

## MATHEMATICAL SKILLS OF THE NURSING AND MIDWIFERY STUDENTS OF SAKARYA UNIVERSITY SCHOOL OF HEALTH SCIENCES<sup>1</sup>

*HABILIDADES MATEMÁTICAS DOS ESTUDANTES DE ENFERMAGEM E OBSTETRÍCIA DA ESCOLA DE CIÊNCIAS DA SAÚDE DA UNIVERSIDADE DE SAKARYA<sup>1</sup>*

*HABILIDADES MATEMÁTICAS DE LOS ESTUDIANTES DE ENFERMERÍA Y OBSTETRICIA DE LA ESCUELA DE CIENCIAS DE LA SALUD DE LA UNIVERIDAD DE SAKAYA<sup>1</sup>*

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**ABSTRACT:** This study was carried out with the purpose of determining the Nursing and Midwifery students' interest and skills in mathematics, and their skills in calculating the medication dosages. In the study, a survey form comprising 16 questions having the purpose of determining the students' demographical characteristics and interest in mathematics, and the Medication Skill Test (MCS Test), which had been also prepared by the researchers, were used. The Medication Skill Test (MCS Test) were developed, by the researchers, by means of reviewing the relevant literature, particularly the studies carried out by Grandell-Neime et al. and the pharmacology test books. The MCS Test consisted of 25 questions, of which eleven were about general mathematics and fourteen were about the calculation of the medication dosages. The answers the students gave to the questions were evaluated as correct or incorrect. The sampling of the research comprised totally 73 students from the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> grades of the midwifery classes, and totally 142 students from the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> grades of the nursing classes. The survey form were applied to the students by providing the examination conditions and giving 20 minutes time. The data collected was evaluated in computer. It was determined that 96.5 % of the nursing students (n: 137) and 90.4 % of the midwifery students (n: 66) liked the mathematics. 90.1 % of the nursing students (n: 128) and 83.6 % of the midwifery students (n: 61) stated that they found mathematics enjoyable, and likewise, 35.2 % of the nursing students (n: 50) and 34.2 % of the midwifery students (n: 25) stated that they deemed the mathematics as necessary in nursing. 66.9 % of the nursing students (n: 95) and 63.0 % of the midwifery students (n: 46) stated that they had good mathematical skills. 60.6 % of the nursing students (n: 86) and 75.3 % of the midwifery students (n: 55) stated that they didn't deem themselves as adequate in calculating the medication dosages. 65.5 % of the nursing students (n: 93) and 74.0 % of the midwifery students (n: 54) stated that they experienced occasional problems in the mathematical calculations relating to the medication administrations. According to the MCS Test results, it was seen that the lowest correct answering rate was 26.9 % for the nursing students and 5.5 % for the midwifery students, while the highest correct answering rate was 98.6 % for the nursing students and 94.5 % for the midwifery students. Medication administration is an essential

skill for nurses and midwives. Any mistake in calculation can lead to medication error and life threatening situations for patients. In the study, it was found that the mathematical skills of the nursing and midwifery students were weak and they didn't feel adequate in the calculation of the medication dosages. Determining and overcoming this inadequacy of the students during their education would prevent the problems they possibly face in their profession after their graduation.

**KEY WORDS:** Nursing students; Medication error; Administration & dosage.

**RESUMO:** Este estudo foi realizado com a finalidade de determinar interesse e habilidades dos estudantes de Enfermagem e Obstetrícia na matemática, e suas habilidades em calcular os dosages do medication. No estudo, um formulário contendo 16 questões com o propósito de determinar as características demográficas dos estudantes, o interesse em matemática, e um teste de habilidades em medicação (Medication Skill Test- MCS Test), desenvolvido pelos pesquisadores conforme revisão da literatura, em particular os estudos desenvolvidos por Grandell-Neime et al. e um livro de testes farmacológicos. O MCS Test consiste de 25 questões, das quais onze sobre matemática geral e quatorze sobre cálculo de dosagens em medicação. As respostas dos estudantes às questões foram avaliadas como correta ou incorreta. A amostra da pesquisa compreendeu um total de 73 estudantes dos segundo, terceiro e quarto ano de Obstetrícia, e um total de 142 alunos do primeiro, segundo, terceiro e quarto anos de Enfermagem. O formulário de pesquisa foi aplicado aos estudantes fornecendo as condições necessárias para aplicação do teste em 20

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minutos. Os dados coletados foram analisados em computador. Foi identificado que 96,5% dos estudantes de enfermagem (n: 137) e 90,4% de obstetrícia (n: 66) gostam de matemática. 90.1 % dos estudantes de enfermagem (n: 128) e 83.6 % dos estudantes de obstetrícia (n: 61) acham a matemática agradável, e do mesmo modo, 35.2 % dos estudantes de enfermagem (n: 50) e 34.2% dos estudantes de obstetrícia (n: 25) julgaram a matemática como necessária aos cuidados. 66.9 % dos estudantes de enfermagem (n: 95) e 63.0 % dos estudantes de obstetrícia (n: 46) indicam que tiveram boa habilidade matemática. 60.6 % dos estudantes de enfermagem (n: 86) e 75.3 % dos estudantes de obstetrícia (n: 55) não se julgaram capazes para calcular as dosagens da medicação. 65.5 % dos estudantes de enfermagem (n: 93) e 74.0 % dos estudantes de obstetrícia (n: 54) indicam que experimentaram problemas ocasionais nos cálculos matemáticos no que se relaciona às administrações de medicamentos. De acordo com os resultados de Teste MCS, viu-se que a menor taxa de resposta correta foi de 26.9 % para os estudantes de enfermagem e 5.5 % para os estudantes de obstetrícia, enquanto a maior taxa de resposta correta foi de 98.6 % para os estudantes de enfermagem e 94.5 % para os estudantes de obstetrícia. A administração de medicação é uma habilidade essencial para enfermeiros e obstetras. Qualquer falha no cálculo pode conduzir ao erro na medicação que pode provocar situações que ameaçam a vida dos pacientes. No estudo, encontrou-se que as habilidades matemáticas dos estudantes de enfermagem e de obstetrícia eram fracas e não estes não se sentiam capacitados para o cálculo das dosagens da medicação. Determinar e superar este despreparo dos estudantes durante sua formação impedirão os problemas que possivelmente enfrentarão em sua profissão após sua graduação.

**PALAVRAS CHAVE:** Estudantes de enfermagem; Erros de medicação; Administração & dosagem.

**RESUMEN:** Este estudio fue realizado con el propósito de determinar el interés y las habilidades matemáticas de los estudiantes de enfermería y de la obstetrícia, y sus habilidades en calcular las dosificaciones de la medicación. En el estudio, un formulario de 16 preguntas con el propósito de determinar las características demográficas y el interés de los estudiantes en la matemática, y un teste de habilidad en medicación (Medication Skill Test – MCS Test), que también fuera preparado por los investigadores por medio de la literatura relevante, en especial los estudios realizados por Grandell-Neime et al. y uno libro de testes farmacológicos. El teste MCS consistió en 25

preguntas, de las cuales once sobre matemática general y catorce sobre el cálculo de las dosificaciones de la medicación. Las respuestas que los estudiantes dieron a las preguntas fueron evaluadas como correctas o incorrectas. La población de la investigación abarcó 73 estudiantes de los 2dos, 3ro y 4tos grados del curso de la obstetrícia, y 142 estudiantes de los 1ros, 2dos, 3ro y 4tos grados del curso de enfermería. El formulario fue aplicado a los estudiantes proporcionando las condiciones de examinación realizado en 20 minutos. Los datos recogidos fueron evaluados en computadora. Fue identificado que 96.5% de los estudiantes de enfermería (n: 137) y el 90.4% de los estudiantes de obstetrícia (n: 66) tienen gusto a la matemática. 90.1% de los estudiantes de enfermería (n: 128) y 83.6% de los estudiantes de obstetrícia (n: 61) indican la matemática como agradable, y además, 35.2% de los estudiantes de enfermería (n: 50) y 34.2% de los estudiantes de obstetrícia (n: 25) juzgan la matemáticas necesaria en el cuidado en enfermería. 66.9% de los estudiantes de enfermería (n: 95) y 63.0% de los estudiantes de obstetrícia (n: 46) indican que tenían buenas habilidades matemáticas. 60.6% de los estudiantes de enfermería (n: 86) y 75.3% de los estudiantes de la obstetrícia (n: 55) no se juzgan capaces en calcular las dosificaciones de la medicación. 65.5% de los estudiantes de enfermería (n: 93) y 74.0% de los estudiantes de obstetrícia (n: 54) indican que experimentaron problemas ocasionales en los cálculos matemáticos referentes a las administraciones de la medicación. Según los resultados del teste del MCS, fue visto el menor índice de despostas correcta en 26.9% para los estudiantes de enfermería y 5.5% para los estudiantes de obstetrícia, mientras que el índice de desposta correcta más alta era 98.6% para los estudiantes del oficio de enfermería y 94.5% para los estudiantes de obstetrícia. La administración de medicación es una habilidad esencial para los enfermeros y parteras. Cualquier problema en el cálculo puede conducir al error de la medicación y a las situaciones peligrosas para la vida para los pacientes. En el estudio, fue encontrado que las habilidades matemáticas de los estudiantes de enfermería y de obstetrícia eran débiles y no se sentían capaces en el cálculo de las dosificaciones de la medicación. La determinación y la superación de esta insuficiencia de los estudiantes durante su formación prevendrían los problemas que hacen frente posiblemente en su profesión después de su graduación.

**PALABRAS CLAVE:** Estudiantes de enfermería; Errores en la medicación; Administración & dosage.

## INTRODUCTION

Medication administration is a nursing function. As such nurses and midwives are expected to remain fully responsible and competent in the knowledge of medication administration, which includes proficient mathematical, dosage calculation skills and also pharmacological skills (GRANDELL-NIEMI et al 2006; BAYNE & BİNDLER 1988; KAPBORG & ROSANDER 2001). These skills are needed to safely and correctly administer medicines to patients in clinical practice, to provide advice and information to patients about their treatments and to evaluate adverse drug effects. Even though nurses need mathematics in fulfilling their duties in medication administration they find mathematics difficult and have problems in coping with dosage calculations. The same difficulties are also faced by nursing and midwifery students for student nurses and midwives therefore learning how to calculate drug dosages is an important skill that they need to be taught during their training.

For decades studies have found the mathematical skills of nurses and nursing students insufficient. The mathematical skills of nurses and students have been studied by using calculation tests, mostly developed by the researchers (GRANDELL-NIEMI et al 2006; KAPBORG 1995).

No study on the evaluation of mathematical skills of the nursing and midwifery students was encountered in the literature in Turkey about nursing and midwifery. This study thus designed in order to draw attention to this important subject and to make an evaluation of the current situation.

The Turkish public school system comprises compulsory education schools and various types of private schools. The 8-year compulsory primary education is for all children between the ages of 7 and 15. Almost all of the pupils attending compulsory education schools continue directly to the voluntary high school education, and almost all of them complete their high schooling within 3 years. High school confers general eligibility for further studies in higher education. In Turkey, mathematics classes are

compulsory both during the compulsory primary education and during the high school education.

In Turkey, the nursing and midwifery education is given as a 4-year vocational education after the 3-year high school education.

Many subsequent investigations have demonstrated a lack of mathematical and / or calculation abilities in nurses. ROSANDER (1989) has shown that these errors can sometimes be explained by stress, but are often a result of insufficient arithmetic understanding and training. (KAPBORG & ROSANDER 2001; ELLIOTT & JOYCE 2005).

This study was carried out with the purpose of determining the Nursing and Midwifery students' interest and skills in mathematics, and their skills in calculating the medication dosages.

## METHODS

In the study, a survey form comprising 16 questions having the purpose of determining the students' demographical characteristics and interest in mathematics, and the Medication Skill Test (MCS Test), which had been also prepared by the researchers, were used. The Medication Skill Test (MCS Test) were developed, by the researchers, by means of reviewing the relevant literature, particularly the studies carried out by GRANDELL-NIEMI et al. (2006) and the pharmacology test books. The MCS Test consisted of 25 questions, of which eleven were about general mathematics and fourteen were about the calculation of the medication dosages. The answers the students gave to the questions were evaluated as correct or incorrect. The sampling of the research comprised totally 73 students from the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> grades of the midwifery classes, and totally 142 students from the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> grades of the nursing classes. The survey form were applied to the students by providing the examination conditions and giving 20 minutes time. The data collected was evaluated in computer.

## RESULTS

**Table 1:** Characteristics of samples; Nursing Students n:142, Midwifery Students n:73

Characteristic	Nursing Students		Midwifery Students	
	n	%	n	%
<b>Grade</b>				
1	37	26,1	....	....
2	39	27,5	22	30,1
3	40	28,2	26	35,6
4	26	18,3	25	34,2
<b>Does the student work in a field connected with its occupation</b>				
Yes	6	4,2	2	2,7
No	136	95,8	71	97,3
<b>The type of the high school graduated</b>				
Ordinary High School	61	43,0	35	47,9
Super High School	55	38,7	20	27,4
Anatolian High School	19	13,4	12	16,4
Health Vocational School	6	4,2	1	1,4
Others	1	7	5	6,8
<b>Did the student use to like the mathematics during the primary education</b>				
Yes	137	96,5	66	90,4
No	5	3,5	7	9,6
<b>The grade for the mathematics class during the secondary school</b>				
1	....	....	....	....
2	....	....	1	1,4
3	4	2,8	5	6,8
4	42	29,6	31	42,5
5	83	58,5	27	37,0
not remembered	13	9,2	9	12,3
<b>Did the student attend to private courses or took extra mathematics lessons while preparing for the University Entrance examination?</b>				
Yes	69	48,6	33	45,2
No	73	51,4	40	54,8
<b>How the student consider the mathematics?</b>				
Annoying	2	1,4	....	....
Frightening	3	2,1	3	4,1
Harming the motivation	....	....	1	1,4
Difficult	26	18,3	19	26,0
Easy	20	14,1	11	15,1
Pleasurable	128	90,1	61	83,6
Necessary in Nursing and Midwifery	50	35,2	25	34,2
<b>Do you think the mathematics should be included in the nursery curriculum?</b>				
Yes	86	60,6	51	69,9
No	52	36,6	21	28,8
Unanswered	4	2,8	1	1,4

**Table 2:** The Characteristics of the Students regarding the Dose Calculations; Nursing Students n:142, Midwifery Students n:73

Characteristic	Nursing Students		Midwifery Students	
	n	%	n	%
<b>How do you deem your mathematical skills?</b>				
Very good	20	14,1	6	8,2
Good	95	66,9	46	63,0
Of average level	26	18,3	20	27,4
Poor	1	0,7	1	1,4
<b>How often do you employ dose calculations in medication administrations?</b>				
Occasionally	36	25,4	19	26,0
Sometimes	55	38,7	34	46,6
Frequently	26	18,3	10	13,7
Never	17	12	10	13,7
<b>Are your dose calculations checked by the lecturers and nurses during the medication administrations?</b>				
Yes	50	35,2	17	23,3
No	59	41,5	56	76,7
<b>Do you deem yourself adequate in calculating the medication doses?</b>				
Yes	43	30,3	17	23,3
No	86	60,6	55	75,3
<b>Do you experience any problem in the mathematical calculations regarding medication administrations in clinical practices?</b>				
Always	10	7,0	11	15,1
Never	26	18,3	6	8,2
Sometimes	93	65,5	54	74,0

It was determined that 96.5 % of the nursing students (n: 137) and 90.4 % of the midwifery students (n: 66) liked the mathematics. 90.1 % of the nursing students (n: 128) and 83.6 % of the midwifery students (n: 61) stated that they found mathematics enjoyable, and likewise, 35.2 % of the nursing students (n: 50) and 34.2 % of the midwifery students (n: 25) stated that they deemed the mathematics as necessary in nursing. 66.9 % of the nursing students (n: 95) and 63.0 % of the midwifery students (n: 46)

stated that they had good mathematical skills. 60.6 % of the nursing students (n: 86) and 75.3 % of the midwifery students (n: 55) stated that they didn't deem themselves as adequate in calculating the medication dosages. 65.5 % of the nursing students (n: 93) and 74.0 % of the midwifery students (n: 54) stated that they experienced occasional problems in the mathematical calculations relating to the medication administrations (Table 1,2 ).



**Table 3:** Actual mathematical skills of nursing students: correct answers, incorrect answers and unanswered

Questions concerning	Grade	n	Correct answers %	Incorrect answers %	Unanswered %	P value
Multiplication	<b>Nurses Student (NS)I</b>	37	81,1	18,9	....	>0,05
	NS II	39	87,2	10,3	2,6	
	NS III	40	72,5	27,5	...	
	NS IV	26	61,5	38,5	...	
Division	NS I	37	52,75	40,5	6,75	>0,05
	NS II	39	65,4	29,45	5,15	
	NS III	40	76,25	17,5	6,25	
	NS IV	26	65,35	23,1	11,55	
How many grams is 5 mgr?	NS I	37	62,2	35,1	2,7	>0,05
	NS II	39	48,7	51,3	....	
	NS III	40	47,5	52,5	....	
	NS IV	26	57,5	34,6	7,7	
How many grams is 300 mgr?	NS I	37	73,0	24,3	2,7	>0,05
	NS II	39	64,1	35,9	....	
	NS III	40	65,0	32,5	2,5	
	NS IV	26	69,2	23,1	7,7	
How many grams is 0,75mgr?	NS I	37	64,9	21,6	13,5	>0,05
	NS II	39	66,7	33,3	....	
	NS III	40	60,0	37,5	2,5	
	NS IV	26	76,9	19,2	3,8	
Weight has risen from 54 to 60 kg. How much is this rise in per cents?	NS I	37	48,6	37,8	13,5	<0,05
	NS II	39	76,9	17,9	5,1	
	NS III	40	47,5	40,0	12,5	
	NS IV	26	38,5	53,8	7,7	
Write 1/5 as per cents?	NS I	37	91,9	5,4	2,7	<0,05
	NS II	39	82,1	17,9	....	
	NS III	40	62,5	32,5	5,0	
	NS IV	26	88,5	11,5	....	
A baby in a premature service weighs 3000 g at the birth. One week after the birth, it is realized that the infant has lost 6% of its weight. How many grams has the infant lost?	NS I	37	70,3	16,2	13,5	>0,05
	NS II	39	74,4	23,1	2,6	
	NS III	40	87,5	12,5	....	
	NS IV	26	76,9	19,2	3,8	
Write 59 in Roman numbers?	NS I	37	16,2	16,2	67,6	<0,05
	NS II	39	2,6	43,6	53,8	
	NS III	40	12,5	35,0	52,5	
	NS IV	26	7,7	53,8	38,5	
Write 32 in Roman numbers?	NS I	37	32,4	5,4	62,2	>0,05
	NS II	39	41,0	10,3	48,7	
	NS III	40	35,0	2,5	62,5	
	NS IV	26	30,8	15,4	53,8	
Medicine is available in 250 mgr capsule, the order is 500 mgr x 3 count the duration of 30 capsules package	NS I	37	51,4	18,9	29,7	<0,05
	NS II	39	76,9	10,3	12,8	
	NS III	40	87,5	12,5	....	
	NS IV	26	65,4	7,7	26,9	
How many units do 4 dizeyms contain?	NS I	37	40,5	48,6	10,8	<0,05
	NS II	39	28,2	41,0	30,8	
	NS III	40	35,0	55,0	10,0	
	NS IV	26	50,0	50,0	....	
How many dizeyms do 3 ml contain?	NS I	37	40,5	16,2	43,2	<0,001
	NS II	39	15,4	25,6	59,0	
	NS III	40	50,0	15,0	35,0	

	NS IV	26	80,8	7,7	11,5	
A 1200-mg medication is going to be administered in 4 equal amounts a day, with 6-hour intervals. What is the amount to be given in every administration?	NS I	37	86,5	8,1	5,4	>0,05
	NS II	39	87,2	10,3	2,6	
	NS III	40	90,0	5,0	5,0	
	NS IV	26	69,2	11,5	19,2	
The dose given in the morning is 800 mg. At noon, $\frac{3}{4}$ of the dose given in the morning will be given. So what is the amount of the dose to be given at noon in grams?	NS I	37	100	....	....	>0,05
	NS II	39	100	....	....	
	NS III	40	100	....	....	
	NS IV	26	92,3	3,8	3,8	
It is required to give 1+1/4 units of atarax suspension by using 4-ml measurement container. So, how many ml of suspension are given?	NS I	37	51,4	18,9	29,7	>0,05
	NS II	39	56,4	25,6	17,9	
	NS III	40	60,0	30,0	10,0	
	NS IV	26	65,4	15,4	19,2	
In the label, it is stated that 12 mg medication is contained in one ml. If the ordered amount is 18 mg, how many ml are to be given?	NS I	37	62,2	8,1	29,7	>0,05
	NS II	39	82,1	5,1	12,8	
	NS III	40	77,5	7,5	15,0	
	NS IV	26	80,8	7,7	11,5	
The order is to infuse 600ml of IV solution in 10h. The drug factor of IV tubing is 15 gtts/mlt. You would infuse?	NS I	37	10,8	54,1	35,1	<0,00 1
	NS II	39	69,2	30,8	....	
	NS III	40	67,5	17,5	15,0	
	NS IV	26	30,8	42,3	26,9	
A 500-mg medication needs to be administered as 175 mg. How many dilyems of the medication which is required to be diluted to 2 ml should be administered?	NS I	37	2,7	21,6	75,7	<0,00 1
	NS II	39	5,1	17,9	76,9	
	NS III	40	20,0	35,0	45,0	
	NS IV	26	50,0	11,5	38,5	
10 mg of an ampule whose 2 ml equals to 40 mg is to be administered. So, how many dilyems should be taken into the syringe?	NS I	37	29,7	37,8	32,4	<0,00 1
	NS II	39	20,5	56,4	23,1	
	NS III	40	37,5	32,5	30,0	
	NS IV	26	76,9	23,1	....	
A patient is required to be given 1500 ml liquid in 24 hours. How much liquid should be given in 8 hours?	NS I	37	78,4	....	21,6	<0,01
	NS II	39	97,4	2,6	....	
	NS III	40	87,5	10,0	2,5	
	NS IV	26	84,6	3,8	11,5	
500-mg flacon is to be diluted with 4 ml and 175 mg medication is to be administered to the patient. How many dilyems should be administered?	NS I	37	16,2	18,9	64,9	<0,05
	NS II	39	10,3	20,5	69,2	
	NS III	40	25,0	22,5	52,5	
	NS IV	26	46,2	11,5	42,3	
The daily dose for an antibiotics is 25 mg per kilogram of body weight. So, how much of this antibiotics is to be given to a 9-kg child?	NS I	37	78,4	5,4	16,2	>0,05
	NS II	39	82,1	10,3	7,7	
	NS III	40	87,5	5,0	7,5	
	NS IV	26	84,6	....	15,4	
2400 ml liquid is to be sent in 10 hours. Calculate the number of the drops per minute.	NS I	37	10,8	54,1	35,1	<0,00 1
	NS II	39	59,0	35,9	5,1	
	NS III	40	60,0	30,0	10,0	
	NS IV	26	34,6	42,3	23,1	

It was determined that the actual mathematical skills differed depending on the grade the nursing

students are attending. In some of the items of the test evaluating the actual mathematical skills of the

nursing students, meaningful differences were determined between the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> grade students (for p values, see Table 3). Though the correct answering rate of the 1<sup>st</sup> grade students was found to be higher than the students of the other grades in most of the questions, the differences were not statistically meaningful ( $p > 0.005$ ). It was found out that, the lowest “correct answering rate” of the students was for the questions on the Roman Numerals. It was found out that the correct answering rate of the 1<sup>st</sup> grade students for these questions was

higher, and that the difference between the grades was meaningful ( $p < 0.05$ ).

In the calculation of the oral and parenteral medication doses, it was found out that the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> grade students were more successful than the 1<sup>st</sup> grade students ( $p < 0.05$ ,  $p < 0.01$ ). It was also found out that the 2<sup>nd</sup> and 3<sup>rd</sup> grade students were more successful than the 1<sup>st</sup> and 4<sup>th</sup> grade students in the calculation of the amounts of the liquid to be sent intravenously, and the difference was determined to be statistically meaningful ( $p < 0.001$ ).

**Table 4 :** Actual mathematical skills of midwifery students : correct, incorrect and unanswered

Questions concerning	Grades	n	Correct answers %	Incorrect answers %	Unanswered %	P value
Multiplication	<b>Midwifes Student (MS) II</b>	22	72,7	27,3	...	>0,05
	MS III	26	76,9	19,2	3,8	
	MS IV	25	72,0	20,0	8,0	
Division	MS II	22	75,0	20,45	4,55	<0,05
	MS III	26	44,25	30,8	25,0	
	MS IV	25	46,0	36,0	18,0	
How many grams is 5 mgr?	MS II	22	59,1	40,9	....	<0,05
	MS III	26	53,8	42,3	3,8	
	MS IV	25	24,0	60,0	16,0	
How many grams is 300 mgr?	MS II	22	59,1	40,9	....	<0,01
	MS III	26	65,4	34,6	....	
	MS IV	25	24,0	60,0	16,0	
How many grams is 0,75mgr?	MS II	22	50,0	15,5	....	<0,05
	MS III	26	69,2	26,9	3,8	
	MS IV	25	24,0	56,0	20,0	
Weight has gained from 54 to 60 kg. How much in per cents?	MS II	22	22,7	45,5	31,8	>0,05
	MS III	26	38,5	46,2	15,4	
	MS IV	25	28,0	36,0	36,0	
Write 1/5 as per cents?	MS II	22	81,8	13,6	4,5	>0,05
	MS III	26	57,7	30,8	11,5	
	MS IV	25	76,0	20,0	4,0	
An infant in premature service weighs 3000 grams at birth. One week after the birth, it is realized that the infant has lost the 6% of its weight. How many grams the infant has lost?	MS II	22	86,4	4,5	9,1	>0,05
	MS III	26	84,6	11,5	3,8	
	MS IV	25	72,0	8,0	20,0	
Write 59 in Roman numbers?	MS II	22	9,1	45,5	45,5	>0,05
	MS III	26	11,5	30,8	57,7	
	MS IV	25	12,0	36,0	52,0	
Write 32 in Roman numbers?	MS II	22	22,7	9,1	68,2	>0,05
	MS III	26	30,8	3,8	65,4	
	MS IV	25	56,0	4,0	40,0	
Medicine is available in 250 mgr capsule, the order is 500 mgr x 3. Count the duration of 30 capsules package.	MS II	22	68,2	22,7	9,1	>0,05
	MS III	26	65,4	19,2	15,4	
	MS IV	25	80,0	4,0	16,0	
How many units do 4 dizeyms contain?	MS II	22	18,2	72,7	9,1	<0,01
	MS III	26	65,4	30,8	3,8	
	MS IV	25	24,0	64,0	12,0	
How many dizeyms do 3 ml contain?	MS II	22	13,6	36,4	50,0	<0,001
	MS III	26	73,1	19,2	7,7	



	MS IV	25	16,0	24,0	60,0	
A 1200-mg medication is going to be administered in 4 equal amounts a day, with 6-hour intervals. What is the amount to be given in every administration?	MS II	22	77,3	9,1	13,6	>0,05
	MS III	26	84,6	7,7	7,7	
	MS IV	25	80,0	16,0	4,0	
The dose given in the morning is 800 mg. At noon, $\frac{3}{4}$ of the dose given in the morning will be given. So what is the amount of the dose to be given at noon in grams?	MS II	22	95,5	4,5	...	>0,05
	MS III	26	100	....	...	
	MS IV	25	88,0	8,0	4,0	
It is required to give 1+1/4 units of atarax suspension by using 4-ml measurement container. So, how many ml of suspension are given?	MS II	22	50,0	31,8	18,2	>0,05
	MS III	26	61,5	26,9	11,5	
	MS IV	25	60,0	12,0	28,0	
In the label, it is stated that 12 mg medication is contained in one ml. If the ordered amount is 18 mg, how many ml are to be given?	MS II	22	59,1	22,7	18,2	>0,05
	MS III	26	57,7	23,1	19,2	
	MS IV	25	48,0	4,0	48,0	
The order is to infuse 600ml of IV solution in 10h. The drug factor of IV tubing is 15 gtts/mlt. You would infuse?	MS II	22	13,6	54,5	31,8	<0,05
	MS III	26	50,0	30,8	19,2	
	MS IV	25	8,0	76,0	16,0	
A 500-mg medication needs to be administered as 175 mg. How many dilyems of the medication which is required to be diluted to 2 ml should be administered?	MS II	22	....	27,3	72,7	>0,05
	MS III	26	11,5	11,5	76,9	
	MS IV	25	4,0	12,0	84,0	
10 mg of an ampule whose 2 ml equals to 40 mg is to be administered. So, how many dilyems should be taken into the syringe?	MS II	22	13,6	63,6	22,7	<0,01
	MS III	26	57,7	23,1	19,2	
	MS IV	25	8,0	44,0	48,0	
A patient is required to be given 1500 ml liquid in 24 hours. How much liquid should be given in 8 hours?	MS II	22	86,4	9,1	4,5	>0,05
	MS III	26	84,6	7,7	7,7	
	MS IV	25	80,0	8,0	12,0	
500-mg flacon is to be diluted with 4 ml and 175 mg medication is to be administered o the patient. How many dilyems should be administered?	MS II	22	4,5	40,9	54,5	>0,05
	MS III	26	15,4	15,4	69,2	
	MS IV	25	12,0	8,0	80,0	
The daily dose for an antibiotics is 25 mg per kilogram of body weight. So, how much of this antibiotics is to be given to a 9-kg child?	MS II	22	77,3	13,6	9,1	>0,05
	MS III	26	76,9	...	23,1	
	MS IV	25	80,0	...	20,0	
2400 ml liquid is to be sent in 10 hours. Calculate the number of the drops per minute.	MS II	22	13,6	68,2	18,2	<0,05
	MS III	26	34,6	30,8	34,6	
	MS IV	25	12,0	68,0	20,0	

It was determined that the actual mathematical skills differed depending on the grade the midwifery

students are attending. In some of the items of the test evaluating the actual mathematical skills of the

midwifery students, meaningful differences were determined between the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> grade students (for p values, see Table 4).

The correct answering rate of the 2<sup>nd</sup> grade students was found to be higher than the 3<sup>rd</sup> grade students grades in some of the questions measuring the basic mathematical skills, and the differences were statistically meaningful ( $p < 0.005$ ). It was found out that, the lowest "correct answering rate" of the midwifery students, likewise the nursing students, was for the questions on the Roman Numerals. In the calculation of the oral and parenteral medication doses, it was found out that there was no meaningful difference between the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> grade midwifery students. And the rate of incorrect answering was found to be high for these questions. It was also found out that the 2<sup>nd</sup> and 3<sup>rd</sup> grade students were more successful than the 4<sup>th</sup> grade students in the calculation of the amounts of the liquid to be sent intravenously, and the difference was determined to be statistically meaningful ( $p < 0.05$ ).

## DISCUSSION

Nursing and midwife students need mathematics to perform medication administration safely in clinical practice. Though a great number of the students taking part in the study considered the mathematics enjoyable and necessary in the nursing and midwifery profession, most of them stated that they found themselves inadequate in calculating the medication doses. NIEMI et al. (2005) also have found out that the nurses and the nursing students found the mathematics difficult and felt inadequate in it. Students, in general, did not perform well on the test, the results showing a lack of mathematical skills (GRANDELL-NIEMI et al 2006). This results are worrying especially for the last grade students who will be graduated a few months later. The finding is similar to the ones of the other studies (WEEKS, 2001; WEEKS et al.2000).

It was found out that, among the nursing students, the 1<sup>st</sup> grade student's answering rate was higher than the students of the other grades. In Turkey, a university entrance exam including difficult mathematical questions has to be passed before entering the universities. In order to succeed this exam, students take extra mathematics lessons or attend to the private university preparation courses. The fact that the 1<sup>st</sup> grade students were more successful can be attributed to this. We can interpret the findings that since they don't take any mathematics lessons during their nursing education their mathematical skills weaken in higher grades.

There were some questions in the MCS test that proved difficult. Estimation of a sensible amount was founded difficult. It is very important that everyone dealing with medications has an idea beforehand of what might be a sensible amount. Roman Figures and solid and dilute solutions were

difficult. These skills are taught within medication calculation, but less commonly used in every day practice, so low belong to critical skills which are needed when ready-made doses are not available (WRIGHT 2005; KAWASHIMA & PETRINI 2004).

That the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> grade students were more successful than the 1<sup>st</sup> grade students can be attributed to the fact that though the 1<sup>st</sup> grade students take this lessons theoretically they have little clinical experience. It is possible to infer from these results that the rate of correct calculation of the medication doses increases proportionally to the increased clinical experience of the students.

The 1<sup>st</sup> grade midwifery students were not included into the study since they hadn't taken yet the theoretical lessons regarding to medication doses. Between the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> grade midwifery students, no difference were found in the success obtained in the calculation of the oral and parenteral medication doses. 2<sup>nd</sup> and 3<sup>rd</sup> grade nursing and midwifery students were found to be much more successful than the last grade nursing and midwifery students in flow rate calculations. This result which is contrary to the expectation that the last grade students should be more successful is worrying. The fact that the 2<sup>nd</sup> and 3<sup>rd</sup> grade students employ these processes more frequently in their clinical practices and that the last grade students, taking Public Health and Psychiatry lessons, employ this processes rarely can account for this result. It is apparent that the unused knowledge is forgotten.

Limitations of this study should be acknowledged. Firstly, the rate of the questions not answered by the students was found to be high. In order to decrease this rate, it could have been emphasized more strongly that the students should have answered the test completely.

Attention should also be paid to MCS test. Firstly, there were some calculation problems which were difficult and might need refinement. Secondly, written tests have been criticized as a predictors of mathematical competence in clinical practice. This test assessed nursing and midwifery students' actual mathematical skills in theory but did not monitor their skills and performance in every day practice (GRANDELL-NIEMI et al 2006; ADAMS 1991; MURRAY 1996; CARTWRIGHT 1996).

Testing skill levels at the beginning, before starting clinical practice and periodically during nursing programs would reveal those students who need extra help with mathematics. Remedial teaching can be directed towards those students who consider their skills in sufficient (GRANDELL-NIEMI et al 2006; KAPBORG 1995).

Every nurse and student should primarily be responsible for the development of their own mathematical skills needed in clinical practice and, not only rely on occasionally testing.

## CONCLUSION

Medication administration is an essential skill for nurses and midwives. Any mistake in calculation can lead to medication error and life threatening situations for patients. In the study, it was found that the mathematical skills of the nursing and midwifery students were weak and they didn't feel adequate in the calculation of the medication dosages. This study showed that few respondents attained 100 % correct in MCS test. Determining and overcoming this inadequacy of the students during their education would prevent the problems they possibly face in their profession after their graduation. Moreover, the connection with learning environment in clinical practice and mathematical skills should be studied.

## REFERENCES

- ADAMS A. The value of drills in developing and maintaining numeracy skills in an undergraduate nursing programme. *Nurse Education Today*. v.11, n.3, p.213-219, 1991.
- BAYNE T., BİNDLER R. Medication calculation skills of registered nurses. *The Journal of Continuing Education in Nursing*. v.19, n.6, p.258-262, 1988.
- CARTWRIGHT M. Numeracy needs of the beginning Registered Nurse. *Nurse Education Today*. v.16, n.2, p.137-143, 1996.
- ELLIOTT M., JOYCE J. Mapping drug calculation skills in an undergraduate nursing curriculum. *Nurse Education Practice*. v.5, n. 4, p.225-229, 2005.
- GRANDELL-NIEMI H., HUPLI M., PUUKKA P., LEINO-KILPI H. Finnish nurses' and nursing students' mathematical skills. *Nurse Education Today*. v.6, n.3, p.151-161, 2006.
- KAPBORG I., ROSANDER R. Swedish student nurses solving mathematical items with or without help of a hand-held calculator – a comparison of results. *Nurse Education in Practice*. v.1, n.1, p.80-84, 2001.
- KAPBORG I.D. An evaluation of Swedish nurse students' calculating ability in relation to their earlier educational background. *Nurse Education Today*. v.15, n.1, p.69-74, 1995.
- KAWASHIMA A., PETRINI A. M. Study of critical thinking skills in nursing students and nurses in Japan. *Nurse Education Today*. v.24, n.4, p.286-292, 2004.
- MURRAY S., REED J., SEDGWICK H. An investigation of the components used to calculate staff: student ratios in nursing and midwife education. *Nurse Education Today*. v.16, n.4, p.245-255, 1996.
- WEEKS K. W., LYNE P., MOSELY L., TORRENCE C. Written drug dosage errors made by students: the threat to clinical effectiveness and the need for a new approach. *Clinical Effectiveness in Nursing*. v.4, n.4, p.20-29, 2000.
- WEEKS K. W., LYNE P., MOSELY L., TORRENCE C. The strive for clinical effectiveness in medication dosage calculation skills: the role of constructivist

learning theory in the design of a computer-based 'authentic world' learning environment. *Clinical Effectiveness in Nursing*. v.5, n.1, p.18-25, 2001.

WRIGHT K. An exploration into the most effective way to teach drug calculation skills to nursing students. *Nurse Education Today*. v.25, n.6, p.430-436, 2005.

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