical approval no. 4407/UN22.9/PG/2021 was obtained from Faculty of Medicine University of Tanjungpura, Pontianak, Indonesia.

An online questionnaire was given out using the Google Form platform in the first and the last days of the module (18 days). The knowledge questionnaire was composed using the Guttman scale (correct-incorrect) referring to theories of research [1], [13]–[16], comprised of 15 questions covering four research knowledge concepts in total, three questions about the basic concepts of medical research (item no 1-3), eight questions about the concepts of medical research methodology (item no. 4, 5, 6, 7, 9, 10, 11, 12), two questions about the concepts of medical biostatistics (item no 8, 15), and two questions about research bioethics (12, 14). The validity examination result using bivariate Pearson product-moment showed that nine questions were valid with significance value>0.05 for one question about the basic concepts of medical research (item no. 3), five questions about the concepts of medical research methodology (item no. 4, 6, 7, 9, 10), two questions about the concepts of medical biostatistics (item no. 8, 15), and one question about research bioethics (14). The questionnaire reliability analysis using the split-half Guttman method showed significance results 0.404>r-table (the r-table is 0.2096).

The perception questionnaire consisted of ten questions, composed using a 5-point Likert scale (strongly disagree-strongly agree) to examine students' perception towards the benefit and obstacles of research conduction in medical school. The validity test using product-moment correlation showed that all questions for perceptions were valid with r-count>r-table. The questionnaire reliability test by using Cronbach's Alpha coefficient showed the result 0.771>0.75.

Based on the normality test using Kolmogorov-Smirnov Test, it was found that the data was not evenly distributed with $p<\alpha=0,05$. Therefore, the Two-Related-Sample Tests of non-parametric statistical tests were used. The Wilcoxon Signed-Rank statistical test was administered to examine the difference in students' knowledge and perceptions before and after research module implementation. This research was conducted in regards to the protection of human rights and welfare in medical research.

3. RESULTS AND DISCUSSION

The subjects of this research were first-year students of the Medical Education Study Program, with 46 female students (53.49%) and 40 male students (46.51%), all aged between 18-19 years old. Medical Education study program students' knowledge about the basic concept of medical research improved after the research module implementation; eight students (9.30%) improved at understanding medical literature review. Improvements also occurred at the understanding of the concept of medical research methodology

about research subject selection (18.6%), types of research errors (12.79%), types of research designs (11.6%), and types of bias (1.16%). The knowledge about concepts for biostatistics on the topic of descriptive statistics also improved (6.96%). However, there were also parts of knowledge being stable on the students, no improvement after research module implementation, which are the knowledge about types of research dimensions based on the time, interpretation of statistical analysis, and ethics in research.

Based on the statistical analysis as shown in Table 1, there were significant changes in students' answers of four of the questions before and after the research module implementation which were about the concept of research theories and the concept of research methodology (Wilcoxon test $p \leq \alpha = 0.05$). In the analysis of total score for knowledge before and after research module, it was found that Z: -2.867 (based on negative ranks), $p \leq \alpha$ (p:0.004) so that it was concluded that there were significant changes on students' knowledge about medical research from before to after research module implementation.

Table 1. The knowledge about medical research

Question	Pre-module				Post-module				Z	p-value
	Correct		Incorrect		Correct		Incorrect			
	n	%	n	%	n	%	n	%		
In medical literature review, some of the terms related to evaluation of medical service are effectivity, efficiency, and efficacy	73	85	13	15	81	94	5	6	-2.309	0.021*
Descriptive epidemiology research focuses on the distribution of a disease in terms of population, geographic location, and time-frequency	73	85	13	15	83	97	3	3	-2.673	0.008*
The best sampling method is Randomized Controlled Trials	39	45	47	55	55	64	31	36	-2.469	0.014*
Prospective study is a study in which all related occurrences (exposure and disease) already took place at the time of the research conduction	44	51	42	49	44	51	42	49	0.000	1.000
The weakness of Median data is that it is not good enough to examine statistical significance	55	64	31	36	61	71	25	29	-1.095	0.273
Research errors are divided into two types: randomization and systematic errors	54	63	32	37	65	76	21	24	-2.043	0.041*
Bias is a random error caused by the inability to measure the variables.	62	72	24	28	63	73	23	27	-0.160	0.878
The principles of research ethics and development of health are respecting human dignity and standards, doing good deeds, not harming, and justice	84	98	2	2	84	98	2	2	0.000	1.000
Odd Ratio and Relative Risk are statistics to measure the relation or to predict the risk of a disease from two groups	80	93	6	7	80	93	6	7	0.000	1.000

Italic word: Unfavorable question; *Wilcoxon Signed Rank Test significance $p<\alpha$:0.05

The perception towards medical research after the application of the research module resulted in 75% of the students agreeing that research activity or thesis writing is needed, with perceptions that research will help in systematic thinking (83%), in building self-discipline (79%), and in building a future career (67%). The research module is considered helpful by the students in understanding medical research (83%), and the students also feel that research has been a part of being medical students (74%). When compared with the questionnaire result for the pre-research module, perceptions about things considered as obstacles in study increased after the research module implementation, such as perception that research becomes extra academic workloads for the students increased to (16.28%), extends study length (3.49%), adds study cost (3.49%), and that research is only for obtaining a degree (2.33%). The positive perceptions got better, indicated by the statements that students need to conduct research (25%) and that research helps in developing careers (2%). On the contrary, there was a decrease in students who have a positive perception towards medical research in certain areas which were the perception that research will help in systematic thinking (1.16%) and that it becomes part of being medical students (2.33%).

Based on the statistical analysis as shown in Table 2, the statements about research/thesis becoming extra workloads during the study in medical school changed significantly from before to after the implementation of the research module (Wilcoxon test $p<\alpha$:0.05). Besides, other statements did not have significant changes. The students' perceptions after the application of the research module tended to change in a negative way. The result of the significance test showed Z: -1.964 (based on negative ranks), $p \leq \alpha$ (p:0.050). Hence, there were significant changes in the perception towards medical research before and after the implementation of the research module.

Table 2. Perceptions towards medical research

Statements	Pre-module					Post-module					Z	p-value
	SD	D	N	A	SA	SD	D	N	A	SA		
Medical students need to conduct research	1	7	28	50	0	1	1	9	33	42	-1.529	0.126
Research activity/thesis writing will help you to think systematically	0	0	2	32	52	0	1	2	34	49	-0.908	0.364
Research activity/thesis writing will build self-discipline and commitment in doing your activities	0	0	5	30	51	0	0	7	36	43	-1.504	0.133
Research activity/thesis writing will become extra academic workloads in medical school	2	16	39	20	9	1	10	32	24	19	-3.532	0.000*
Research activity/thesis writing will extend study length in medical school	2	14	34	30	6	2	11	34	25	14	-1.383	0.167
Research activity/thesis writing will add study cost in medical school	5	9	36	29	7	3	15	29	31	8	-0.105	0.916
Research activity/thesis writing is only to obtain a degree	15	35	23	9	4	17	30	24	7	8	-0.779	0.436
Research module helps you understand and conduct research/write thesis in medical school	0	0	1	19	66	0	0	3	21	62	-1.105	0.269
Research activity/thesis writing will help your career in the future	0	3	18	35	30	1	1	17	33	34	-0.887	0.375
Research is a part of you as a medical student	0	0	9	28	49	0	2	10	25	49	-.0647	0.517

Italic word: Unfavorable question; *Wilcoxon signed rank test significance $p<\alpha:0.05$
SD=Strongly disagree; D=Disagree; N=Neutral; A=Agree; SA=Strongly agree

For medical students, research activity is needed in order to step up their ability and medical career. A good knowledge about research would improve the students' ability to understand other subjects and to help them in solving clinical questions in line with the EBM principles [17]. Besides, research learning that includes professional (clinical) elements would foster enthusiasm and belief that research has a relevancy with learning and will eventually contribute to clinical practice [6], [18]. This shows that the need to add research subjects into the curriculum of medical school is a must [19]. In Sudan, students' positive perceptions towards EBM would raise their awareness of the importance of research, even though their knowledge about methodology, statistics, and scientific literature related to the EBM skills is still low [8], [20].

Tanjungpura University medical students' knowledge changed significantly after the implementation of the research module, and the total score of knowledge was the median score. Based on research conducted in India, students in the second year (78.8%) and final year (70.6%) had a better understanding about research, while the first year students (63%) were the least knowledgeable [21]. The students being well-knowledgeable could be caused by their awareness of the importance of medical research implementation [22]. Researching would improve their scientific knowledge that will be applied not only when they are medical students but also when they become doctors in order to solve clinical problems and health management [23]. The ability to conduct a research as well as to look for and review literatures would be a part of scientific discussion, report composition, thesis writing, case study reporting, and journal reading when the students do their internship until the activities listed in their track records for continuing to master degree or professional degree and as one of requirements to obtain an undergraduate degree in medical school [10], [23].

Statistics is one of the competencies studied in the research module. In the medical world, the introduction to the application of statistics is needed to understand how to design, analyze and interpret medical research data. Students' appreciation of the values or the benefits of statistics on their medical professional career was good enough, but they had a negative to neutral attitudes towards their own intellectual knowledge and skills in statistics [24]. Less understanding of statistics, Mathematics, and the statistical data processing applications in computers, could became the causes of their anxiety which affected negative perceptions towards research [20]. Besides, negative perceptions towards the benefits of research made the students unaware of their professional tasks as medical staff who must do lifelong learning. Education about the theories, methodologies, and biostatistics in research in order to improve their knowledge and skills of research needs to be done early in the start until the students graduate from medical school, and it is a solution to the negative perceptions and attitudes towards medical research [23], [25].

In Indonesia, to obtain an undergraduate degree in medical school, a thesis as a final task in the form of research must be conducted by every medical student [1]. As a result, it is a requirement to conduct research, and the faculty must facilitate the students to finish their tasks. A thesis considered only as a requirement to obtain a degree is agreed by 17.44% of the research subjects, and the percentage increased after the research module was implemented. In the end, medical research as a requirement is deemed as an

extra academic workload and extending study length for the medical students of Tanjungpura University. Thesis writing was deemed to require a separate time while other study loads during the study period must still be done. The absence of flexibility from the academic institution for the students to fulfill the medical curriculum study loads and the final task caused many of the students to extend their study length in order to conclude a research [5], [7], [9], [10], [19]. An academic year is closely related with research knowledge and practice. The struggles to decide a topic, the uncertainties in starting to write a research proposal, the absence of support to conduct a research, and the timings were considered as obstacles of the medical students in the first year [7], [26].

The rejection towards the stage of research urgency feasible, interesting, novel, ethical, relevant (FINER) during the proposal of thesis title was one of the obstacles which affected the students' thesis writing process and graduation. This obstacle could lead to academic dishonesty as the students' negative reaction to the thesis [3], [27]. Based on the research findings, Tanjungpura University students' knowledge about research ethics was good and even better after the module was implemented. The awareness and past association with research ethics became the reasons for them to avoid cheating practice in thesis writing [28], [29]. The introduction to International Committee of Medical Journal Editors (ICMJE) or The Committee on Publication Ethics (COPE) or the committee of research ethics in the faculty could prevent scientific misconducts (fabrication, falsification, and plagiarism) [29]. Little knowledge about research ethics would lead the students to do plagiarism even when it was unintentional, and according to the medical students, plagiarism is an unjustified action and is considered as stealing [28].

Besides, research is thought to add study cost, especially when there is no financial support, no funding from the faculty, lack of incentive, or low achievement in research grant competitions [5], [23]. On the other hand, the needs and interests to conduct research come more frequently from medical students in developing countries compared to those from developed countries because of the demands emerging from competitions among individuals and the acceptance on the international level [9], [19]. This condition is worsened by zero experience in research, lack of knowledge and skills in conducting research, lack of infrastructures, difficulties in contacting the research subjects, and the absence of interests which became the obstacles in conducting research [19], [21]. Even so, it was stated that there was no effect of thesis writing on the students' grade point average scores; instead, it affected the students' career projections as researchers in the future [10], [30].

Even though there was no correlation between the desire to obtain a higher degree and conducting research, research eventually was considered as uncertainty that inhibited their desires to pursue research and obtain a higher education degree in the future [23]. However, the students' skills and confidence in conducting medical research would improve by conducting research [7], [10]. The support from experienced, competent mentors/advisors who have similar interests with the students supposedly had strong effect to increase their interest to finish their theses [6], [23]. Also, self-motivation to do research for the sake of oneself accompanied by academic support, information related to scientific competition, and hope for financial income will help increase medical students' interest in conducting research [19].

As an effort in raising awareness and improving skills in research conduction, a number of methods in the undergraduate courses could be given to assure a research-oriented environment, such as complete research subjects/programs, periodical statistical-analysis workshops or journal workgroup formation, and doing research on students' level [9], [10], [19], [23], [30]. In the Medical Education Study Program of Tanjungpura University, the application of the research module significantly changed students' knowledge and perceptions towards medical research. Hence, giving a research module from the beginning with the right curriculum composition will increase motivation, participation, trust, discipline, critical-thinking ability, and positive attitudes towards medical research.

4. CONCLUSION

The basic knowledge about research, the experience of research conduction, and social-academic support from the faculty motivate the students, increase their positive perceptions, and lead them to make research a part of their lives as lifelong learners. Currently, in the Medical Education Study Program of Tanjungpura University, the research module is set as mandatory and is integrated into every course until semester six. Introduction to the basics of research from the beginning in the medical curriculum helps them to think critically and systematically. Therefore, project-based learning would be the best method to develop students' ability to applicate and engage in the research also a better understanding of EBM as the basis of clinical practice.

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