A Study of the Use of Vernier Calipers on Student Competence in the Department of Mechanical Engineering, Politeknik Mukah

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Abstract

This study was carried out with the aim of reviewing the level of knowledge of semester 1 students in the Department of Mechanical Engineering at Mukah Polytechnic about using vernier calipers. The aspects of knowledge ability, technical skills, and willingness to use the Vernier Caliper are measured. This study is descriptive and uses a questionnaire instrument involving a sample of 100 respondents. The set of questionnaires used to conduct this study is divided into four parts which are respondent demographic, knowledge level of using Vernier Calipers, skill level of using Vernier Calipers, and student change willingness level. It contains 35 questions items to obtain research data. The entire data obtained was analyzed using the Statistical Package for Social Science (SPSS) software to obtain frequency, percentage, mean, and standard deviation values for each respondent's response. The results of the study show that the highest level of item knowledge is B9 (basic use of the Vernier Scale should be applied to students of semester 1) with a mean score = 3.60 where students emphasize the need for initial exposure related to the use of vernier calipers applied in semester 1. It can be concluded that there is a significant relationship between the level of knowledge and skill in the use of the Vernier Caliper and student competence. The findings of the study also show that there is a relationship between the level of knowledge and the level of willingness to change among students. In addition, the relationship between the level of skill and the level of willingness to change shows a positive relationship with moderate strength.

Keywords: Competence; Vernier Caliper; Skills; Usage; Students

1.0 Introduction

Polytechnic is a study center based on technical and vocational education. The establishment of a technical institution like this contributes to a semi-skilled workforce to fill job opportunities in the technical field (JPPKK, 2018). In order to meet the needs of today's industrial sector, students need to be exposed to various fields of skills and knowledge (Mohd Matore et al., 2020). DJJ10022 (Mechanical Workshop Practice 1) is one of the engineering workshop practice courses that must be taken by Semester 1 students for the Mechanical Engineering Diploma Program at Politeknik Mukah. In the teaching and learning process for this course, the use of a vernier caliper is one of the basic measurement tools used by the students, especially in the machine and gear workshop, to measure project materials. Its use involves measuring dimensions such as the length, inner diameter, and outer diameter of the workpiece.

Measurement errors can occur when students read the scale mark at the wrong position and are weak in the skill of reading the scale mark. To ascertain students' opinions of their competency in the use of vernier calipers, studies on the extent of knowledge and students' skills in this area during the teaching and learning process need to be conducted.

The first objective of this study is to identify the level of knowledge in the use of Vernier Calipers for semester 1 students in the Department of Mechanical Engineering, Politeknik Mukah. The second objective is to know the level of Vernier Caliper skill for semester 1 students in the Department of Mechanical Engineering, Politeknik Mukah. The third objective of this study is to determine the level of students' willingness to change towards the use of vernier calipers. The relationship between the three variables was also studied by conducting a Pearson Correlation analysis.

2.0 Literature Review

There are three main elements in this research: knowledge and skills, technical skills, and the willingness of students to change. In accordance with the requirements of Technical and Vocational Education and Training (TVET), which is to produce graduates who are work-ready, knowledge and skills are important elements to fulfill this requirement. TVET also needs technical skills, which involve training in essential real-world skills. The willingness of students to change is the intention element in this research to study the student readiness to improve their skills while using Vernier Calipers.

2.1 Knowledge and Skills

In the context of human maturation, knowledge is an important element. Knowledge becomes a medium for humans to obtain various inputs that can be used as a support and guide for life(Utusan Sarawak, 2022). Skills, or more specifically, technical skills, are the basis of knowledge for every job done (Nasir et al., 2011). Therefore, knowledge and skills are closely related to measuring cognitive, psychomotor skills and students' affective skills in performing practical work. Students are said to be able to master and apply something if they have the knowledge to know the subject.

2.2 Technical Skills

Technical skills are a person's ability to apply specific knowledge and expertise in performing tasks, methods, processes, and procedures. The use of sophisticated and high-tech tools requires technical skills in handling them in accordance with the will of the needs Fourth Industrial Revolution (Industry 4.0) (Maisiri et al., 2019). The government prioritizes technical skills in the field of engineering because it is an important component of national education to improve the country's progress (Ismail & Kasman, 2020). Competency elements that involve students' knowledge and skills in the techniques of doing work, such as using equipment and work materials correctly and safely, are one of the technical elements.

2.3 Willingness of Students to Change

The main aims of the fourth industrial revolution (Industry 4.0) transform the nature of industry work. Despite the need for Industry 4.0, the demand for specific high skills is rising. The requirement of the high and specialized skills among the workforce are related to the ability and willingness to learn , to unlearn and relearn(Ra et al., 2019). Willingness can be described as the preparedness of someone to get involve or not to involve in a task. This is aligned with the theory of planned behavior which premised that human behavior is predicted by people's intentions to or not to perform the behavior in question(Chukwuedo, 2019).

2.4 Measuring Tools

Measurement is a process to obtain the value of a quantity, such as length or mass, relative to a unit of measurement. Various measuring tools can be found in laboratories and workshops, for example, rulers, measuring tapes, vernier calipers, and micrometers. In order to ensure that measurement tools, machine tools, materials, and buildings are in perfect condition, workspace management practices must be followed to ensure the safety of students (Ahmad Shariff et al., 2023). When the management of workshop equipment is well taken care of, students can use the measurement equipment perfectly. Imperfect equipment can affect the teaching and learning process in the workshop. This factor can also cause students' competence in the use of measuring tools such as vernier calipers to have problems.

3.0 Methodology

3.1 Research Instruments

In this study, the research instrument used is a descriptive study, which refers to statistical methods to explain the characteristics of a sample group. This descriptive method aims to study the level of competence in the use of vernier calipers among semester 1 students of the Department of Mechanical Engineering, Politeknik Mukah. This study involved a sample of 100 Semester 1 students who took the DJJ10022 - Mechanical Engineering Workshop Practice 1 course for the Mechanical Engineering Diploma program at Politeknik Mukah. In the final week of each workshop practice study, they were asked to fill out a questionnaire distributed via Google Form to examine the level of knowledge, skill level, and readiness of the students to use Vernier calipers. This study uses a questionnaire instrument adapted from Azniza et. al (2014). It is adapted and processed without changing the meaning of the actual sentence (Othman et. al, 2020). The data obtained from the respondents was analyzed using the Statistical Package for the Social Science (SPSS) software. Next, the data obtained will be processed and analyzed to obtain more detailed results involving descriptive statistics. The questionnaire instrument is in Bahasa Malaysia which easy to understand and was shared through google form for respondent to obtain detailed data to be analyzed. Table 1 shows the four parts of this questionnaire instrument.

Table 1: Questionnaire instruments

Section	Instruments
A	Respondent Demographics
B	Knowledge Level of Using Vernier Calipers
C	Skill Level of Using Vernier Calipers
D	Student Change Willingness Level

Respondents must choose one of the Likert scale numbers to indicate their response to the given question statement. The score scale for all question items will use a Likert Rating Scale that contains four score values, as shown in Table 2 below. 4-point Likert scale is used to prevent respondents from not giving any opinion because it has no center point (Ishak & Mir Ahmad Talaat, 2020).

Table 2: Likert Rating Scale (Ishak & Mir Ahmad Talaat, 2020)

Scale	Description
1	Strongly Disagree
2	Don't Agree
3	Agree
4	Strongly Agree

3.2 Data Analysis

All the data obtained is carefully examined, recorded, collected, and categorized. As a result of the data, it is analyzed using the Statistical Package for Social Science (SPSS) software to obtain frequency, percentage, mean, and standard deviation values for each respondent's response.

4.0 Results and Discussion

4.1 Background of Respondents

The respondents to this study consisted of 1st semester students of the Mechanical Engineering Department at Politeknik Mukah, Sarawak. The total number of students involved in this study is 100. Table 3 shows the demographic background for this study. The frequency value of male respondents is 78 (78%) which is more than the female respondents value of 22 (22.0%). In addition, it was found that most students graduated from National Secondary School (SMK) with a frequency value of 95 (95%), while the frequency value for students who graduated from Technical Secondary School (SM Teknik) was 2 (2%). The frequency of Vocational College graduates is 1 (1%), and the frequency of graduates from other types of schools is 2 (2%).

Table 3: The demographic background of the study

Demographic Backgroun	Item	Frequency	Percent (%)
Gender	Men Women	78 22	78.0 22.0
Admission Qualification to Polytechnic	SPM	100	100.0
Age	18 19 20-25	22 75 3	22.0 75.0 3.0
Races	Melayu Cina Iban Others	14 5 51 30	14.0 5.0 51.0 30.0
Background of Education	SMK SM Teknik Kolej Vokasional Others	95 2 1 2	95.0 2.0 1.0 2.0

In this section, the results of the study, which include mean score analysis and Pearson-r correlation test results, will be explained. Analyze Pearson-r was carried out due to the statement of the hypothesis, which explains that there is a relationship between the level of knowledge and the level of skill of students, as well as the relationship between the level of knowledge and the level of willingness of students to change in the use of vernier calipers against student competence.

4.2 Level of Knowledge of Using Vernier Calipers Against Student Competence

There are 10 items that are studied and analyzed at this level to answer the research question: First, what is the level of knowledge of the use of Vernier Calipers among semester 1 students in the Department of Mechanical Engineering, Politeknik Mukah. Table 4 shows the results of descriptive analysis based on the mean value, standard deviation, and data interpretation for this study.

Table 4: Mean score, standard deviation, and interpretation
for the level of knowledge

Level	Mean	SP	Interpretation
Knowledge	3.31	0.426	Moderate

Based on the results of the descriptive analysis, every function shows that the overall level of students' knowledge of the use of vernier calipers is at a moderate level, with a mean score of 3.31 and a standard deviation of 0.426. From Table 5, the interpretation of this mean score is based on the mean interpretation scale table (Harun et al., 2016), which states that a value between 2.51 and 3.50 is moderate.

Table 5: Interpretation of the mean score
of the four mean likert scale (Harun et al., 2016)

Scale	Mean Score Level
1.00 - 1.50	Lack of relevance
1.50 - 2.50	Low
2.51 - 3.50	Moderate
3.51 - 4.00	High

Table 6 shows the distribution of the level of knowledge of using Vernier Calipers for students in the 1st semester of the Department of Mechanical Engineering, Politeknik Mukah, according to the items that have been studied.

Table 6: Distribution of student's knowledge level by item

No	Item	Mean	SP	Interpretation
B1	I know how to use Vernier Caliper	3.21	0.591	Moderate
B2	Vernier caliper is a handy tool	3.32	0.584	Moderate
B3	I had early exposure to the use of a Vernier caliper before entering the polytechnic	3.02	0.887	Moderate
B4	I make book/ internet/ references/ related resources in case I have problems using Vernier Caliper	3.37	0.646	Moderate
B5	I know every function in the Vernier Caliper	3.15	0.642	Moderate
B6	The 1st Mechanical Workshop Practice course offered helped me acquire the necessary measuring skills	3.36	0.560	Moderate
B7	If there's any misuse of the Vernier scale, I'll refer to the lecturer	3.45	0.592	Moderate
B8	The use of the digital Vernier scale is very easy to use	3.40	0.636	Moderate
B9	Basic use of the Vernier Scale should be applied to students of semester 1	3.60	0.569	High
B10	I need a manual for using the Vernier Scale	3.22	0.629	Moderate

Based on Table 6, the mean value of item B9 is the highest, with a mean value of 3.60 and a standard deviation of 0.569. The level of interpretation for this item is medium to high. It can be concluded that most respondents agree with the statement in item B9 that the basics of using the Vernier Caliper should be taught to students in semester 1. Item B3 with the statement that I had early exposure to the use of the Vernier Caliper before entering the Polytechnic has the lowest mean value, with a mean of 3.02 and a standard deviation of 0.887. Based on the demographic background of the study, most of the respondents are SMK graduates who lack in terms of filling in technical engineering skills in the school syllabus compared to Technical Colleges and Vocational Colleges, which include basic skills in their syllabus.

4.3 Level of Vernier Caliper Use Skills Against Student Competence

There are also 10 items in the skill level domain. Table 7 shows the results of the study, which is a descriptive analysis based on the mean value, standard deviation, and interpretation.

Table 7:Mean score, standard deviation, and interpretation for the level of knowledge

Level	Mean	SP	Interpretation
Skills	3.07	0.514	Moderate

The score value for descriptive analysis is a mean of 3.07, the standard deviation is 0.514, and the interpretation of skill level is medium. Table 8 shows the distribution of Vernier Caliper skill levels for students in the 1st semester of the Department of Mechanical Engineering, Politeknik Mukah, according to the items that have been studied.

Table 8: Student skill level mix by item

No	Item	Mean	SP	Interpretation
C1	I'm good at handling the Vernier scale in the workshop	3.10	0.644	Moderate
C2	I'm good at using scales by parameters (mm and inch) in vernier scales	3.17	0.652	Moderate
C3	I often help my friends to use the Vernier scale	2.94	0.722	Moderate
C4	If there's any damage to the Vernier scale, I know how to fix it	2.35	0.821	Low
C5	Before making the measurement, I need to make the calibration	3.05	0.626	Moderate
C6	I can distinguish the primary scale and Vernier scale on the Vernier Scale	3.32	0.680	Moderate

C7	I often make sure the correct range before making measurements on the work material	3.30	0.628	Moderate
C8	Mechanical Workshop 1 practice is enough to give me the skills to use the Vernier scale	3.11	0.665	Moderate
C9	I applied the use of the Vernier scale in learning	3.21	0.591	Moderate
C10	I applied the use of the Vernier scale in all workshop practices	3.19	0.563	Moderate

Based on Table 8, the highest mean score value is on item C6, with a mean value of 3.32 and a standard deviation of 0.680. The level of interpretation for item C6 is moderate. Based on the statement of item C6, which is that I can distinguish the main scale and the Vernier scale on the Vernier Caliper, it can be explained that some students can distinguish the two scales on the Vernier Caliper, which is a basic skill in using the Vernier Caliper. The lowest score value for the student's skill level in the use of a Vernier Caliper is on item C4, with a mean value of 2.35 and a standard deviation of 0.821, where the statement of the item is that if the Vernier Caliper is damaged, I know how to fix it.

It can be seen from this low mean value that most students are not good at repairing Vernier calipers, which is an important practical requirement for operating a Vernier caliper. Before using the Vernier Caliper for measurement purposes, students must ensure that the Vernier Caliper is in good condition. Vernier calipers should be calibrated before use. If the Vernier Caliper is in poor condition, it should be calibrated according to the established standard using the Caliper Checker. This is important because the reading of the Vernier scale depends on the accuracy marked on the caliper.

4.4 Student Change Willingness Level
In the level of willingness of student change, there are 10 items that are asked to ensure the level of willingness of student change. Table 9 shows the results of the level of willingness of students change for the mean score value, standard deviation, and interpretation.

Table 9: Results of Willingness of student change for the mean score value, standard deviation, and interpretation.

Level	Mean	SP	Interpretation
Willingness of student change	3.19	0.353	Moderate

Based on Table 9, the mean score value for the study of willingness of student change is 3.19, with a standard deviation of 0.353. The interpretation of these findings is simple. Table 10 shows the distribution of willingness of students change levels for each item that has been studied.

Table 10: Distribution of willingness of student change for each item that has been studied.

No	Item	Mean	SP	Interpretation
D1	When I hear about something new, I can't wait to try it	3.44	0.625	Moderate
D2	I usually wait until somebody else tries the new stuff first	3.07	0.820	Moderate
D3	I'm more comfortable with the existing circumstances	3.35	0.626	Moderate
D4	I'm always willing to try new approaches in doing something work	3.45	0.575	Moderate
D5	The new procedure will only cause trouble and pressure	2.56	0.903	Moderate
D6	I'm worried about learning new skills	2.43	0.977	Low
D7	I'm looking for opportunities to make radical and lasting change	3.19	0.631	Moderate
D8	Change leads to good	3.45	0.557	Moderate
D9	It's a pleasure to try something new even though he may not succeed at last	3.38	0.599	Moderate
D10	As a student, I like something innovative	3.60	0.512	High

Based on the distribution of willingness of student change for each item that has been studied, which is shown in Table 10, the highest mean score value is for item D10, with a mean value of 3.60 and a standard deviation of 0.512. The interpretation of this item, D10, is in the high category. Based on the statement of item 10, as a student, I like something innovative, showing that students like change and new things. Mahdi et al. conclude that individuals involved in innovation activities will be able to develop various important skills in the professional world, such as problem-solving skills, communication skills, and time management skills(Mahdi et al., 2015).

In addition, it can also be seen that other items that have a mean score value approaching 3.51 (the interpretation value of the high category) are items D1, D4, and D8, with a mean value of 3.44, 3.45, and 3.45, respectively. Based on the statements of the three items, it can be concluded that students are ready to try something new and accept that a change leads to good.

The lowest mean score value is on item D6, with a mean value of 2.43 and a standard deviation of 0.977. The interpretation score for item D6 is low with the statement of the item, i.e., I worry about learning new skills. Based on the results of this finding, it can be explained that students' anxiety about learning new skills is due to the perception of not getting full guidance from lecturers or instructors and will cause learning pressure to increase due to a lack of understanding. Based on previous research, one of the factors that causes students to experience stress is that it is difficult to understand what the lecturer is teaching when learning takes place (Ramli & Dawood, 2020). Based on Vygotsky's theory of 'scaffolding' , the approach that needs to be taken if students learn new skills is that the lecturer provides full guidance, but when the students have begun to understand, the guidance given is reduced slowly and gradually until the student masters the skill (Van Der Stuyf, 2002). With this approach, stress can be reduced, and students' anxiety about learning new skills can also be overcome.

4.5 The Relationship Between the Level of Knowledge and The Level of Skill in The Use of Vernier Calipers Against Student Competence
Pearson's Correlation Analysis was conducted to identify the relationship between the level of knowledge, skill level, and willingness to students change in term of improving use of Vernier Calipers and the competence of students in the 1st semester of the Department of Mechanical Engineering, Politeknik Mukah. Table 11 shows the value of the correlation coefficient obtained from the results of the analysis that has been carried out.

Table 11: The relationship between the level of knowledge and skill level, the level of knowledge and willingness of students change and the level of skill and willingness of student change.

Variables	Pearson Correlation Coefficient (r)	Significant Level	Interpretation Strength Connection
Knowledge and Skills	0.789	0.00	High
Knowledge and willingness of Student Change	0.520	0.00	Moderate
Skills and willingness of Student Change	0.539	0.00	Moderate

The study found that the Pearson Correlation coefficient between the level of knowledge and the level of skill is r = 0.789, P =0.00 (p<0.05). This shows that both variables are positively related to the strength of the relationship. The level of interpretation of the strength of the relationship is determined based on the value of the Pearson Correlation Coefficient by referring to Table 12.

Table 12: Interpretation of the strength of the relationship based on the value of the Pearson correlation coefficient (Baba, 1997)

Correlation Coefficient	Relationship Strength
0.00 – 0.20	Can be Ignored
0.20 – 0.40	Low
0.40 – 0.60	Moderate
0.60 – 0.80	High
0.80 – 1.00	Very High

Next, for the relationship between enablers and student change, the level of knowledge and level of student change readiness found that the resulting Pearson Correlation coefficient was r = 0.520, P =0.00 (p<0.05). This shows that both variables are positively related to the strength of the relationship at a moderate level. The Pearson Correlation Coefficient for the relationship between the variable skill level and the level of willingness to change students is r = 0.539, P =0.00 (p<0.05). It can be concluded that these two variables are also positively related to the strength of the relationship at a moderate level.

5.0 Conclusion

Based on the research that has been carried out, it can be concluded that there is a significant relationship between the level of knowledge and skill in the use of the Vernier Caliper and student competence. This is based on the results of a study that shows there is a positive relationship between the level of knowledge and the level of skills, with high relationship strength. The findings of the study also show that there is a relationship between the level of knowledge and the level of willingness to change among students. In addition, the relationship between the level of skill and the level of willingness to change shows a positive relationship with moderate strength. In conclusion, from the analysis of the level of knowledge and the requirements that students need in terms of initial exposure to the use of Vernier Calipers, at the skill level, students need to prepare themselves with the basics of Vernier Caliper maintenance, and at the level of readiness for change, students show that they are ready for good changes and try to learn new skills. Therefore, this study was conducted to improve students' practical skills in line with the Polytechnic's vision, which is to become a center of excellence in Technical Education and Vocational Training (TVET) that excels in producing highly skilled human capital and becomes a source of energy for the country's industry.

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Author Contributions

Z. Abdullah: Conceptualization, Abstract, Introduction, Discussion, Conclusion; **C. S. C. Berahim**: Data collection, Methodology, Result and Editing; **R. I. A. Rahman**: Result, Discussion and Writing-Reviewing.

Conflicts of Interest

The manuscript has not been published anywhere else and is not being considered by any other journals. All authors have authorized the review, agree with the submission, and state that they have no conflicts of interest in the work.

References

Ahmad Shariff, S. S., Adnan, S. W., & Abdul rahim, M. (2023). Keberkesanan penggunaan Detector Storage with Sensor System (DESS) di bengkel Kayu Politeknik Melaka. In *Teori, Amalan Dan Inovasi Dalam Organisasi Dan Industri* (pp. 5–22). Kaizentrenovation Sdn Bhd.

Baba, A. (1997). *Statistik Penyelidikan dalam Pendidikan dan Sains Sosial.* Universiti Kebangsaan Malaysia.

Chukwuedo, S. O. (2019). Technical education graduate students' career satisfaction and willingness for skills upgrading: The mediating role of lifelong learning opportunities. *International Journal of Educational Research, 6*(1), 29–38.

Harun, M. A., Hamid, Z., & Wahab, K. A. (2016). Melahirkan warga yang berketerampilan bahasa: Kajian hubungan antara pengetahuan dengan amalan komunikatif dalam kalangan guru Bahasa Melayu. *Malaysian Journal of Society and Space, 12*(9), 32–45.

Ishak, A. A., & Mir Ahmad Talaat, A. Z. (2020). Pembelajaran atas Talian: Tinjauan terhadap Kesediaan dan Motivasi dalam kalangan pelajar Diploma Logistik dan Pengurusan Rantaian Bekalan, Politeknik Seberang Perai, Pulau Pinang. *Jurnal Dunia Pendidikan, 2*(4), 68–82.

Ismail, A., & Kasman, Z. (2020). Pembangunan Kompetensi Kemahiran Teknikal bagi Sektor Pengangkutan di Malaysia. *Jurnal Kajian Pendidikan, 10*(1), 75–88.

JPPKK. (2018). *Rangka Kerja TVET 4.0 (2018-2025)* (Vol. 1). Jabatan Pendidikan Politeknik Dan Kolej Komuniti.

Mahdi, R., Sukarman, S. S., & Yok, M. C. K. (2015). Fostering Creativity through Innovation Engagement in Science and Technology Education: Case Study of Universiti Teknologi MARA Students. *Procedia - Social and Behavioral Sciences, 167,* 256–260.

Maisiri, W., Darwish, H., & Van Dyk, L. (2019). An investigation of Industry 4.0 Skills Requirements. *South African Journal of Industrial Engineering, 30*(3), 90–105. https://doi.org/10.7166/30-3-2230

Mohd Matore, M. E. @ E., Zainal, M. A., Mohd Noh, M. F., Khairani, A. Z., Abdul Rahman, N., & Idris, H. (2020). Pengujian Psikometrik item kecerdasan menghadapi cabaran untuk pelajar lelaki Kejuruteraan Mekanikal menggunakan model pengukuran Rasch. *Jurnal Pendidikan Malaysia, 45*(1), 87–100.

Nasir, A. N. B., Ali, D. F. B., Noordin, M. K. B., & Nordin, M. S. B. (2011). Non-technical skills for technical skilled workers in Malaysia. In *Proceedings of the International Engineering and Technology Education Conference (Kuala Lumpur, Malaysia, 16-19 January).*

Ra, S., Shrestha, U., Khatiwada, S., Yoon, S. W., & Kwon, K. (2019). The rise of technology and impact on skills. *International Journal of Training Research, 17*(sup1), 26–40. https://doi.org/10.1080/14480220.2019.1629727

Ramli, M. W., & Dawood, S. R. S. (2020). Faktor tekanan dalam kalangan pelajar Universiti Sains Malaysia: Satu tinjauan awal. *Journal of Social Sciences and Humanities, 17*(7), 66–76.
Utusan Sarawak. (2022). *ILUSI ILMU PENGETAHUAN.* Utusansarawak.Com.My. https://www.utusansarawak.com.my/?p=31076

Van Der Stuyf, R. R. (2002). *Scaffolding as a Teaching Strategy, Adolescent Learning and Development. 52*(3), 5–18.