121 - TECHNOLOGY FOR ACCURACY EVALUATION OF BEGGINER TABLE TENNIS PLAYER

OCHIANĂ NICOLAE
Faculty of Movement, Sports and Health Sciences,
University "Vasile Alecsandri" of Bacău, Romania
sochiana@yahoo.com

INTRODUCTION TO THE RESEARCH TOPIC

The questionnaires filled in and analyzed in 2008-2009 underlined the coaches' reticence in using the new technologies during the training of high performance athletes, especially during the periodic evaluation of different training sessions.

Table tennis has long fascinated robotics as a particularly difficult task. Significant research on robot table tennis started around 1983 (Billingsley), and was followed by a period of enthusiastic research until 1993 (Andersson, 1988; Knight & Lowery, 1986; Hashimoto et al., 1987; Fässler et al., 1990). A few groups continue to work on this problem (Miyazaki et al., 2005; Matsushima et al., 2005; Mulling et al., 2011),

Considering the special results that Romania has achieved in table tennis over a long period of time and the wish of the Romanian Table Tennis Federation to combining the experience and the talent of coaches with the new technologies and information, we have tried to make a simple, efficient platform which could be used on a large scale, so that the federation could perform uniform, periodic tests, especially in the case of section I of the sports department. The gathering and the quick delivery of the electronic data will allow the adaptation of the long-term and the short-term strategies concerning the future generation of table tennis players.

RESEARCH PROBLEMS, OBJECTIVES, SETTINGS, DESIGN AND METHODS

The objective of this scientific investigation was to determine the possibility of using the table tennis robot and the contact sensors as a means of evaluating the precision, in order to transform them into a working tool for the researchers, teachers or coaches who need to identify and quantify these movement qualities.

The tests were carried out from March 2010 to October 2011, on 63 subjects 23 girls and 20 boys, aged between 9 and 10, coming from 6 tennis table associations from Romania. This study was coordinated by the Faculty of Health, Sports and Movement Science in cooperation with the Romanian Table Tennis Federation.

THE RESEARCH METHODS AND TECHNIQUES

The technical platform used has been made up of a table tennis robot, contact sensors, central visualization and command unit, notebook

The possibilities for using this platform are multiple, starting from using it to measure the specific movement speed, the eye-hand coordination, the speed of execution and up to using it as a means of correcting and improving the performance technique. In this material we will present only the possibilities of measuring the accuracy, the mental-motion quality which is essential for the table tennis players.

For the beginning, together with the coaches of the Romanian girls and boys national teams, we have decided upon a control test that should quantify the minimum essential elements in table tennis. It is also them who have certified the minimum number of operators for the traditional method in 2.

The control test was made up of 6 tests which assessed the technical performance in the case of the drive, topspin and service, forehand as well as backhand (table no.1). We made an initial experiment during which we settled the work methodology.

table no.1. The control test

Test	element
1	Forehand drive
2	Backhand drive
3	Forehand topspin
4	Backhand topspin
5	Forehand backspin service
6	Backhand backspin service

The tests have been carried out using the technical platform, the speed and the frequency of the robot's throws being constant and close to the similar speed of execution using the "box of balls", as well as using the traditional method, execution with a partner.

We registered the number of correct executions performed by the athletes out of a total of 20 shots, coefficient 0,25/ successful execution for the tests 1-4 and the number of correct executions performed by the athletes out of a total number of 10 services, coefficient 0,50/successful execution for the tests 5-6. The bonus offered tried to differentiate the importance of certain executions (in the case of tests 5 and 6 which referred to the service, not performing it and failing it would automatically lead to losing a point, no matter what are the motion abilities and the technical-tactical knowledge gathered by the player).

In order to measure the accuracy, a contact sensor with a diameter of 25,5 cm was placed on the tennis table, 35 cm away from the side and 40 cm from the end line, on the technical platform, while for the traditional method a paper copy of the contact sensor (photo 3) was placed there, and the athletes were instructed to hit it as many times as possible during each test. The bonus coefficient offered was of 0,50/successful execution for the tests 1-4 and 1/ successful execution for the tests 5 and 6.

In order to measure the efficiency, we have also recorded the number of executions during which the operator was not sure the execution was correct, because the speed of the ball was too high and the contact point was very close to the marked area.

The scores achieved have been registered in the first case in an excel data base and in the second case on a result card, later achieving a single ordered list (table no.2).

table no.2. Example of ordered results for the control test

	Name		D.S.					
Test		ceff	TPM			TRM		
			Ne	pts	Ue	Ne	pts	Ue
1	ex	0,25	18	4,50	0	17	4,25	4
	acc	0,50	13	6,50		8	4,00	
2	ex	0,25	20	5,00	0	20	5,00	2
	acc	0,50	15	7,50		16	8,00	
3	ex	0,25	20	5,00	0	18	4,50	3
	acc	0,50	10	5,00		8	4,00	
4	ex	0,25	18	4,50	0	20	5,00	4
	acc	0,50	12	6,00		7	3,50	
5	ex	0,50	10	5,00	0	10	5,00	2
	acc	1,00	8	8,00		7	7,00	
6	ex	0,50	10	5,00	0	10	5,00	3
	acc	1,00	6	6,00		7	7,00	

Abbreviations
ceff=coefficient
ex=execution
acc=accuracy
TPM=the “technical platform” method
TRM= the “traditional” method
Ne=number of executions
Pts=points
Ue= “unclear” executions

The times necessary for performing the tests using the two methods have been recorded in all the 6 centres included in the study (table no.3). The times have been measured using a stopwatch, starting from the beginning of the executions until the end of the result presentation.

table no.3. Table of the times for the tests performed in the 6 centres using the two methods

Centres	A	B	C	D	E	F
NS	12	10	15	7	10	9
TMTP./min	26,24	21,86	32,80	15,30	21,86	19,68
TMTR./min	99,38	88,31	125,47	67,22	90,31	79,28

Abbreviations
NS= number of subjects
TMTP= total time using the “technical platform” method
TMTR=total time using the “traditional” method

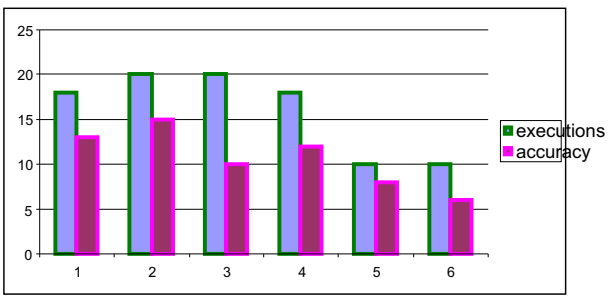
The analysis from the efficiency point of view of the new method has been established by the report classical method - new method for the values achieved in the case of three indicators: the minimum number of operators, the number of subjects tested during a certain time unit and the percentage of executions which could not be assessed.

RESULTS AND DISCUSSION

Comparing the results achieved by the athletes during the 6 tests, we could notice that the average results of the executions using the technical platform have had values close to the ones achieved using the traditional method, respectively 32,937 compared to 30,937.

As to the score differences, we can notice that: the calculated value t of 0,26879 is inferior to the corresponding theoretical value of 1,96 for 124 degrees of freedom and the significance level chosen, fact which confirms that there are no significant differences between the results achieved using the two methods. In other words, the group has had a similar evolution from the point of view of the score achieved, both during the test using the platform and during the test using the traditional method.

We could draw up a top of the athletes according to the results achieved but, which was even more important, we could make efficient individual observations based on the graphical analysis which led to discovering certain deficiencies that will be corrected in due time. Analysing the results achieved by the subject DS (graphic no.2) we can notice the following facts:

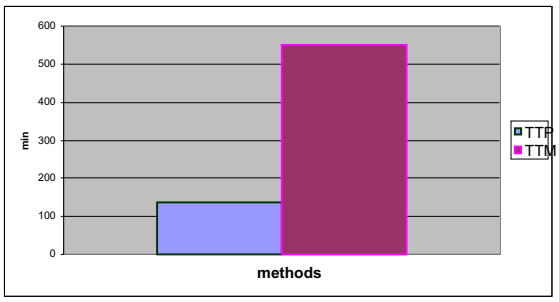


graphic no.2. Graphical representation of the shot accuracy during the 6 tests carried out by subject DS

There is a difference in all 6 tests performed, the general accuracy of the performance being of 66,6%. The lowest

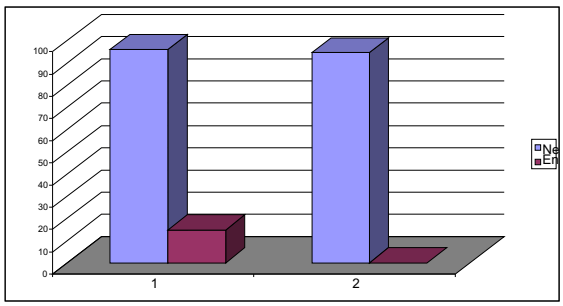
percentage was achieved for test 3 – forehand topspin 50%, and the highest result was achieved during test 5 forehand service 80%.

After a certain training period, the tests can be repeated in order to follow the evolution in time of the athletes, the improvement of the parameters, the stagnation or the regression achieved. You can also make analyses on individual level, on group level, according to the sex, age, training level etc.



Abbreviations
TTP= Total time for the technical platform
TTM= Total time for the traditional method
graphic no.3. Graphical representation of the total time necessary to perform the 6 tests using the two methods

By analysing the total time for the performance of the 6 tests using the two methods (graphic no.3), we can notice an essential difference. In the first case, using the technical platform, the total time necessary for the performance and the communication of the results was of 137,76 minutes, while using the traditional method the total time was of 549,99 minutes. In this case, the rate of efficiency was of 1 to 3,99 in favour of the method using the technical platform.



graphic no.4. Graphical representation of the average number of executions and of the average number of executions which could not be recorded during the 6 tests using the two methods

The average number of executions performed using the “traditional” method was of 94,63, and in the case of 14,79 executions the operator could not be sure that the execution was correct.

The average number of executions performed using the “technical platform” method was 96. All of them could be validated.

The data presented here show that using the technical platform is 14% more efficient than the traditional method.

CONCLUSION

Besides the accuracy of information (the robot and sensors exclude the influence of the human factor), the system also offers the possibility of testing a large number of subjects in a relatively short period of time using only one operator.

The graphical display of the results in real time offers the possibility to correct and improve the weak parameters.

The results achieved concerning the three efficiency indicators established beforehand can lead to the conclusion that the report traditional method/new method favours as follows:

1. the minimum number of operators necessary: 2/1
2. the number of subjects tested during a certain unit of time: 1/4
3. the percentage of executions which could not be validated 14%/0%

REFERENCES

ANDERSSON, R. A robot ping-pong player: experiment in real-time intelligent control. Cambridge, MA,USA: MIT Press, 1988.

BILLINGSLEY, J. Machineroe joins new title fight. Practical Computing, May/June, 14–16, 1983.

FÄSSLER, H.; BEYER, H. A.; WEN, J. T. A robot ping pong player: optimized mechanics, high performance 3d vision, and intelligent sensor control. Robotersysteme, 6(3), 161–170, 1990.

HASHIMOTO, H.; OZAKI, F., ASANO, K.; OSUKA, K. Development of a ping pong robot system using 7 degrees of freedom direct drive. In Industrial applications of robotics and machine vision (IECON) (pp. 608–615), 1987.

KNIGHT, J.; LOWERY, D. Pingpong-playing robot controlled by a microcomputer. Microprocessors and Microsystems, 10(6), 332–335, 1986.

MATSUSHIMA, M.; HASHIMOTO, T.; TAKEUCHI, M.; MIYAZAKI, F. A learning approach to robotic table tennis. IEEE Trans. on Robotics, 21, 767–771, 2005.

MIYAZAKI, F.; MATSUSHIMA, M.; TAKEUCHI, M. Learning to dynamically manipulate: A table tennis robot controls a ball and rallies with a human being. In Advances in robot control (pp. 337–341). Springer, 2005.

MÜLLING, K.;KOBER, J.; PETERS, J., A Biomimetic Approach to Robot Table Tennis, <http://www.kyb.tuebingen.mpg.de> accessed in March 2012.

University "Vasile Alecsandri" of Bacău, Romania
Marasesti 157 str., 600192
sochiana@yahoo.com

TECHNOLOGY FOR ACCURACY EVALUATION OF BEGGINER TABLE TENNIS PLAYER

ABSTRACT

The objective of this scientific investigation operate between March 2010-October 2011 -was to determine the possibility of using the table tennis robot and the contact sensors as a means of evaluating the precision, in order to transform them into a working tool for the researchers, teachers or coaches who need to identify and quantify these movement qualities. At this study was participate 63 subjects between 9-10 years old, from 6 tennis table associations from Romania. This study was coordinated by Faculty of Health, Sports and Movement Science. The accuracy level of the execution has been established by administrating a control test made up of 6 types of exercises (control of forehand and backhand stroke, play with forehand and backhand stroke and service); the processing of the data and the graphical display have been made on a Toshiba A2 notebook, using a data base similar to Excel. Besides the accuracy of information (the robot excludes the influence of the human factor), the system also offers the possibility of testing a large number of subjects in a relatively short period of time. The graphical display of the results in real time offers the possibility to correct and improve the weak parameters.

KEY WORD: technology, evaluation, tennis table

TECHNOLOGIE POUR L'ÉVALUATION DE L'EXACTITUDE JOUEURS DEBUTANT TENNIS DE TABLE

RÉSUMÉ

L'objectif de cette enquête scientifique menée entre Mars 2010 et Octobre 2011-était de déterminer la possibilité d'utiliser le robot de tennis de table et les capteurs de contact comme un moyen d'évaluer la précision, afin de les transformer en un outil de travail pour les chercheurs, enseignants ou les entraîneurs qui ont besoin d'identifier et de quantifier ces qualités de mouvement. Lors de cette étude 63 sujets de 9-10 ans ont été impliqués provenant, de 6 associations de tennis de table localisée en Roumanie. Cette étude a été coordonnée par la Faculté de Santé, des Sports et des Sciences du Mouvement. Le niveau de précision de l'exécution a été établi par l'administration d'un test de contrôle composé de 6 types d'exercices (contrôle de coup droit et en revers, jouer avec coup droit et en revers et services), le traitement des données et l'affichage graphique ont été effectuées sur un ordinateur portable Toshiba A2, en utilisant une base de données similaire à Excel. En plus de l'exactitude de l'information (le robot exclut l'influence du facteur humain), le système offre également la possibilité de tester un grand nombre de sujets dans une période de temps relativement courte. L'affichage graphique des résultats en temps réel offre la possibilité de corriger et d'améliorer les paramètres faibles.

MOTS-CLÉ: la technologie, l'évaluation, tennis de table

TECNOLOGÍA PARA EVALUAR LA PRECISIÓN DE JUGADORES PRINCIPIANTES EN TENIS DE MESA

RESUMEN

El objetivo de esta investigación realizada durante marzo de 2010 y octubre de 2011, fue determinar la posibilidad de utilizar el robot de tenis de mesa y los sensores de contacto como medio para evaluar la precisión, a fin de convertirlos en una herramienta de trabajo para los investigadores, profesores o entrenadores que necesitan identificar y cuantificar la calidad de los movimientos. En este estudio participaron un total de 63 sujetos con edades comprendidas entre los 9-10 años, de 6 federaciones de tenis de mesa de Rumanía. Este estudio fue coordinado por la Facultad de Salud, Deporte y Ciencias del Movimiento. El nivel de precisión de la ejecución se ha establecido mediante la administración de una prueba compuesta por 6 tipos de ejercicios (control de golpe de derecha y de revés, jugar con golpe de derecha y de revés y de servicios); el procesamiento de los datos y la visualización gráfica ha sido realizada con un ordenador portátil modelo Toshiba A2, usando una base de datos similar a Excel. Además de la precisión de la información (el robot excluye la influencia del factor humano), el sistema también ofrece la posibilidad de evaluar a un gran número de sujetos en un período relativamente corto de tiempo. La representación gráfica de los resultados en tiempo real ofrece la posibilidad de corregir y mejorar los parámetros más débiles.

PALABRAS CLAVE: tecnología, evaluación, tenis de mesa

TECNOLOGIA PARA AVALIAÇÃO DA PRECISÃO DE JOGADORES INICIANTES DE TÊNIS DE MESA

RESUMO

O objetivo desta investigação científica que teve início em março de 2010 e término em outubro de 2011 teve por determinar a possibilidade de utilizar o robô de tênis de mesa e os sensores de contato como um meio de avaliar a precisão, a fim de transformá-los em uma ferramenta de trabalho para pesquisadores, professores ou treinadores que precisam identificar e quantificar estas qualidades de movimento. Neste estudo participaram 63 atletas entre 9-10 anos de idade, de 6 associações de tênis de mesa diferentes da Romania. Este estudo foi coordenado pela Faculdade de saúde, esportes e ciência do movimento. Foi estabelecido o nível de precisão da execução por administração de um teste de controle composto de 6 tipos de exercícios (controle de golpe forehand e backhand, jogar com golpe de forehand e backhand e serviço); o processamento dos dados e a exibição gráfica foram feitas em um notebook Toshiba A2, usando uma base de dados semelhante ao Excel. Além da precisão das informações (o robô exclui a influência do fator humano), o sistema também oferece a possibilidade de testar um grande número de disciplinas em um período relativamente curto de tempo. A exibição gráfica dos resultados em tempo real oferece a possibilidade de corrigir e melhorar os parâmetros fracos.

PALAVRA CHAVE: Tecnologia, avaliação, Tênis de mesa.