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Source / Izvornik: **Acta kinesiologica, 2015, Vol. 9, 19 - 24**

Journal article, Published version

Rad u časopisu, Objavljena verzija rada (izdavačev PDF)

Permanent link / Trajna poveznica: <https://urn.nsk.hr/urn:nbn:hr:262:628755>

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Download date / Datum preuzimanja: **2025-02-02**



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DIFFERENCES IN TECHNICAL AND TACTICAL INDICATORS OF ATTACKS AND COUNTERATTACKS IN ELITE MALE KARATE FIGHTERS

Tihomir Vidranski¹, Franjo Maškarin² and Josefina Jukić³

¹ Faculty of Education, University of Josip Juraj Strossmayer, Osijek, Croatia

² Faculty of Kinesiology, University of Zagreb, Zagreb, Croatia

³ Faculty of Kinesiology, University of Split, Split, Croatia

Original scientific paper

Abstract

In this research we identified, registered and analyzed the specific technical and tactical structures of attacks and counterattacks in karate fights in order to test our hypothesis that karate fights are primarily won by using simple techniques. In order to attain the aforementioned goals we analyzed a sample of total 274 senior contesters in 137 karate fights, who are older than 18 years and who participated in the maximum of three fights during the 2008 World Karate Championships in Tokyo. The sample was described with 48 technical and tactical indicators of situational efficiency and fight outcome variables. The data were used to form an initial matrix (48 variables in 274 fights = 4642 derived data) where events in each variable (48 technical and tactical indicators) were defined as frequencies in which an individual fighter executed a marked or unmarked technique in attack or counterattack. Such data was used to derive variables for assessment of overall situational effect of karate practitioner during the fight and for the assessment of partial situational effects of technique. The obtained results indicate that the situational efficiency and obtained differences in technical and tactical fighting concept were influenced by quick techniques of low biomechanical requirements, that is, the aforementioned techniques were used by situationally better and more effective fighters as assets of tactical surprise for gaining advantage in the attack phase. Such results confirm our hypothesis that karate fights are won by using primarily techniques with low biomechanical requirements.

Key words: karate, combat sports, techniques, tactics, world championships

Introduction

The research of the structural analysis of karate, as the outset point of technical and tactical training, represents the scientific aspect of analysis of the functioning of the phenomena which pervade every level of sports activity. Situational efficiency regarding success in karate fights to a great degree depends on the ability to accomplish various structures of motion, in different manner and from variable distances. Consequently, there is a great necessity to identify the technical and tactical indicators (Olivia et al., 2002). There are few papers which describe factual indicators of technical and tactical fighter efficiency in situational conditions: Gužvica, 2001; Kapo et al., 2005; Villani 2004; Katić et al. 2005; Blažević et al., 2006; Doder et al. 2009, whereas only the reports conducted by Villani and Distaso 2004; Koropanovski and Jovanović 2007 and Koropanovski et al., 2008, that represent a more precise study of technical and tactical indicators, specifically of frequencies of marked techniques in a karate fight. The most recent research by Jovanović et al., 2010 makes inquiry into point differences between the techniques regarding the earlier and present rules of point scoring. The majority of studies in recent years suggest the mutual influence of scientific accomplishments and technical advancement in sports, which is a trend crucial for the development of elite sport. The high efficiency of this relation is defined by numerous components, where the factor of competitor efficiency analysis research represent the set of

variables which describe the factors of sport success in the most significant way. A karate fight can be observed as a complex dynamical system consisting of two fighters who have opposite interests and goals. The interests and goals of fighter "A" are the same as the interests and goals of fighter "B", although diametrically opposed. The fighter "A" is in the phase of the attack if they perform a technique before the fighter "B", who is in the phase of counterattack when they perform a technique as a reaction to the attack. The goal of the fighter in the attack phase is to score points using a performed technique, whereas the goal of the fighter in the counterattack phase is to prevent the fighter in the attack phase to realize the potentially valuable technique and to gain a favorable position to score points using their own performed technique. Therefore, a confrontation between two contesters in a karate fight can be observed as a complex dynamic system of encounter between two mutually opposed systems – two individuals or two teams. Both systems are determined by the contesters' level of ability, attributes and cognition, which are used to achieve the best possible result – victory. Prominent identifiable and recordable events occur during the encounter between the two contesters. Those events can disclose the levels of efficiency in both teams and individuals and reveal in which segments and elements of sports contest a particular team or an individual realize their advantage.

In other words, they can indicate the possible causes of the final result of the competition according to Dizdar (2001). The aim of this study is to prove the hypothesis that karate fights are primarily won by using simple techniques during the fight. To achieve this goal we will identify, register and analyze the specific technical and tactical structures of attack and counterattack on the high-quality sample, using the methodologically confirmed process (method) to estimate analyzed situational efficiency of karate practitioners for derived data for studies of situational efficiency of karate practitioners according to Sertić et al., 2011. In addition, the data obtained by this method can be utilized as outset hypotheses for modeling and analysis of technical and tactical fighting training.

Materials and Methods

Study Subjects

The sample was comprised of the total of 274 male competitors from 137 fights, seniors and older than 18 years, who participated at the 2008 World Karate Championship in Tokyo, Japan. The contestants were participants of the competition from 97 countries from five continents (Africa, America, Asia, Australia and Europe).

Table 1 Display of the fights structures by weight cathegory

| Category | Total fights in cathegory | Number of fights observed | % |
|----------|---------------------------|---------------------------|-------|
| -60 | 52 | 36 | 69,25 |
| -65 | 61 | 40 | 65,57 |
| -70 | 68 | 47 | 69,11 |
| -75 | 70 | 43 | 61,42 |
| -80 | 65 | 46 | 70,76 |
| +80 | 61 | 46 | 75,40 |
| OPEN | 78 | 16 | 20,51 |

Table 2 Display of the fight structures in competition phases

| Category | 1st round | 2nd round | 3rd round | Semi-finals | Finals |
|----------|-----------|-----------|-----------|-------------|--------|
| -60 | 17 | 12 | 4 | 2 | 1 |
| -65 | 19 | 14 | 4 | 2 | 1 |
| -70 | 22 | 18 | 4 | 2 | 1 |
| -75 | 20 | 17 | 3 | 2 | 1 |
| -80 | 21 | 19 | 4 | 1 | 1 |
| +80 | 21 | 18 | 4 | 2 | 1 |
| OPEN | 7 | 4 | 2 | 2 | 1 |

The sample variables in this study were: 12 descriptive technique and tactics variables divided into individual non-scoring attack techniques ("TEH"nn), individual scoring attack techniques ("TEH"bn), individual non-scoring counterattack techniques ("TEH"nk) and individual scoring counterattack techniques ("TEH"bk). Kizame tsuki (KT_nn, KT_bn, KT_nk, KT_bk), Gyaku tsuki jodan (GYJ_nn, GYJ_bn, GYJ_nk, GYJ_bk), Gyaku tsuki chudan (GYC_nn, GYC_bn, GYC_nk, GYC_bk), Mawashi geri chudan (MWC_nn, MWC_bn, MWC_nk, MWC_bk), Ashi mawashi geri chudan (AMWC_nn, AMWC_bn, AMWC_nk, AMWC_bk), Mawashi geri jodan (MWJ_nn, MWJ_bn, MWJ_nk,

MWJ_bk), Ashi mawashi geri jodan (AMWJ_nn, AMWJ_bn, AMWJ_nk, AMWJ_bk), Ura mawashi geri jodan (UMWJ_nn, UMWJ_bn, UMWJ_nk, UMWJ_bk), Ashi uramawashi ger ijodan (AUMWJ_nn, AUMWJ_bn, AUMWJ_nk, AUMWJ_bk), Ushiro mawashi geri jodan (UMWJ -nn, UMWJ_bn, UMWJ_nk ,UMWJ_bk), Nagewaza-tsuki (NWTs_nn, NWT_bn, NWT_nk, NWT_bk). Other techniques (OT_nn, OT_bn, OT_nk, OT_bk), Descriptive variables of the contest outcome: win(PJ) and loss(PZ).

Data analysis

The data was extracted through analysis of video camera records of 274 karate combats which took place during the 2008 World Karate Championship in Tokyo. The data was calculated by trained and experienced measurers from Combat Sports Department of University of Zagreb Faculty of Kinesiology. The analysis observed the frequencies of 12 techniques in order to estimate the individual indicators of technical and tactical activities which were further recalculated as indicators of situational efficiency technique and overall situational efficiency during the fight.

The derived data used to estimate the impact of situational efficiency of karate athletes was based on the initial data matrix. For the purposes of calculation each of the two stages of the karate sports fight (attack and counterattack) had been given the numerical ratio scale values, which were later used for statistical analysis. The method of objective assessment of situational effect of karate athletes through technical and tactical situational efficiency indicators was calculation through Spearman's rank correlation coefficient (r=0,60, p=0,05) between variables PJ-PZ (win-loss) and UK_SE (total situational efficiency in a fight) for groups of winners and defeated candidates.

The difference between the situational efficiency of particular attack and counterattack techniques were calculated using Wilcoxon statistically significant difference test. The normal distribution of variables was tested using Kolmogorov-Smirnov test for the results obtained in the basic variables of situational efficiency. The registration of situational indicators was implemented using a specialized software package DARTFISH 4.5.2.0. The data were tested and loaded into a statistical data program Statistics 7 (StatSoft, Inc., Tulsa, USA).

Results

Table 3 denotes the results of Wilcoxon statistically significant difference test between situational efficiency of certain attack and counterattack techniques. It is noticeable that four out of ten observed variables display a statistically significant difference (p<,01) in technical and tactical attack and counterattack phases. Respective are the variables of situational efficiency techniques: SE_KT (kizame tsuki), SE_GYJ (gyaku tsuki jodan), SE_GYC (gyaku tsuki chudan) and SE_MWC (mawashi geri chudan).

Table 3 The results of Wilcoxon test of statistically significant difference between situational efficiency of certain techniques of attack and counterattack

| variable | \bar{x} ranks | | T | z | p | $z/\sqrt{2n}$ |
|----------|-----------------|---------------|------|------|------|---------------|
| | attack | counterattack | | | | |
| SE_KT | 293 | 260 | 338 | 3,20 | 0,00 | 0,19 |
| SE_GYJ | 294 | 259 | 1733 | 3,48 | 0,00 | 0,21 |
| SE_GYC | 293 | 260 | 1831 | 2,66 | 0,01 | 0,16 |
| SE_MWC | 284 | 269 | 37 | 2,54 | 0,01 | 0,15 |
| SE_MWJ | 277 | 276 | 14 | 0,08 | 0,93 | 0,01 |
| SE_AMWJ | 277 | 276 | 3 | 0,00 | 1,00 | 0,00 |
| SE_UMWJ | 278 | 275 | 10 | 0,76 | 0,45 | 0,05 |
| SE_AUMWJ | 278 | 275 | 4 | 1,08 | 0,28 | 0,06 |
| SE_NWT | 275 | 278 | 11 | 1,68 | 0,09 | 0,10 |
| SE_OT | 276 | 277 | - | - | - | 0,00 |

(\bar{x} ranks—arithmetic mean of ranks, T – T Wilcoxon equivalent pair test value, z – calculated value of Wilcoxon equivalent pair test, p – minimal margin of error for determining statistically significant difference between arithmetic rank of means, $(z / \sqrt{2n})$ – relative effect size (0 denotes minimal difference between the groups))

Table 4 Total display of frequency and proportion (%) scored in the marked and unmarked techniques of attack and counterattack

| TECHNIQUES | MARKED | | | | UNMARKED | | | |
|-------------------------------------|-----------|-------|-------------------------|-------|-----------|-------|-------------------------|-------|
| | A T A C K | | C A U N T E R A T A C K | | A T A C K | | C A U N T E R A T A C K | |
| | FREQ | % | FREQ | % | FREQ | % | FREQ | % |
| KT – kizame tsuki | 48 | 16,1 | 15 | 11,45 | 692 | 24,52 | 194 | 14,42 |
| GYJ – gyaku tsuki jodan | 111 | 37,24 | 55 | 41,98 | 695 | 24,62 | 570 | 42,37 |
| GYC – gyaku tsuki chudan | 98 | 32,8 | 44 | 33,58 | 639 | 22,64 | 387 | 28,77 |
| MWJ – mawashi geri jodan | 4 | 1,34 | 3 | 2,29 | 90 | 3,18 | 9 | 0,66 |
| MWC – mawashi geri chudan | 21 | 7,04 | 2 | 1,52 | 239 | 8,46 | 42 | 3,12 |
| AMWJ – ashi mawashi geri jodan | 2 | 0,67 | 1 | 0,67 | 0 | 0 | 16 | 1,18 |
| AMWC – ashi mawashi geri chudan | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0,37 |
| UMWJ – ura mawashi geri jodan | 5 | 1,67 | 2 | 1,52 | 35 | 1,24 | 6 | 0,44 |
| AUMWJ – ashi ura mawashi geri jodan | 4 | 1,34 | 1 | 0,67 | 71 | 2,51 | 19 | 1,41 |
| NWT – nage waza tsuki | 4 | 1,34 | 7 | 5,34 | 176 | 6,23 | 85 | 6,31 |
| RT- remaining techniques | 1 | 0,33 | 1 | 0,67 | 29 | 1,02 | 8 | 0,59 |

Derived variables of situational efficiency of techniques which do not exhibit statistically significant difference in technical and tactical phase of attack and counterattack are: SE_MWJ (mawashigerijodan), SE_AMWJ (ashi mawashi geri jodan), SE_UMWJ (ura mawashi geri jodan), SE_AUMWJ (ashi ura mawashi geri jodan) and SE_OT (other techniques). The maximum difference between the variables of attack and counterattack are denoted by the value of relative effect size ($z / \sqrt{2n}$). According to the listed relative value effect 0 represents the minimal difference between the derived variables of situational efficiency of techniques realized in attack and counterattack. Based on these indicators we can notice that the variable SE_GYJ (gyaku tsuki jodan) with the relative value of effect of 0,21 on the level of statistical significance $p < ,01$ differs the technical and tactical concepts of attack and counterattack to the highest degree. When compared to the research (Vidranski 2010) we can notice the differences in arithmetic means of situational efficiency of variable SE_GYJ (gyaku tsuki jodan) realized in attack and counterattack. The derived variable of situational efficiency SE_GYJbn (gyaku tsuki jodan – attack) has a higher value of arithmetic mean, which amounts to 4,35, whilst the variable SE_GYJbk (gyaku tsuki jodan –

counterattack) has a lower value of arithmetic mean of situational efficiency which amounts to 2,33. The values of the afore-mentioned arithmetic means reflect in the higher arithmetic mean of ranks of the SE_GYJ (gyaku tsuki jodan) variable realized in the attack (294) as opposed to the arithmetic mean of counterattack which is lower (259). Thereby it can be noticed that the fighters achieved higher values of situational efficiency by executing the gyaku tsuki jodan technique in technical and tactical attack phase as opposed to the counterattack phase and thus generated higher values of the arithmetic means of ranks which is higher in the attack phase. As mentioned above, the higher situational efficiency of gyaku tsuki jodan technique in the attack phase can be explained through the fighting concept of the elite contesters, that is to say, the elite contesters frequently take initiative in a fight in order to realize their advantage early on and to finish the fight in their favor. Assuming the initiative in a fight implies the execution of a technique as an attack feature in a time period before the opponent's technique. According to the existing research (Vidranski, 2010) it is known that higher ranking contesters (victors) attain a higher degree of situational efficiency in techniques realized predominately in the attack phase.

In accordance with (Vidranski, 2010) the point valued technique of gyaku tsuki jodan in attack phase (GYJbn) with frequency of 111 repetitions accounts for 25,87% of total point valued techniques in 274 fights. Such structure makes it the most frequent point valued technique in a karate fight in technical and tactical attack phase. The same gyaku tsuki jodan technique in the counterattack phase (GYJbn) with frequency of 55 repetitions accounts for 12,82% of total point valued techniques which makes it the third most frequent point valued technique and the most frequent point valued counterattack technique. From the observed data we can conclude that the initiative of the more skillful competitors and high frequency in a fight make gyaku tsuki jodan technique more effective in the technical and tactical attack phase as opposed to the counterattack phase. In the second place with statistically significant difference $p < ,01$ and relative effect size ($z / \sqrt{2n}$) of 0,19 between technical and tactical attack and counterattack phase is the situational efficiency of SE_KT (kizame tsuki) technique. The value of arithmetic mean of situational efficiency of SE_KT (kizame tsuki) technique is higher in technical and tactical attack phase (Vidranski, 2010). According to the referenced study we can conclude that the more skilled competitors and contest victors attained an overall higher value of arithmetic mean of situational efficiency of SE_KT (kizame tsuki) technique in the attack phase. Therefore we can conclude that the more skilled contesters employed the kizame tsuki technique in order to obtain initiative in a fight and therefore attained the higher situational efficiency in the attack phase. Beside this reasoning kizame tsuki technique is frequently used because of its low degree of biomechanical complexity and minimal amplitude demands in point scoring. The aforementioned characteristics make it the prime technique for opponent surprisal and point scoring in the attack phase. All of the observed qualities of kizame tsuki technique were emphasized during the high-stake competition where the elite contesters utilized their skills to obtain initiative and ensure dominant position in a fight by point acquisition in the attack phase. In addition, a higher situational efficiency was attained using the kizame tsuki technique in technical and tactical attack phase, which accounts for obtained values of statistically significant differences. In the third place with the statistically significant difference $p < ,01$ and relative effect size ($z / \sqrt{2n}$) of 0,16 between technical and tactical phases of attack and counterattack is the situational efficiency of SE_GYC (gyaku tsuki chudan) technique. The values of arithmetic means of situational efficiency of SE_GYC (gyaku tsuki chudan) technique are higher in technical and tactical attack phase (Vidranski, 2010). According to Table 3 it can be noticed that the more skillful competitors and contest winners attained higher values of arithmetic means of situational efficiency of SE_GYC (gyaku tsuki chudan) technique in the attack phase. Concurrently, it can be noticed that the group of victorious contesters differed the most

from the group of defeated contesters in situational efficiency of this technique. Thereby it can be concluded that the more skilled contesters employed gyaku tsuki chudan technique in order to obtain initiative in a fight and thus attained a higher situational efficiency in attack phase in such way. In addition to the aforementioned reasons, gyaku tsuki chudan technique is frequently used in the attack as a second choice technique in composite combinations. The reasons for such classification are: low biomechanical complexity and transition of the point scoring zone to the body. In reality, the attack is generally commenced by executing a technique in the point scoring zone of the head (jodan technique). The point scoring zone is subsequently transited and a technique is executed in the point scoring zone of the body (chudan technique). These exact characteristics make gyaku tsuki chudan technique the second most effective technique for opponent surprisal and point scoring in the attack phase (Vidranski, 2010).

All of the aforementioned advantages of the technique were emphasized during the high-stake competition where the elite contesters utilized their skills in order to obtain initiative and ensure dominant position in a fight by point scoring in the attack phase. Concurrently, a higher situational efficiency of gyaku tsuki chudan technique in technical and tactical phase of attack was obtained, which accounts for the resulting statistically significant difference. In the final, fourth place, with the statistically significant difference $p < ,01$ and relevant effect size ($z / \sqrt{2n}$) of 0,15 between technical and tactical attack and counterattack phase is situational efficiency of foot technique SE_MWC (mawashi geri chudan). The values of arithmetic mean of situational efficiency of SE_MWC (mawashi geri chudan) are significantly higher in technical and tactical attack phase (Vidranski 2010). According to the aforementioned study, it can be concluded that the more skilled contenders and victors of the contests attained higher values of arithmetic means of situational efficiency of SE_MWC (mawashi geri chudan) technique in the attack phase. It can also be noticed that the group of victorious contesters differed the most from the group of defeated contesters in the situational efficiency of the mentioned footwork technique. It can be concluded that the winners of the contests execute complex and demanding techniques, whereas the contesters who are motorically inferior to their opponents cannot execute those techniques. It can be recapitulated that the more skilled contesters employed foot technique mawashi geri chudan technique in order to obtain initiative in a fight and in such a way attain higher situational efficiency in the attack phase. In addition to aforementioned reasons mawashi geri chudan technique is frequently used as a second and third choice technique in composite combinations. The reasons for such classification are: the lowest biomechanical complexity among all of the observed foot techniques and transfer of point scoring zone to body. In reality, the attack is generally commenced

by executing a technique in the point scoring zone of the head (jodan technique). The point scoring zone is subsequently transited and a technique is executed in the point scoring zone of the body (chudan technique). Foot technique mawashi geri chudan is frequently executed in the attack phase as a second choice technique after the jodan technique kizame tsuki. These characteristics make mawashi geri chudan technique on the third place out of all observed techniques for technique for effective opponent surprisal and point acquisition in the attack phase (Vidranski 2010). Aforementioned advantages of the technique were emphasized during the high-stake competition where the elite contesters utilized their skills to obtain initiative and to ensure dominant position in a fight by point scoring in the attack phase. Higher situational efficiency was attained using the mawashi geri chudan technique in technical and tactical attack phase, which accounts for obtained values of statistically significant differences. The other observed variables did not indicate statistically significant difference in situational efficiency of attack and counterattack phases.

Conclusion

Situational efficiency and derived differences in technical and tactical concept of fighting were mostly influenced by quick techniques with low biomechanical demands. The mentioned techniques were used by situationally more efficient and skilled

fighters as an instrument of tactical surprise in order to attain advantage in a fight during the attack phase. The issue occurs whether it is justified to use techniques that are biomechanically simpler, such as ippon and nihon techniques, in order to gain advantage in a contest. Are the mentioned techniques truly situationally more effective when scoring points during the attack phase or is the lower level of the training process in elite karate the reason behind less frequent use of higher scoring techniques (sanbon techniques)?

The execution of those techniques in the attack phase implies the highest level of muscle automatization, along with the sports preparation technology. The aforementioned facts can still be observed in a theoretical manner, whereas their empirical confirmation can only be established once the three point techniques become more represented in contests. The 2008 change in karate rules which increases the time period of fights by 60 seconds creates the possibility of a greater risk at the earlier points in a fight, which in turn increases the potential usefulness of sanbon techniques. The mentioned variables SE_KT (kizame tsuki), SE_GYJ (gyaku tsuki jodan), SE_GYC (gyaku tsuki chudan) and SE_MWC (mawashi geri chudan) display statistically significant difference in technical and tactical concepts of attack and counterattack, and are situationally more efficient and usually employed by more skillful fighters.

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RAZLIKE U TEHNIČKIM I TAKTIČKIM POKAZATELJIMA NAPADA I PROTUUDARA KOD ELITNIH MUŠKIH KARATE BORACA

Sažetak

U ovom istraživanju smo identificirali, registrirali i analizirali posebne tehničke i taktičke strukture napada i protuudara u karate borbama kako bi testirali hipotezu da se karate borbe prvenstveno osvajaju pomoću jednostavne tehnike. Kako bi se postigli gore navedene ciljeve analizirali smo uzorak od ukupno 274 seniorska natjecatelja u 137 karate borbi, koji su stariji od 18 godina, a koji su sudjelovali u najviše tri borbe tijekom Svjetskog karate prvenstvu u Tokiju 2008. Uzorak je opisan sa 48 tehničkih i taktičkih pokazatelja situacijske učinkovitosti i borbenim varijablama. Podaci korišteni su za formiranje početne matrice (48 varijable u 274 borbi = 4642 izvedena podatka), gdje su događaji za svaku varijablu (48 tehničkih i taktičkih pokazatelji) definirani kao frekvencije u kojima je pojedini borac izvršio registriranu ili neregistriranu tehniku u napadu ili protunapadu. Takvi podaci su upotrijebljeni za dobivanje varijable za procjenu ukupne situacijske učinkovitosti karate prakse u borbi i za procjenu situacijskih parcijalnih efekata tehnike. Dobiveni rezultati pokazuju da situacijske učinkovitosti i dobivene razlike u tehničkim i taktičkim konceptom borbe su pod utjecajem brzih tehnike, niskih biomehaničkih zahtjeva. Spomenute tehnike su korištene od situacijski boljih i učinkovitijih boraca kao inventor za taktičko iznenađenje za stjecanje prednosti u fazi napada. Takvi rezultati potvrđuju našu hipotezu da se karate borbe osvajaju ponajprije pomoću tehnika s niskim biomehaničkih zahtjevima.

Ključne riječi: karate, borilački sportovi, tehnike, taktika, svjetsko prvenstvo

Received: November 21, 2014

Accepted: May 10, 2015

Correspondence to:

Assist.Prof.Tihomir Vidranski, PhD

University of Josip Juraj Strossmayer

Faculty of Education

31000 Osijek, Ul. cara Hadrijana 10, Croatia

Phone: 00385 (0)99 499 9903

E-mail: tvidranski@foozos.hr