USING OF VIDEOANALYSIS IN DIDACTICS TO IMPROVE MOTOR LEARNING, SKILLS AND TACTICS IN WATER SPORTS

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Abstract
This study applies video analysis to assess performances in water sport; it focuses on the whole phenomenon carrying out some aspects. It is evaluated by quantitative data for biomechanics and bioenergetics and qualitative data related single performance to evaluate specific indicators and descriptors. The aim is to take in relationship quantitative data and qualitative one. The theoretical and argumentive method is applied to each single experimental study. Water polo study evaluates the correlation between tactics scheme and outcome and the correlation between swimming velocity ball handling and without ball in different athlete types. The cliff diving (that means diving from 28 meters with speed 24 m/s) study evaluates the correlation between water biomechanics impact and technical model. The synchronized swimming study evaluates correlation between biomechanical aspects of technical elements and score indicators and descriptors. The swimming study evaluates the correlation between morphological diseases and pains in water polo athletes. Investigation of water sports utilizes ecological and integrated method that joins qualitative and quantitative aspects, so that new technologies could be integrated to address the use of technical instruments to obtain a global vision of sport performance to help the coaches in monitoring and assessment.

Key words: *assessment, evaluation, qualitative and quantitative data.*

Introduction

The advent of new technologies evaluation in sports, focuses the research's attention to study of the "special", that has given something unknown until now. The performance analysis is divided into two broad categories: the biomechanical analysis, which observes and studies the technical gesture of a sport and notational analysis, which categorizes and analyzes the events of a race. (Raiola, 2012). Between these two categories, the second one is applicable to all the team and individual sports that involve the opposition between adversaries and it is a great benefit both to assess the performance of the athletes, both for the work of the referees and judges, the biomechanics analysis is rather characteristic of all sports in which the competition is conducted individually by an athlete or group of athletes whose result will be expressed in a response or in a lap mark awarded by judges. Both types of analysis are based on observation and then tied to a tool for visual recovery. Even in natatorium sports the use of video analysis is increasingly developed. Both types of analysis are based on observation and then tied to a tool for visual recovery. The aim is to compare the two techniques of analysis in natatorium sports. As for water polo, we have made two tactical researches on the analysis of a water polo women's team participating in the Italian Championship A1 League. In this study, through the use of Dartfish software and Kinovea, it is evaluated the impact of the application on the outcome of tactical performances. In fact were analyzed all the game phases in numerical superiority of the examined team to highlight the correlation between the model of expected schema, its right application and the incidence of realization. The labeling system analysis "step by step" allowed us to analyze the video of the race in all its singular moments. Furthermore, through the use of video analysis it has been studied the incidence of transport of the ball in swimming water polo. By observing individual frames we have analyzed and calculated the angle of the stroke for each single swimming player, comparing the two different swims with and without the ball.

Water polo tactical
In water polo lacks a codified methodology for tactics training, which is only left to coach's discretion. This work represents an attempt to develop methods and consequential tools to analyze, and then train, tactical water polo side, knowing that

- "the coaches of team sports analyze matches and performances of team and opposing teams to get useful data in coaching"(Hughes, Franks, 2008)
- "currently, the process of training, its organization, and teaching methodology need more knowledge on the qualitative aspects of sports performance" (Schmidt, Wrisberg, 2008)

During the season 2011/2012 (Italian female A1 League), nine women water polo matches, have been analyzed by a water polo coach, helped by a statistician and a performance analyst. The purpose of the analysis process was to identify single events during the matches, to examine the tactical pattern implemented in this events, to obtain by the coach an evaluation on tactical pattern compliance and then to put this compliance in relation to event's outcome. Aim of the work is to verify the efficacy of different attack patterns, when they were well-performed, in order to create a codified methodology for teaching water polo through tactics. The collected data via Dartfish TeamProSoftware, were analyzed trough a "Water polo Tactics Analyzer" software, developed as a web-based application at University of Salerno and released under GPL license, that has returned basic descriptive statistics and the correlation coefficient of each pattern with events outcomes. The results show a positive and statistically significant correlation coefficient between tactical compliance and events outcome, and highlight the need of developing a common methodology for teaching water polo through tactics and it confirms once again that "the practical value of performance analysis is that well-chosen performance indicators highlight good and bad techniques or team performances" (Hughes, 2008).

The research has an integrated approach and it consists of 3 distinct methods:

- case study (9 matches of the Italian A1 League Women's Championship, season 2011/2012, played by the Volturnos.c.) for the analysis of matches,
- action research method for coach contribution,
- and theoretical-argumentative method to deduce a theoretical framework in which define the processing data.

The matches were examined by the research team with Dartfish TeamPro, isolating each single keyframe related to attack events and identifying the implemented attack pattern, then the coach expressed an evaluation on attack pattern compliance. The assessment of compliance for tactical patterns is entrusted to the coach, based on the video analysis-aided confrontation of pattern attack design against pattern attack effectively implemented during match. This data sheet is processed through the "water polo Tactics analyzer software", that produces basic descriptive statistics and the correlation coefficient of each well-implemented pattern attack with events outcomes. Were analyzed in total 7 attack patterns on 73 events during 9 matches. The analyzer software output was discussed by the research team, with consciousness of internal validity.

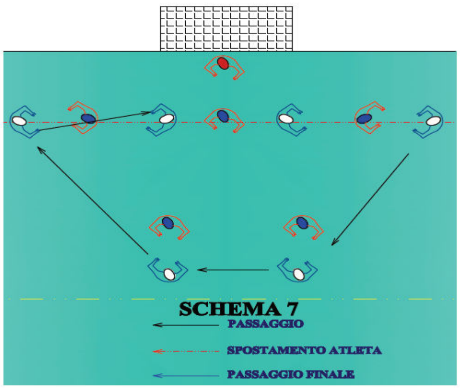


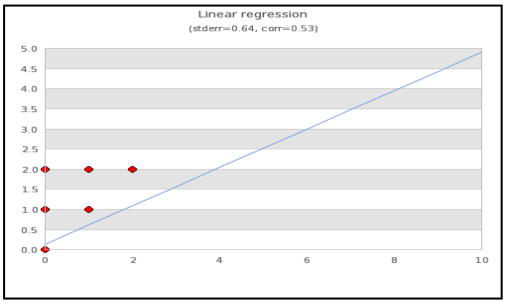
Figure 1. Example pattern- schema 7

Picture 1. Scheme 7

An evaluation table was constructed by combining, for each single event, the coach Boolean evaluation on the compliance of patterns with the event final outcome. Here are reported comparisons of pattern design with Dartfish screenshot of pattern implemented during the game; basic descriptive statistics (occurrence of single patterns on total events, occurrence of "well-performed pattern" on total events, etc…); a linear regression scatter plot for single patterns; acomparison between correlation coefficients of single patterns, only referred to "well-performed" patterns. (Tursi et al, 2013a)

Table 1. Report Scheme 1

Scheme_1			
Match	Total occurrence	Wellperformed	goals
volturno vs orizzonte ct	2	1	0
volturno vs fiorentina fi	0	0	0
volturno vs ortigasr	3	2	1
volturno vs firenzepn	2	2	2
volturno vs padova	1	0	0
volturno vs messina	1	1	1
volturno vs imperia	2	1	1
volturno vs pro recco	2	2	0
volturno vs bologna	2	1	1



Graph 1. Linear Regression scheme 1

Water polo incidence ball

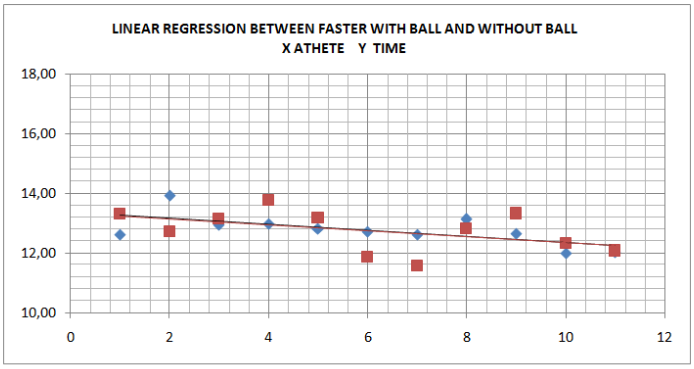
The purpose of this study is to verify the incidence of ball handling in swimming intensity in water polo, in order to obtain useful indication in coaching. The integrated research method consists in action research for coach contribution by training and evaluation, and theoretical-argumentative to deduce a framework in which define the processing data. Eleven, well-trained and competitive athletes were recruited and asked to swim 5 x 20-m, one time with ball, and one time without ball.

This test was repeated three times. For each swimmer was calculated the mean and the standard error of times per test, both with and without the ball. Analysis was conducted individually for each athlete, and in total for each test.

The results, compared means of times, reveals a high variability, and it indicates a no-mechanical incidence of ball handling on swimming intensity. Reading these results in correlation to athletes anamnesis it reveals that the incidence of ball-handling is significant in athletes who have a swimming-oriented athletic history only, but there are not significant differences in times for athletes who have a water polo oriented athletic history.

The results show how this study can help the coach to train the team to improve the analyzed skills in different mode, creating a methodological system training to enhance the performance. Coaches are suggested to carefully monitor swimming rhythm during trials, and to increment ball-handling in every training condition. Eleven well-trained competitive athletes were recruited and asked to swim the test of the 300 fastest (15 reps of 20 meters), one time with ball, and one time without ball. For each swimmer was calculated the mean and standard error of times per test, both with and without the ball.

Analysis was conducted individually for each athlete, and in total for each test. All performances were recorded and analyzed by Kinovea to detect corners and extensions of strokes. The data Analysis collected shows that the thehighest level water polo players (Starace and Valkai) do not have significant changes in chronometric. Instead, for the athletes coming from competitive swimming (Guillet and Giuliani), ball-handling has a clear and negative impact on swimming development. For the athletes coming from water polo (Anastasio, Pellegrino), ball-handling affects swimming times in a positive way (results indicate fastest times in the tests carried out with the ball). For the other athletes the results do not show significant changes. The results show that this study will help the coach to develop a training methodology effectively in improving performance. Coaches are suggested to increase the use of ball-handling in all conditions of training. (Tursi et al, 2013b, Gaetano et al. 2015, Raiola, Tafuri, 2015).



Graph 2. Linear regression

Table 2. Linear regression

ATHLETE	VEL CP	VEL SP	XY	X2	Y2	Y'	e	e^2	(Y-M)^2
ANASTASIO	**12,61**	**13,31**	167,8391	159,0121	177,16	39,26908	-25,96	673,874	0,338512
CIAMPICHETTI	**13,93**	**12,71**	177,0503	194,0449	161,54	43,37972	-30,67	940,632	0,000331
CICCARIELLO	**12,94**	**13,13**	169,9022	167,4436	172,40	40,29674	-27,17	738,0319	0,161458
DE SIMONE	**12,98**	**13,75**	178,475	168,4804	189,06	40,42131	-26,67	711,3587	1,044112
DI MONACO	**12,80**	**13,18**	168,704	163,84	173,71	39,86077	-26,68	711,8633	0,20414
GIULIANI	**12,70**	**11,87**	150,749	161,29	140,90	39,54935	-27,68	766,1466	0,736476
GUILLET	**12,61**	**11,56**	145,7716	159,0121	133,63	39,26908	-27,71	767,7933	1,364649
MASCIANDARO	**13,12**	**12,80**	167,936	172,1344	163,84	40,85729	-28,06	787,2112	0,005158
PELLEGRINO	**12,64**	**13,32**	168,3648	159,7696	177,42	39,36251	-26,04	678,2121	0,350249
STARACE	**11,99**	**12,31**	147,5969	143,7601	151,54	37,33833	-25,03	626,4171	0,174876
VALKAI	**12,02**	**12,07**	145,0814	144,4804	145,68	37,43175	-25,36	643,2184	0,433203
SOMMA	**140,34**	**140,01**	**1787,47**	**1793,268**	**1786,886**			**8044,759**	**4,813164**
MEDIA	**12,76**	**12,73**							
						X2	VARIABLE SQUARE X		
	B	0,4299954		r^2	-1670,41	Y2	VARIABLE SQUARE Y		
	A	7,242222				Y'	VALUATION OF X		
		r2=	-1670,4			e	DIFFERENCES BETWEEN THE Y VALUE OBSERVED WITH THE REGRESSIONE PARAMETERS Y'		
	slope	**= b =**	**0,43**			e^2	SUM OF ERRORS SQUARED		
	intercept	**= a =**	**7,24**			(Y-M)^2	EXPLAINED PROPORTION OF VARIANCE		

Water polo: postural effect
The study examines the postural effects on wellness and the performance of fourteen professional female water polo athletes. There are no written studies on water polo, probably because it is assumed that there is no pain because ofArchimedes's formula that opposes the force of gravity. Currently athletes carry out exercises to compensate and to avoid any eventual pain that then disappears when they are out ofwater according to motor control and learning theory (Raiola, 2012). The aim is to understand the phenomenon in professional athletes using a tridimensional analysis of the surface of the torso and the baropodometric platform. It consists in examining the "3D" surface of the torso of fourteen professional water polo athletes, participants in the Italian Championship in the A1 league, and the data of the baropodometric platform. This data highlights curves that will be considered with regards to athletic performance and well being. The data of performance andwell being of the athletes iscollected by a trainer for every single athlete.The study was carried out at the specialized center CORPORA of Gricignano (CE) with the following apparatus: "FormetricSpinometer".

This allows the morphological 3D image of the torso, with extreme accuracy (error below 0,2 mm), speed, and safety thanks to the radiation free equipment. The postural Formetric check-up supplies a series of indicators which together give a detailed evaluation of the subject's posture. For each athlete a synthesis chart was elaborated, showing a 3D reconstruction of the surface of the torso and the detection of specific postural parameters with the data collected by the trainers on the athlete's performance and well being. This data was elaborated using a statistic model of linear regression. The evaluation of the data shows no existing correlation between cases with pseudo pathological curves and their state of well being and performance. While athletes with a near perfect exam often complained about occasional pain. There is a paradox regarding affection, performance and pain; in some cases it is low, while in some cases, it is the opposite. The results of the Archimedes's principle and the force of gravity probably produce physiological adjustments in water.

Impact in high diving
A high diving can be considered as free falls in water, it is (interesting) important to know the design limitations of the human body and to understand the load supported by people during water impact in order to investigate the consequence on the body structure. Studies on the water impact have been conducted to identify the load supported by aeronautical or space structure caused by impact with and detachment from the water surface and to develop the system to assure people survival condition. The aim of this analysis is to determine the maximum impacting load in high diving by analytical formulas. The studies developed in the aeronautical field on water impact have been considered. The human body has been simulated by a cylinder with a mass of 80 Kg and 1,71 m height. Velocity in free fall is calculated as $v=\sqrt{(2*g*h)}$, without considering drag effects. During the water impact the feet-first body (cylindrical) orientation has been considered. Under the water surface the acting forces between body and water have been calculated by the application of momentum theorem. The results have been compared with those obtained using the formula in ref (Von Karman, 1929) for "Flat-Bottomed Float", with little differences. The results show a maximum force of 26891,57 [N] during dt = 0,001s from a 28 m diving height. This maximum force obtained by the current calculation appears rather high and needs to be further evaluated. Nonetheless, the current calculation with an impact velocity of 9,14 m/s ref confirms the loads of 500g reported in ref.

An injury in a crash is the result of human response to force application to the body. Force and acceleration are vector quantities comprising both magnitude and direction. This is (far forma) not a simple question (to answer) and depends on a number of interrelated and variable conditions. These incidents may provide valid data. Some cases of voluntary and involuntary free-fall have been documented and studied. In order to calculate the load supported by a diver, the body has been considered as an elementary structure: a cylinder. The cliff is divided in two steps, the first one is when the cylinder falls in the air and the second when the cylinder has an interaction with water. Ii has been considered the normal diving condition: during the water impact the feet-first body orientation, and the perpendicularity between the cylindrical axisis and the water line.

Tolerance abrupt acceleration:
In general, human tolerance to acceleration is a function of the following extrinsic factors:

1) Magnitude of the acceleration
Clearly, the higher the acceleration is, the more likely it can cause injury.
2) Direction of acceleration
- Duraction of accelleration
- Ipothesis:
  Diver body = cylinder
  H_c= 1,71m
  M_b = 80 (Kg)

S_0 = 0,056 m^2 (flat-foot position)
H_d = 28 (m)
v_d= 0 (m/s)
body impact position = feet-first
α = 90°

3) Impact velocity:
For impact velocity calculation it has been considered only the gravity acceleration, without considering drag effects.

$E_p = M_b *g* H_d$
$E_k =1/2\ M_b *v^2$

at t_0

$v_0 = \sqrt{(2*g* H_d)} = \sqrt{(2*9,81*28)} = 23,43$ m/s.

In literature [Neverthless], as reported studies in the impact velocity in the free fall from Golden Gate Bridge at San Francisco was in a range closely 37.19 – 38.04 m/s (with H_d about 61m) and using the aerodynamic drag correction of Conter[a] and Earley [b], these velocities were calculated to range closely between 32.92-33.53 m/s. Snyder [1967] consider that the calculated values used in the study of the voluntary and involuntary free-fall are lower, but more realistic than that provided by standard formula (3), it must be considered that these injury tests and calculations have shown that clothing such as jackets or skirts do provide an additional drag.

4) Force evaluation - Force is calculated by application of the momentum theorem [Von Karman]. The body movement in water is not a stationary condition and it has been considered that for each dt there are interaction between the mass of water involved and body. We have only considered that the body changes the mass water condition: from static condition to a movement.

$F * dt= M_b * dv$
$F= M_b * (v_{t-1-}v_t)/dt$ (*)

The original momentum of the body is assumed to be distributed between the body and the water during the impact [9].

$M_b v_{t-1}= v_{t*}(M_b + M_w)$

The M_w ,involed in the process at t time, is calculated, vs. y_t

$$M_w= y_t *S_0* \rho_w$$

$$v_t = v_{t-1} + a_b *dt$$

$$z_t -z_{t-1} = v_{t-1} + a_b *dt.$$

Considerations on the acceleration
When I cover is in free fall acceleration of gravity acts in the air. When the water enters, the reaction force on the body, given by the mass of water that passes from the state of rest to the speed impressed by the body (calculated with the theorem of momentum), provides an acceleration of negative sign on the body (the negative sign is due to the force which tends to brake the body). We call it the balance between the two inertial accelerations. When the body begins to dive, because of the force that pushes it downwards, we must consider the effect of the reaction of the buoyancy force, which tends to oppose the downward thrust. The instant dt, the body enters a certain amount of volume, which moves the equivalent mass of water: Water volume * density water = Kg mass of water displaced. The budget is one of the forces that push down and the buoyancy force: Water volume * density water * gravitational acceleration = force of the water mass.

m ^3 *kg/ m ^ 3* m/s ^ 2= N

Found the buoyancy force acceleration is given by = Buoyancy force/mass= acceleration due to floating body -> LAW OF ARCHIMEDES. A body immersed in a liquid undergoes a direct pierces upwards of intensity equal to the weight of the liquid displaced.

$F= g \rho V$ ($N= m/s^2* kg/m^3*m^3$)

A body sinks, floats opsalt when its density is respectively greater than, equal to or less than that of the liquid.

5) Evaluation at t_0

$v_0 = 23,43$ m/s.
$z_0 = 0$

6) Evaluation at $t_1= 0,001$ s ($dt_1= 0,001$s)

$z_{t1}=v_0*dt$
(9)
$M_{wt1} = z_{t1} *S_0* \rho_w$

$z_{t1}=M_b v_{0/}(M_b +M_{wt1})$

$F_{t1}= M_b * (v_{t1-}v_0)/dt$

7) Evaluation at $t_2= 0,002$ s ($dt_1= 0,001$s)

Byt his time the body overgravitational acceleration is subjected to two other forces:

- A date from the reaction force that is undergoing= F /Mb
- A given acceleration of floating Mw = * g/Mb

$v_{t2}= v_0+a_b/dt$

$z_{t2}= z_{t1+} z_{t2}*dt$

$M_{wt2} = y_{t2} *S_0* \rho_w$

$v_{t2}=M_b v_{t1/}(M_b +M_{wt2})$

$F_{t2}= M_b * (v_{t2-} v_{t1})/dt$

Results

V0= 23,43 m/s
Fmax 25995 N

Zmax=1,64m
Gmax= 33

In most cases examined survival is recorded at a speed of 100 ft / s (30.48 m / s).

Survival was measured under the following conditions impact:

- Lateral (-Gy) up to 87 ft / s (26.83 m / s)
- Back (-Gx) up to 88 ft / s (26.82 m / s)

- Supino (+ Gx) up to 93 ft / s (28.34 m / s)
- Head (-Gz) up to 97 ft / s (29.56 m / s).

For the different levels of speed (drop height of 46 ft - 14.02 m) over 50 ft / s (15.24 m / s), the condition of impact with the foot (+ Gz) showed is the highest percentage of cases of survival.

Drawing up a table of the other cases of survival impact of foot we have:

- 100 ft / s 30.48 m / s
- 102 ft / s 31.9 m / s
- 111 ft / s 33.83 m / s
- 116 ft / s 35 m / s

With a standard speed 133 ft / s 40.54 m / s

The maximum human body limit of tolerance on impact with the water it was found to be close to 100 ft / s (68.2mph-30.48m/s),or equivalent drop height of 186-foot (56 , 69 m). Patterns of injury were found to vary with the direction of forces or body orientation. Of 34 cases of feet-first (+Gz) impact, which was the most commonly survived body orientation, 11, or 32,2 %, had no associated clinically reported trauma. The most typically injury in feet-first impact involved contusions to thighs and buttocks, compression fracture (particularly to the twelfth thoracic and first lumbar vertebra), shock, and hemorrhaging of the lung.

Besides the high incidence of compression fractures in this impact position bilateral mid-shaft fractures to the tibia and femur or homers occurred. In one case, a comminuted fracture of the scapula and distal clavicle occurred when the individual landed with one arm down, forming a fulcrum against the impact force. It does appear that internal trauma is significantly more frequent in any position of impact other than feet-first. While it is generally been considered that the wider the distribution of force over the body's surface is, the less the unit force, and thus the greater distribution of energy (and survival capability), this factor by itself is somewhat misleading, particularly as regards the water impact.

A clean dive or jump into water, represents a smaller surface area and a greater concentration of forces, leaves a little or no sting. The difference, of course, is in the deformation characteristic of the water, and so the distance and time duration of deceleration. In the clean dive the impact duration time is longer since there is less braking action due to the decreased body surface area and greater depth penetration.

While this may seem obvious and elementary, it is a basic factor in water-impact survival. Velocity at impact is used in this study to indicate magnitude of forces because it can be accurately calculated in unimpeded free-falls, providing a valid basis of relative fall severity. Unlike falls onto hard surfaces such as concrete, however, the deformation characteristics of each impact cannot be precisely determined since the displacement is unknown. Therefore, time duration, a most important factor in deceleration calculations, cannot be accurately determined. In general, the time duration, and rate of change of velocity, in water impacts is of much longer duration than in impacts on solid surfaces.

The stopping distance will vary with the body orientation upon impact, it is much greater in feet or head-first impacts, and lower, because of the greater surface area, in lateral or traverse impacts. Evidence does seem to indicate, however, that even from great heights velocity is rapidly lost in water. Experiments [Neuriert and Trey], for example, showed that in head-first dives into water:

From 238 cm= 2,38 m
Mass= 3,38 Kg.
Specific gravity 1,08
Had lost 71% of their velocity by a depth of only 16 cm (0,16m).

Mathematical estimates by Early predict a magnitude force (G):

Velocity f/s	Velocity m/s	G feet/head-first	G flat configuration
20		3,5	18,6
30		6,0	40
50	15	16	112
80	24	43	300

In water impacts, some factors not usually associated with these types of surfaces may play an important role in determining survival. For example, the surface of the water may be smooth and horizontal to the falling body through waves and trough shaping a surface angle nearly perpendicular and thus parallel to the body. Even in inland water, waves may be a factor.

Velocity of the current, while a relatively minor factor impact, is immediately important to survive. Therefore meteorological conditions are often of more importance to water impacts than other impacted surfaces and less subject to variation.

Additional forces acting in a water impact may involve such factors as frictions, tumbling, water uplope, resultant force, and even shear due to current. In Ney You're a 32-year-old man jumped 107 ft (41.14m) - for the third time- from a bridge on which 67 other jumpers have been killed. The leader of "high divers" noted that in diving from less than 30 ft a diver should remain relaxed; over 30 feet he "must be as rigid as possible to take up the blow".

Such stunt dives do emphasize that a water impact can be repeatedly made at velocities up to 86 ft/s (26,21 m/s) with no or minimal injury if proper body orientation is maintained. These individuals, however, are all young males, highly trained, and in top physical condition.

Conclusion

The impact surface influence the forces on the body, because with smaller surface area a longer deceleration involved. A previous study of water impact survival in free fall has demonstrated that critical velocity (corrected for aerodynamic drag) for human survival of water impact in the feet-first body position appears to be slightly over 30,48 m/s (100 ft/s), five individuals have survived impact of 30,48-35,30 m/s (100-116 ft/s) impact velocity. The highest impact velocity survived in the head-first is 29,52 m/s (97 ft/s) ($-G_z$). Stunt divers at Acapulco, Mexico, routinely dive up to 135 ft (41 m) (86 ft/s – 26,2 m/s). Tests conducted with an instrumented anthropometric dummy in different body orientations produced measured G forces exceeding 500 G's an only 9,14 m/s impact velocities, less than one-quarter the impact velocity of these fatal cases [c]. (Napolitano et al. 2013a)

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KORIŠTENJE VIDEOANALIZE U DIDAKTICI ZA POBOLJŠANJE MOTORIČKOG UČENJA, VJEŠTINA I TAKTIKE U VODENIM SPORTOVIMA

Sažetak
Ovo istraživanje primjenjuje video analizu kako bi procijenilo nastupe u vodenom sportu;Usredotočuje se na cijeli fenomen koji provodi neke aspekte. Procjenjuje se kvantitativnim podacima za biomehaniku i bioenergetiku i kvalitativne jednokratne rezultate vezane uz podatke za procjenu specifičnih pokazatelja i deskriptora. Cilj je uzeti kvantitativne podatke i kvalitativne odnose. Teorijska i argumentativna metoda primjenjuje se na svaku pojedinu eksperimentalnu studiju. Studija vaterpola procjenjuje povezanost između taktičke sheme i ishoda te korelacije između rukovanja kugličnim brzinama i bez lopte u različitim tipovima sportaša. Ronjenje stijena (to znači da ronjenje s 28 metara brzinom 24 m / s) proučava korelaciju između utjecaja biomehanike vode i tehničkog modela. Studija sinkroniziranog plivanja ocjenjuje korelaciju između biomehaničkih aspekata tehničkih elemenata i pokazatelja i deskriptora. Studija plivanja ocjenjuje povezanost između morfoloških bolesti i bolova u sportašima vaterpolu. Istraživanje vodenih sportova koristi ekološku i integriranu metodu koja se pridružuje kvalitativnim i kvantitativnim aspektima, kako bi se nove tehnologije mogle integrirati za rješavanje korištenja tehničkih instrumenata kako bi se dobila globalna vizija sportskog učinka kako bi pomogli trenerima u praćenju i procjeni.

Ključne riječi: *procjena, evaluacija, kvalitativni i kvantitativni podaci.*

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