

HOW TO PREPARE, WRITE AND PUBLISH SCIENTIFIC PAPER IN KINESIOLOGY AND SPORT

DRAŽEN ČULAR
KREŠIMIR ŠAMIJA
GORAN SPORIŠ

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PREDGOVOR

Dvojezično Hrvatsko-englesko izdanje ove knjige nastalo je kao logičan slijed na hrvatskom jeziku napisane knjige izvornog naslova *“Kako napisati, pripremiti i objaviti znanstveni rad u kineziologiji i sportu”*, kao i ostalih znanstvenih i stručnih tekstova koje su autori publicirali u različitim oblicima. Knjiga je, kao i prethodne, nastala iz potrebe za «pokrivanjem» područja izrade i prezentacije rezultata znanstveno-istraživačkog rada u kineziologiji i sportu, u skladu s temama koje se obrađuju na različitim Fakultetima u okviru različitih kolegija kao što su: Osnove kineziologije, Sistematska kineziologija 1 i 2, Metodologija znanstveno istraživačkog rada, itd....

Naime, razvoj studijskih programa na engleskom jeziku kao jedna od važnih strateških odrednica Kineziološkoga fakulteta u Splitu i dinamika razvoja ovog znanstvenog područja nalaže da se mladim znanstvenicima i svima koji se bave područjem kineziologije i sporta pruže praktični primeri i primjenjive informacije koje će im omogućiti da na što jednostavniji način prezentiraju i realiziraju svoje znanstvene ideje. Ova knjiga je rezultat želje autora da u okviru Projekta *“Izvoz znanja u kineziologiji i sport”* i Projekta broj 6524. Hrvatske zaklade za znanost, voditelja *doc. dr. sc. Dražena Čulara* daju svoj skromni doprinos razvoju kineziologije kao znanstvene discipline, kao i uspostavi i što kvalitetnijoj realizaciji pomenutih studijskih programa na engleskom jeziku.

Pripremajući rukopis, već u trenutku pisanja, pratio nas je nelagodan osjećaj da nećemo uspjeti u namjeri da obuhvatimo sve relevantne informacije koje su potrebne studentima kineziologije, odnosno mladim znanstvenicima na početku njihove znanstvene karijere. Jedna od glavnih poteškoća pri pisanju knjige ogledala se u određivanju dubine i širine sadržaja i usklađivanje s težnjom autora da knjiga ne bude previše opsežna, ali ipak dovoljno obuhvatna.

Nadalje, autori su tijekom pisanja bili prisiljeni rješavati terminološke poteškoće povezane sa odabirom adekvatnih hrvatskih izraza za pojmove koji egzistiraju na engleskom jeziku, tako da se ponekad kao kompromisno rješenje upotrebljavaju i engleski pojmovi u izvornom obliku. Također, postoje i slučajevi gdje se dva ili više uvriježenih kinezioloških pojmova na hrvatskom jeziku prevode kao jedan engleski pojam. Iz navedenog razloga poglavlje Osnovni pojmovi u kineziologiji nije u potpunosti identično u hrvatskoj i engleskoj verziji, niti po broju pojmova niti po abecednom redoslijedu, ali navedeno nije nedostatak već prednost i pokazatelj bogatstva ovoga područja.

Vrijednost teksta, neovisno o aktualnosti same teme i razmjerno svježim izvorima informacija pored ostalog, ogleda se i u dvojezičnom hrvatsko-engleskom konceptu kojim su autori željeli pružiti mogućnost mladim znanstvenicima da na praktičnim primjerima iz područja kineziologije i sporta usavršavaju razinu poznavanja engleskog jezika, koja često može predstavljati prepreku u publiciranju u relevantnim znanstvenim časopisima. Svoj veliki doprinos u ovome pogledu dala je i kolegica Marjana Dražić koja je na najprofesionalniji mogući način sa hrvatskog prevela na engleski jezik ovu terminološki jako zahtjevu materiju.

Obzirom da je Plinije Mlađi napisao: *“Ni jedna knjiga nije tako loša, da ne bi za nešto bila korisna” nadamo se da će knjiga «biti korisna»* studentima i mladim znanstvenicima tijekom studiranja i znanstvenog usavršavanja u kineziologiji i sportu kao važnom području od općeg društvenog interesa.

autori

PREFACE

The bilingual Croatian-English edition of this book was created as a logical sequence of the book written in Croatian, with the original title *“Kako napisati, pripremiti i objaviti znanstveni rad u kineziologiji i sportu”* (*“How to write, prepare and publish research in kineziologiji and sport”*), as well as other scientific and expert papers that the authors have published in various forms. The book, like the previous ones, resulted from the need for “covering” the areas of production and presentation of scientific research results in kinesiology and sport, congruent with the subjects addressed at different faculties within various courses such as: Basics of Kinesiology, Systematic Kinesiology 1 and 2, Methodology of scientific research, etc.

Namely, the development of study programmes in English, as one of important strategic determinants of the Faculty of Kinesiology in Split, and the dynamics of development in this scientific area, dictate that young scientists and everyone involved in the area of kinesiology and sport should have at their disposal practical examples and applicable information which would enable presentation and realization of their scientific ideas in the easiest possible way. This book is the result of the authors’ wish to, within the Project *“The source of knowledge in kinesiology and sport”* and the Project No. 6524 of the Croatian Science Foundation, of project leader *Assist. Prof. Dražen Čular, PhD*, to make their humble contribution to the development of kinesiology as a scientific discipline, as well as to organization and quality realization of the aforementioned study programmes in English.

In preparing the manuscript, at the moment of writing, we had an unsettling feeling that we were not going to succeed in our intent to include all relevant information that kinesiology students, i.e., young scientists at the beginning of their scientific career, need. One of the main difficulties in writing this book was in establishing the depth and the volume of contents and conforming with the authors’ aim not to make the book too extensive, yet sufficiently comprehensive.

Furthermore, the authors were forced to deal with difficulties regarding terminology, related to the selection of adequate Croatian terms for notions which exist in English, thus, as compromise, English terms are used in their original form. Also, there are cases where two or several common kinesiological terms in Croatian are translated as one English term. This is why the chapter called Basic terms in kinesiology is not completely identical in the Croatian and the English version of the text, neither regarding the number of terms nor alphabetically, but this should not be viewed as a deficit, but rather as an asset and indicator of the richness of this area.

The value of the text, regardless of the actuality of the subject and relatively recent sources of information, is, among other things, reflected in the bilingual Croatian-English concept by which the authors wanted to create an opportunity for young scientists to, by using practical examples from the area of kinesiology and sport, improve their knowledge of the English language, which can often create an obstacle in publishing in relevant scientific journals. Great contribution in this regard was given by professor Marijana Bonačić who, in the most professional way, translated this very demanding text with specific terminology from Croatian into English.

As Pliny the Younger wrote: *„There is no book so bad that it is not beneficial in some respect“*, we hope that this book *„will be beneficial“* to students and young scientists during their studies and scientific specialization in kinesiology and sport as an important area of general social interest.

authors

SCIENCE AND SCIENTIFIC APPROACH

1

"THE GREAT TRAGEDY OF SCIENCE, THE SLAYING OF A BEAUTIFUL THEORY BY AN UGLY FACT."
T.H. HUXLEY

DEFINITION AND STRUCTURE OF SCIENCE

Science comes from the word knowledge, i.e., to know (lat. scientia=knowledge; scire=to know). *Anić (2006)* defines it as the totality of arranged and generalized knowledge which includes observation, experiment, research and explanation of facts and phenomena in different parts of human knowledge of nature and society. Some other scientists (*Marušić et al., 2008*) define it as collective, coherent, organized and systematic knowledge of human race acquired by objective and unbiased observations and systematic experiments. *Skinner (1953)* states that science is the search for order, uniformities and relations among the events in nature that surrounds us. According to *Gačić (2012)*, it can be defined as “systematic knowledge of some area that can be objectively tested, and it is characterized by an elaborate conceptual apparatus and research methodology”.

The subject of a certain science is part of objective reality, and science is a mental interpretation of that part of reality. Accordingly, science consists of comprehensions about its subject and methods by which certain subject is analyzed. According to *Vujević (2002)*, research methods are rational-empirical procedures that lead us towards true comprehensions. Science does not consist of subjects, but rather of comprehensions of its object and methods. The subject of science can be part of objective reality which makes a certain logical whole. Thus, by defining its space, it also defines its research value. The facts within research activity depend upon what it is being studied. This way the registered fact becomes data. Based on facts and data, relevant elements of phenomena and processes are separated from irrelevant ones. Essence is what differentiates phenomena and processes of one type from those of other types. The carrier of essence is concept. A concept is the idea of essence of the phenomenon and process to which we come by thinking. To get our thoughts on paper, language represents a part of cultural reality which allows communication.

In order to test some thoughts, we need hypotheses, which represent conceptual explanation of objective reality, which has not been tested by facts of that reality yet (*Vujević, 2002*). *Marušić et al. (2008)* state that statistical hypothesis is an elementary, unambiguous and explicit statement about some characteristic of population, which must be checked, i.e., tested. Based on the aforementioned structure of science, we can notice it consists of methods, data, concepts, language, hypotheses, laws and theories. Such structure is integrated into a certain logical system (*Vujević, 2002*).

THE AIM AND FUNDAMENTAL VALUES OF SCIENTIFIC APPROACH

The aim of science represents the determination of laws on phenomena in nature and society starting out with interrelations of phenomena. After the regularity among phenomena has been established, principles are formulated which have certain laws and which, by further testing, become laws (*Mejovšek, 2013*).

Based on this, *Marušić et al. (2008)* listed four essential qualities of science:

1. It is the source of genuine knowledge (discoveries) for mankind, in which knowledge is attained by scientific-research work, and it represents knowledge attained by scientific procedure at the level of international science;
2. It is one of the key components of the educational system, which represents concrete conformation of an idea, i.e., hypothesis and its testing;
3. It is a part of culture of a particular community, where scientific work increases scientist's knowledge and abilities;
4. It contributes to the general well-being and safety in everyday life through the innovation chain which consists of basic research – development research and new products (*Figure 1*).

FOUR ESSENTIAL QUALITIES OF SCIENCE

CHARACTER AND CHARACTERISTICS OF SCIENTIFIC APPROACH

Moreover, according to *Zechmeister et al. (2001)*, scientific approach is characterized:

1. as empirical, as opposed to intuitive approach;
2. as systematic, as opposed to unsystematic observation;
3. by objectivity, as opposed to subjectivity in reports;
4. by clarity, as opposed to unclear constructs;
5. by precision, as opposed to unprecise instruments;
6. by validity and reliability;
7. by test, as opposed to untestable hypotheses;
8. by sceptic attitude, i.e., critical attitude.

It is a fact that scientific findings are based on human consciousness, and they are exclusively a human activity. This must be particularly pointed out in social sciences and humanities, which study social processes and human behavior, and due to their complexity, wrong conclusions could be drawn.

Bujas (1981) defined four basic characteristics of science and compared them to observations from everyday life:

1. scientific observation is different from observation in everyday life in that it is systematic, successively directed at limited areas and it is conducted in well, i.e., precisely defined conditions;
2. scientific approach is directed towards comprehension of the state of things as they are, regardless of our expectations;
3. scientific approach is under constant control, not only during gathering of data, but also by additional testing through repeated observations or experiments;
1. science requires caution with generalization, we need a large number of verified and unambiguous data to be able to draw general conclusions, principles and laws.

FOUR BASIC CHARACTERISTICS OF SCIENCE

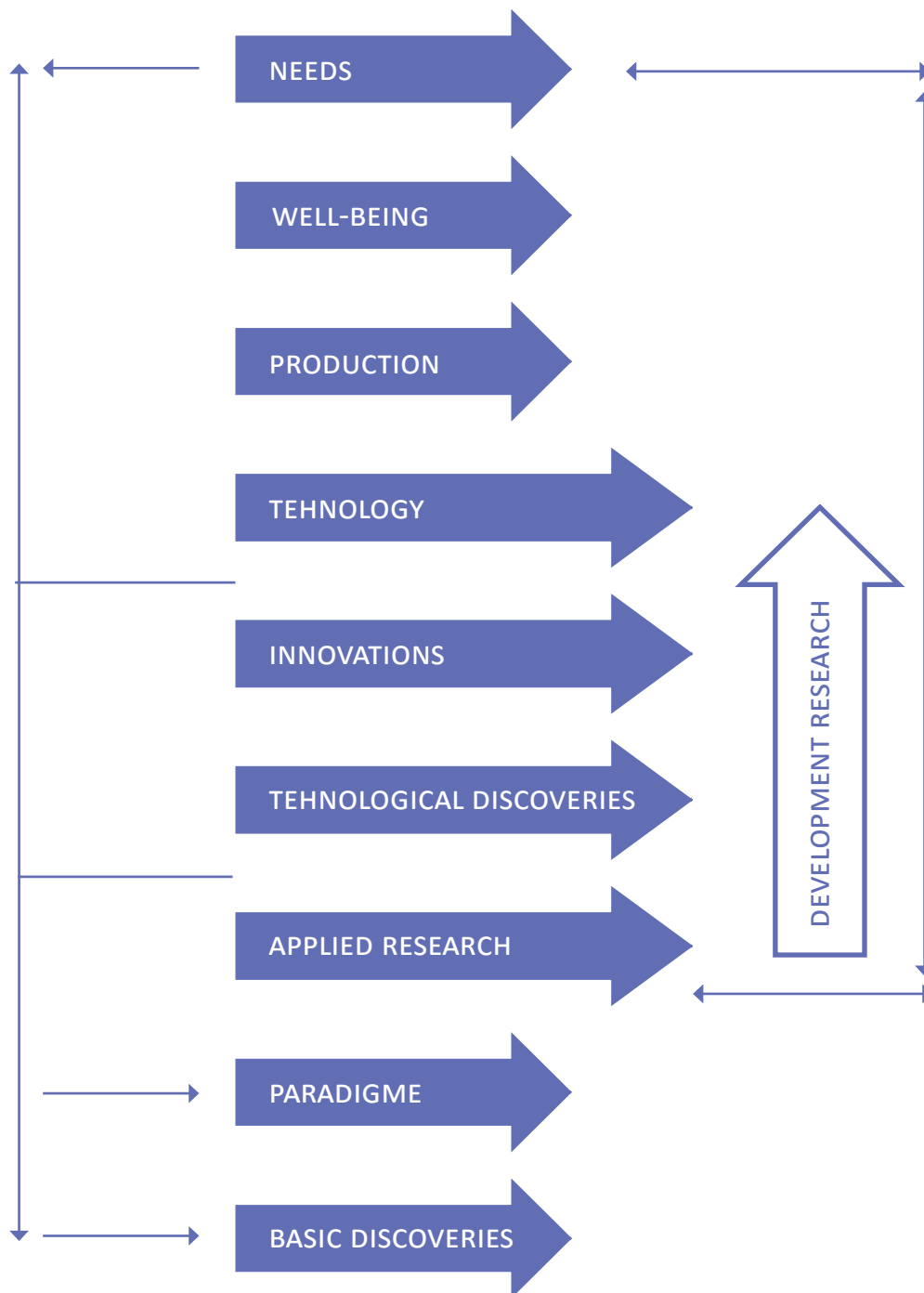


Figure 1. Innovation chain (modified according to Marušić et al., 2008)

THEORIES, HYPOTHESES AND APPROACHES IN SCIENCE

The concept of theory refers to the harmonious system of assumptions which enables explanation of numerous individual assumptions. An important characteristic of the theory concept is its testability (Marušić *et al.*, 2008). Furthermore, Prskalo and Sporiš (2016) say that theory gives an explanation of the phenomenon which is the subject studied, it is derived from it, and it has universal meaning because it includes a great number of individual cases. Mejovšek (2013) states that the most important component, i.e., the aim of research we want to reach in science and confirm certain statements is scientific hypothesis. For this author, hypotheses are statements which are a part of the theories and on which theory relies.

Furthermore, Marušić *et al.* (2008) list five general demands a scientific hypothesis must fulfil:

1. purposefulness – solving a problem of our interest,
2. testability – procedures that require testing of certain hypothesis, it must be enforceable,
3. fruitfulness – from it certain consequences and conclusions are derived,
4. congruence with the existing knowledge – accepting the hypothesis which is congruent with more known facts,
5. simplicity – a simpler hypothesis is better than a more complex one.

There are two ways of developing a theory in science: by inductive and deductive approach. Induction represents a process of reasoning from specific towards general, whereas deduction draws conclusions from general towards specific (Table 1). However, Pooper (2002, in Mejovšek, 2013) states that by inductive approach a theory cannot be proven, but merely confirmed.

On the other hand, the author gives special importance and puts emphasis on deductive approach of theory testing, and lists four phases of that process:

1. internal consistency
2. logical test
3. comparability with existing theories
4. empirical testability.

As previously emphasized, a hypothetic-deductive approach (Mraković, 1997) implies formulation of hypotheses, i.e., assumptions of a possible solution to a kinesiological problem, before the research is conducted, after the goal of the research is defined. These assumptions are then confirmed or rejected by methodological procedures in scientific research. Assumptions based on previous experience which do not withstand testing are rejected.

CHARACTERISTICS OF DEDUCTIVE APPROACH	CHARACTERISTICS OF INDUCTIVE APPROACH
SCIENTIFIC PRINCIPLES	THE AIM IS UNDERSTANDING THE MEANINGS HUMANS ATTACH TO EVENTS
MOVING FROM THEORY TO DATA	MOVING FROM DATA TO THEORY
QUANTITATIVE DATA	QUALITATIVE DATA
THE APPLICATION OF CONTROL TO ENSURE VALIDITY OF DATA, AN A HIGHLY STRUCTURED APPROACH	A MORE FLEXIBLE STRUCTURE TO PERMIT CHANGES OF RESEARCH EMPHASIS AS THE RESEARCH PROGRESSES
RESEARCHER INDEPENDENCE OF WHAT IS BEING RESEARCHED	A REALIZATION THAT THE RESEARCHER IS PART OF THE RESEARCH PROCESS

Table 1. Major differences between deductive and inductive approach in science (adapted from Verčić *et al.*, 2010)

Other authors (Tzeng & Jackson, 1991; in Mejovšek, 2013), claim that a good theory should fulfil seven basic functions:

1. decomposition – denotes the range of theoretical disintegration of general contents of the problem,
2. nomologization – connecting all important elements which resulted from decomposition,
3. understanding – the scope in which a theory may refer to causal processes between constructs,
4. explanation – explanation of the phenomena which occurred,
5. prediction – predicting future events,
6. fruitfulness – generalization of new hypotheses and research,
7. control – theory can affect future events.

A *paradigm* is a very narrow concept of theory in science. *Thomas Kuhn (1970)* stated that normal science of one area is firmly based upon one or more past scientific achievements (*Marušić et al., 2008*). Reconstruction of a paradigm represents a so called “scientific revolution”, where a new paradigm is replaced by the old one.

Kuhn (1999) (in Mejovšek, 2013) described paradigm as a set of basic assumptions which define the area of scientific research, determining the type of problem and methods that are considered legitimate and can be used for collection and interpretation of data. Given that kinesiology, as a science, belongs to the social area, two basic paradigms in that area are the qualitative and the quantitative paradigm (*Table 2*). In social sciences and humanities, the quantitative paradigm was developed primarily through inductive method (from specific to general), and afterwards through the aforementioned hypothetical-deductive method.

Mejovšek (2012) states that a hypothetical theory is obtained by deriving hypotheses which are tested by scientific research. When all hypotheses are confirmed, a theory becomes scientifically based.

CHARACTERISTICS OF QUANTITATIVE PARADIGM	CHARACTERISTICS OF QUALITATIVE PARADIGM
DEFINING HYPOTHESES THAT DO NOT CHANGE DURING RESEARCH	THERE ARE NO SPECIFIC GOALS AND HYPOTHESES (THEY CAN BE INTRODUCED DURING RESEARCH)
THE SUBJECT SAMPLE IS RANDOM AND RELATIVELY LARGE	THE SUBJECT SAMPLE IS VERY SMALL
DATA IS COLLECTED BY STANDARDIZED MEASURING INSTRUMENTS (TESTS, QUESTIONNAIRES, SCALES)	NON-STANDARDIZED PROCEDURES (SEMI-STRUCTURED INTERVIEWS, OBSERVATIONS)
STATISTICAL DATA ANALYSIS	DOCUMENTATION ON THE PHENOMENON THAT IS BEING RESEARCHED
CONCLUSIONS GENERALIZED ON A POPULATION	IT CANNOT BE GENERALIZED (DUE TO SMALL SUBJECT SAMPLES)

Table 2. Major differences between quantitative and qualitative paradigm (adapted from Mejovšek, 2012)

PROBABILITY MODEL

Marušić et al. (2008) say that statistics describes measures of uncertainty by using a model of theory of probability. Accordingly, there are two different models:

1. deterministic model of probability and
2. probabilistic model of probability.

DETERMINISTIC MODEL of probability is described by predictable events, for which it is known in advance and with certainty that they will occur and are expected.

PROBABILISTIC MODEL of probability represents the outcome of research which is never fully predictable, i.e., realization of event can never be known with all certainty, thus every outcome is defined as random event.

Every probabilistic model consists of three components:

1. determination of the measuring outcome
2. comprehension of all events which occur as a consequence of the research
3. assigning probability to each event (*Marušić et al., 2008*).

TYPES OF RESEARCH

Miroslav Vujević (2002) states there are four types of research in science:

1. scientific research
2. technical research
3. expert research
4. action research.

In scientific research, based on a representative number of empirical experiences we think, and in this way compare events, and generalize what is important from sample to population. Scientific research is a process that connects thinking and experience, and whose aim is to detect laws in phenomena and processes, and a written report about that process and the results obtained is called a scientific paper (*Vujević, 2002*).

On the one hand, a scientific discovery satisfies curiosity, and on the other hand, it can have great instrumental value. Technical science is interested in potential values of scientific discoveries. Therefore, the aim of scientific research is discovery, and the aim of technical research is invention (*Vujević, 2002*).

Expert research represents concretization of the obtained results. For example, expert activity of medical treatment is not possible without research results. In different areas, expert research has different names. In medicine it is called a medical test, in law investigation, in pedagogy examination. In other areas these types of research sometimes do not have an exact name and are called diagnostics. The end result of research is called an expert paper. It represents a written report on the research whose aim is concretization of laws (diagnoses) (Vujević, 2002).

Other authors (Verčić et al., 2010), differentiate research studies according to:

1. applicability of their results
2. research methods used
3. types of data that are being collected
4. types of data that are being studied
5. frequency of their conduction
6. their goals
7. the scope of the area that is being investigated
8. the time at which they are oriented
9. object of research (Table 3).

Gill (1974, in Vujević, 2002) states that advocates of action research note that traditional scientific research remains at discovery that ends up in a drawer, whereas action research goes further and lasts until the situation is changed.

Based on the presented types of scientific research, mature research reasoning represents the most complex and the highest form of human intellectual activity. Marušić et al. (2008) state that the first level of knowledge (comprehension) is the recognition of problem, followed by the understanding of the problem. The third level represents the ability to present the problem (the ability of comprehensive understanding), whereas the research of the problem represents the highest level of comprehension.

CHARACTERISTIC OF RESEARCH	TYPES OF RESEARCH
APPLICABILITY	FUNDAMENTAL RESEARCH APPLIED RESEARCH DEVELOPMENT RESEARCH ACTION RESEARCH
METHODOLOGICAL APPROACH	QUANTITATIVE RESEARCH QUALITATIVE RESEARCH COMBINED METHODOLOGY RESEARCH
TYPES OF DATA COLLECTED	PRIMARY RESEARCH SECONDARY RESEARCH
TYPES OF DATA STUDIED	THEORETICAL RESEARCH EMPIRICAL RESEARCH
FREQUENCY	AD HOC RESEARCH LONGITUDINAL RESEARCH
GOALS	EXPLORATORY RESEARCH DESCRIPTIVE RESEARCH CAUSAL RESEARCH
SCOPE OF RESEARCH	MICRO RESEARCH MESO RESEARCH MACRO RESEARCH MEGA RESEARCH
TIME	RESEARCH OF PAST RESEARCH OF PRESENT RESEARCH OF FUTURE
OBJECT OF RESEARCH	DIFFERENT TYPES OF RESEARCH

Table 3. Types of research in science (adapted from Vučević et al., 2010)

STRUCTURE OF SCIENTIFIC RESEARCH

Mejovšek (2013) listed nine phases of scientific research:

1. description and definition of the research problem,
2. selection of literature and key terms,
3. determining specific research goals and defining hypotheses,
4. selection of research design,
5. selection of subject sample and variables,
6. data collection,
7. statistical data analysis,
8. interpretation of results,
9. writing a written report.

STRUCTURE OF SCIENTIFIC REPORT (ARTICLE)

Writing a scientific report (article) includes the following seven parts (Mejovšek, 2013):

1. title
2. abstract
3. introduction
4. methods
5. results
6. discussion
7. references.

TITLE instructs the reader about the contents of the article. Marušić et al. (2008) state there are two types of titles: informative and indicative. An informative title conveys a message of the article, whereas an indicative title does not give the answer provided by the article, but merely the area it covers. An example of the indicative title is: *“The effect of 6-month training on motor and functional abilities”*, whereas the informative title would read: *“6-month training has a positive effect on motor and functional abilities”*.

ABSTRACT is written informatively, as a brief note on the research described in the article. In medical sciences, abstract, as well as the whole article, has IMRaD structure (*Introduction, Methods, Results and Discussion*) (Marušić et al., 2008).

INTRODUCTION of the article helps us to introduce the reader with the research problem, it gives a description of previous research results and it defines specific goals and hypotheses derived from the goals.

METHODS define the subject sample, variable sample, description of measuring tests, testing protocol, and statistical data analysis.

RESULTS of the research are usually presented graphically, in tables, and rarely in form of text. If there are numerous results, the most important ones should be presented graphically and in tables, whereas less important results can be mentioned in the text.

DISCUSSION has a purpose of interpretation and discussion about the research results. First of all, the hypotheses should be reviewed and it should be stated whether the results confirm or dismiss them. Next, the results are compared with the results obtained by other authors. If there are some differences, these should be explained. Then the author should consider the possibility of generalization of the research results and explain the contribution of the results to the existing theory on the research problem (Mejovšek, 2013).

REFERENCES represent written evidence used in the article. This can refer to articles from other journals, graduate theses, Master’s theses or doctoral dissertations, papers presented at symposiums or conferences, etc.

SCIENTIFIC METHODS AND TYPES OF EXPERIMENT

In kinesiology, primary methods for collecting data and facts are:

1. experimental method,
2. method of systematic observation (*Mejovšek, 2013*).

In science, experiment represents a fundamental method, i.e., scientific procedure. *Bujas (1981)* states that controlled conditions represent the main characteristic of experiment, and in this way the dependent variable, i.e., the criterion variable is studied. Furthermore, *Woodworth (1938)* describes an experimenter as someone who deliberately induces a phenomenon in certain place and at certain time, and monitors subjects' reactions. *Mraković (1997)* states that an experiment can be natural, field and laboratory (in controlled conditions).

Mužić (1982) names several types of experimental designs:

1. one-group experimental design,
2. one-group experimental design with two factors,
3. parallel-group design,
4. factorial design.

ONE-GROUP EXPERIMENTAL design is conducted to study the effect some stimulus has on the subjects, taking into consideration the initial state of the subject, transitive states, and the final state of the subject.

TWO-FACTORIAL MODEL includes the effect of the first experimental factor, and due to time conditions, the second factor is also included. Based on that, according to *Mužić (1982)*, the effects of both factors on certain model can be compared.

PARALLEL-GROUP design is based on the effect of two factors on two groups of subjects, e.g., influence of certain kinesiological operators on transformation effect.

FACTOR ROTATION ensures excluding the possibility of influence of structure of a part of the subject sample on the result of the target state, i.e., state after the experimental factor – predictor variable has been conducted.

METHOD OF SYSTEMATIC OBSERVATION is defined as a precise system of observation under strictly controlled conditions. The components of this method are: carefully planned process with precisely determined subject sample, criteria, observation protocol, planned time and place of observation, etc.

TYPES OF SCIENTIFIC AND EXPERT PAPERS

2

SCIENTIFIC PAPERS

ORIGINAL SCIENTIFIC PAPER

ORIGINAL SCIENTIFIC PAPER is an instrument of persuasion built on arguments and evidence, which brings a description of new and unpublished findings and results of scientific research, new techniques or instruments that have not been published yet. It is important to emphasize that an equally qualified researcher could repeat the experiment, evaluate observations, intellectual procedures and achieve the described results with the same accuracy stated by the author (*Gačić, 2012*).

Day (1979) says that a scientific paper is a written and published report describing original research results (*in Silobrčić, 2008*). Furthermore, *Silobrčić (2008)* defines scientific paper as “the first publishing of original results of scientific research (observation) in a publication which is easily accessible to international scientific community, and written in such a way that research can be repeated and the conclusions can be tested.”

According to UNESCO guidelines, the following types of articles can be found in scientific and expert publications:

1. original scientific papers,
2. preliminary communications,
3. review article,
4. conference article,
5. case study
6. expert article (*UNESCO, 1968; in Silobrčić, 2002*).

Scientific paper (*Mejovšek, 2013*) consists of the following parts:

1. title
2. abstract
3. introduction
4. methods
5. results
6. discussion
7. references.

The essential aim of a scientific paper is to communicate ideas and information clearly, concisely and openly (*UNESCO, 1968*).

PRELIMINARY COMMUNICATION

PRELIMINARY COMMUNICATION or preliminary note contains one or several new data or scientific information, but without additional details of testing the presented data (*Gačić, 2012*). According to *Silobrčić (2002)*, preliminary communication is not a scientific paper, but rather a short notice about the result, based on which the author later writes the original scientific paper.

REVIEW ARTICLE

REVIEW ARTICLE is a report on a particular problem, in which information already published is assembled, analyzed and discussed from a new point of view, analyzed or synthesized, i.e., are correlated (*Gačić, 2012*). A review article is based on results already published, but it includes original syntheses or analyses, new relations, or new hypotheses with recommendations for further research (*Silobrčić, 2002*).

CONFERENCE ARTICLE

CONFERENCE ARTICLE is a special type of paper in which usually this type of report is published in conference proceedings, which at that moment represent primary publications (*Silobrčić, 2002*).

CASE STUDY

CASE STUDY method is used for deep analysis of some phenomenon, process, institution, person, group or event. An object (case) is selected which is rich in information and characteristics observed. This method is suitable if we want to answer the question “why” certain circumstances/facts/situations/events occurred. Case study should not be conducted on a single case, but rather on several cases. However, a single case is sufficient for analysis in the following situations:

- a single case is studied in a longitudinal research (research is repeated after certain time);
- a key case for testing some theory is studied;
- a unique or extreme case is studied;
- a case which is typical/representative of some studied phenomenon is studied;
- a case which is analyzed represents a discovery.

If at least one of these criteria is not met, several cases with similar characteristics should be analyzed. In doing so, each case is first analyzed on its own, and then the gathered data are analyzed.

The case study method should analyze:

- the case itself (its characteristics),
- historical perspective of the case (if it is important for the case),
- social context in which it occurred.

The analysis should be substantiated by the existing theories related to the theme and data gathered from all available sources (documents, archival records, interviews, observations, physical evidence, etc.). The conclusion is drawn based on the analysis of all data gathered.

Process of the case study:

1. determining the research subject, research aim and research question;
2. gathering literature and data (theory + data about the cases which are being analyzed);
3. writing the theoretical part of the paper;
4. writing the analysis of the case/cases (characteristics, historical context, social context);
5. drawing conclusions based on analysis.

EXPERT PAPERS

EXPERT ARTICLE does not contain original results, but analyzes known, already described results, and the focus is on the application of known data (*Silobrčić, 2002*). According to *Gačić (2012)*, an expert article contains results of expert studies which do not have a scientific approach, which are not necessarily related to scientific research, but shed light on some theme or problem.

Gačić (2012) also listed some additional types of written papers:

MONOGRAPH which represents a substantial and well documented discussion in which the author, by complex analytical procedures, comprehensively addresses some narrow area, subject or problem in science (*Gačić, 2012*).

EXPERT REVIEW is a report on expert or scientific information which includes a critical review or evaluation. The greatest value of expert reviews is defined through presentation of situation in some scientific area and the place of that paper in that area (*Gačić, 2012*).

REPORT represents a description of a process of some research or project, e.g., annual report or something similar to that (*Gačić, 2012*).

BOOK is a written/printed material with more than 49 bound pages. A textbook represents one of the most frequent expert books. It represents systematic information for studying certain subject. If applied research is conducted for the purposes of writing a textbook and a breakthrough is made in synthesis of scientific findings, it can have characteristics of a scientific-expert paper (*Gačić, 2012*).

PROTOCOL in higher education is defined as empirical-analytic record of the process of some experiment, behavior or procedure, especially when changing parameters, conditions or constituent parts (*Gačić, 2012*).

ANNOTATED BIBLIOGRAPHY is selected bibliography referring to some theme, i.e., area, in which, besides information about the work, additional notes are written about estimation of its contents (*Gačić, 2012*).

ESSAY, i.e., short discussion represents the simplest form of written paper required as a paper within the educational process, a test task. To fulfil its form, it should contain an introduction, elaboration and conclusion (*Gačić, 2012*).

OTHER TYPES OF REPORTS ON RESEARCH WORK

Vujević (2002) describes in detail the following:

SEMINAR PAPER is a paper in which students are introduced to new contents, evaluate its scientific value, arrange it logically and put it in writing.

GRADUATION THESIS represents a report on expert or scientific research or some other activities in science.

Writing a **MASTER'S THESIS** cannot be based only on knowledge of theoretical and practical skills of the profession, rather it is based on solid knowledge, sensibility for problems of the profession and knowledge of the methods for solving those problems.

Writing a **DOCTORAL DISSERTATION**, in which it is not enough to demonstrate the knowledge of the profession and the skill of research, rather it is necessary to attain, by independent research, new scientific findings which are adequately shaped and included in the system of respective science.

KINESIOLOGY AND SPORTS

3

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THE CONCEPT AND DEFINITION OF KINESIOLOGY

When speaking of young sciences we often forget that the foundations on which we have built our knowledge were set in distant past. At first glance you might not find a link between the theory of scientists from the past and the knowledge which we have today, but we must take into account the technology available to us as opposed to the simple methods they used.

ARISTOTLE (384–322 BC), Ancient Greek philosopher and naturalist was the first to analyze and describe the principles of walking as a rotatory motion which is transformed into translatory motion and which subjects muscle action to geometric analyses. This was followed by a series of significant discoveries that contributed to shaping kinesiology as a science we know today.

ARCHIMEDES (287–211 BC) determined hydrostatic principles governing floating bodies, studied the laws of leverage and problems of determining the center of gravity.

GALEN (129–200 AD), prominent Roman physician and philosopher of Greek origin and probably the greatest medical scientists of the Roman period, studied the spirit and the body separately by using the biological approach to kinesiological phenomena. This approach brought about over a thousand years of static in science, with long-term negative consequences which are also present in modern times.

After a thousand years of stagnation, **LEONARDO DA VINCI (1452–1519)** described the mechanics of the body standing, walking up and down hill, rising from a sitting position, and jumping, and studied the relationship between the center of gravity and balance and center of resistance.

GALILEO GALILEI (1564–1643) introduced experiment as basic method of scientific work. Today, kinesiological science is also based on these postulates.

BORELLI'S (1608–1679) is considered a predecessor of modern biomechanics of the locomotor system due to his research.

Scientist who was significant for further development of biomechanics was **ISAAC NEWTON (1642–1727)**, who formulated three laws of motion, which describe relationships between forces, their interaction and effects.

Kinesiology is a word of Greek origin, formed of the word *kinezis/kinhiz* = motion, movement and the word *logos/logoz*– science, study, word, evidence, theory, affirmation. Etymologically, kinesiology is the study of movement. *Aristotle*, the aforementioned great philosopher, formulated the meaning of movement. He connected life and movement very simply and gave a short definition: “*Movement is life*”. Movement is life, and overall physical activity and creativity, regardless of its character (whether it be productive, professional, artistic, athletic), is always manifested through movement. Kinesiology does not study all human movement or movement of all objects. Movement is a biological necessity of every living organism and for years it has been the subject of various fields of study (*Starosta, 2001*). Human life begins and ends with movement. In the process of building modern civilization, people have somehow forgotten about their biological needs. Their sedentary lifestyle resulted in many civilization illnesses. Logically, we are faced with two possible solutions to this problem; people will either put effort in their physical health or the number of kinesiologyally disabled people will continue to grow. The paradox of modern time lies in the fact that our professional activities require an ever growing level of motor skills, while on the other hand the level of motor skills is evidently decreasing. The primary aim of kinesiology is to improve and enhance human health and life through movement, i.e. motion. Anthropological sciences study man. Man consists of different abilities and characteristics. Therefore, from anthropological point of view, kinesiology is the study of movement and motion of man.

Movement is the most important existential function of human organism, and all other functions are related to it, therefore, movement is a precondition for life. Movement exists even when its external manifestation is less noticeable, for example breathing, blood circulation, metabolism, digestion, etc. Movement is the universal need of all living beings; without movement there would be no life. Moreover, movement is necessary if we want to change location, express emotions, work or perform any other activity. Even in ancient times people studied movement and its demands. Scientific study of movement has numerous names, from kinesiology, anthropomotrics, and kinanthropology to motorics or psychomotorics. These are not the only terms that define this field of study. Some of these terms find their origin in other, more general attempts at defining this academic discipline: e.g. science on human movement, science on physical activity, anthropokinetics (*Blahus, 1999*), “reflexomotorics”, somatomotorics, sensomotorics, psychomotorics, kinetics, technomotorics, anthropomotrics, sports motorics (*Hirtz, Kirchner, Pöhlmann 1994*).

The diversity of the proposed names indicates a great interest for the development of this scientific discipline, especially in the 20th century, and shows how many experts from different fields have been interested in it. The interest is entirely justified since the study of movement has great general significance, i.e., it concerns every human being regardless of their sex, age, race, occupation or other characteristics.

Frenchman *Nicolas Dally (1795)*, world traveler curious about getting to know the particularities of the world we live in, after years of research and work in several scientific disciplines, finally finished his creative opus by a masterpiece five years prior to his death. The role of movement and physical exercise in education, hygiene and therapy was the central theme of his interest. „*Cinesiologie ou science du mouvement*“(1857) is a monumental book in which the author points out the role and importance of movement in improving abilities, shaping characteristics and acquiring knowledge and skills with the aim of preserving one's health. By translating the title Kinesiology or the scientific study of movement, we get a definition which is ambiguous enough to be generally correct, but not exact enough to provide clear information of what it is really about to those who are seeing it for the first time. Thus, it announces a new scientific discipline which will study human movement in an integrally and anthropologically relevant way, and it gives us, in a simple way, the best and still irrefutable fact about the name and the essence of kinesiology.

When we speak about the definition of kinesiology, and there have been different ones throughout history, we must mention all relevant experts from this field of science, as well as their papers. Thus, for *Momirović (1968)*, kinesiology is the scientific study on the principles governing the maximum efficiency of human movement.

Kinesiology is the scientific study on specially conditioned movement whose aim is to establish principles of transformation processes affected by that movement (*Mraković, 1971*). In other words, kinesiology is the scientific study of the principles governing exercise processes and consequences of those processes on human body (*Mraković, 1992; 1997*).

Kinesiology is the scientific study which studies human movement and motion in all its forms and interrelations, as well as relations of movement and motion with all other types of human existence and action (*Prot, 2001*). Kinesiology is the scientific study on kinesiological phenomena, characteristics and structures in their numerous mutual relationships with physical, biological, psychological and social conditions and effects (*Prot, 2003*).

Kinesiology is the scientific study on principles regulating maximum efficiency of human movement and on transformation processes affected by motor activity (*Findak, 1995; Findak & Prskalo, 2004*).

According to *Hoffman (2008)*, kinesiology is the discipline or physical learning which studies physical activity through performance, scientific analysis and expert practice.

Moreover, *Klavora (2008)* defines kinesiology as the scientific study on human movement and body's reaction to exercise.

As every other scientific study, kinesiology does not deal with its subject matter only conceptually, but rather it provides scientific evidence based on valid research methodology which allows for the verification of certain principles. Definition of what is considered scientific depends on the convention of competent experts in the given period. In Croatia, kinesiology is considered an empirical experiment-based science that studies the laws, principles and patterns of controlled and targeted processes of physical exercise (activity) and their impact on human body (*Mraković, 1992*).

Kinesiology is an interdisciplinary scientific study and this defines its relationship to other scientific studies (*Mraković, 1992*).

Kinesiology as a fundamental scientific field finds its application in various areas, such as sport, physical education, health, recreation, sport management and kinesitherapy, and it is also superior to them. It contains fundamental principles which apply to all branches of kinesiology (systematic kinesiology, kinesiology of sport, education, recreation, kinesitherapy and kinanthropology). This is even more emphasized in conditions of limited movement, which is a consequence of the modern way of life and results in vulnerability of all categories. Namely, there is an increasing trend of diminished muscle activity in everyday life, and with further growth of technological development, we can expect the situation to become even worse, both at home and abroad. Such activity, even if we did not consider the aim to be a measure for kinesiological or non-kinesiological activity, cannot be a stimulus sufficient for, e.g., health improvement, optimum transformation of anthropological characteristics, abilities and motor skills, and other aims of kinesiological activity. On the other hand, kinesiological activity directed towards the aforementioned aims will also enable greater work efficiency. Such fourfold aim determines the applied areas of kinesiology: education, recreation, sport and kinesitherapy. While in each area health is "condition sine qua non", (Latin proverb meaning "a condition without which it could not be"), the attitude towards health is not the same in sport and in recreation, for example. Maximum development of characteristics and abilities in kinesiological activities which are competitively oriented are associated with sport. Prevention of early deterioration of certain

anthropological characteristics and motor skills, along with the aforementioned concern for health, is the aim usually associated with recreation, whereas optimum development and maintenance of person's characteristics, abilities and motor skills at the highest possible level is associated with education. Therefore, it is extremely harmful to limit oneself only to the area of sport, e.g., in school. Kinesiology also studies sport, but this activity is not the exclusive area of its interest - it is much wider (*Prskalo, 2004*).

The aim of every science is to determine laws (*Momirović, 1968*). Kinesiology has at its disposal the instruments for gathering and analyzing pieces of information and data obtained through research. As a scientific study which deals with governing exercise processes, it includes elements of a system that controls and a system being controlled, as well as application of kinesiological stimuli which represent a set of kinesiological operators, exercises and energy necessary for processes of adaptation. Important subject of interest in kinesiology is the study of consequences of exercise processes on human body, i.e., on changes of different human characteristics, abilities and motor skills. It is clear that the aim classifies certain movement as kinesiological or non-kinesiological activity.

In conclusion, the applied kinesiological findings serve to improve the effects in various sports and sports-recreational activities of any type and level, and in education and kinesitherapy, provided that the principles and laws of applied kinesiology are expertly used in those activities.

KINESIOLOGY AS A SCIENCE

On September 22, 2009, *National Council for science of the Republic of Croatia* in their Act on scientific and artistic areas, fields and branches, classified kinesiology as an independent scientific field in the area of social sciences.

There are nine scientific areas:

1. natural sciences,
2. technical sciences,
3. biomedicine and healthcare,
4. biotechnical sciences,
5. social sciences,
6. humanities,
7. artistic area,
8. interdisciplinary scientific areas,
9. interdisciplinary artistic areas.

Kinesiology was listed in the official nomenclature of scientific disciplines in Croatia, next to all other affirmed disciplines, such as economy, law, sociology, psychology, political science, speech pathology, pedagogy, etc. Furthermore, scientific branches were determined within the defined scientific field of kinesiology.

The **BRANCHES OF KINESIOLOGY** are classified as follows:

1. systematic kinesiology,
2. sports kinesiology,
3. kinesiological education,
4. kinesiological recreation,
5. kinesiotherapy and adjusted physical activity,
6. kinanthropology.

Since the first official use of the term kinesiology in Croatia in 1967 when the *Institute of Kinesiology* was founded, the recognition of kinesiology as a scientific discipline and its classification as an independent scientific field mark the end of a long pursuit for an adequate name for the scientific study of human movement in Croatian academic community. Croatia seems to be the leading European country in the promotion of the term kinesiology in scientific and academic community. Despite the fact that only three higher education institutions in Europe use the term kinesiology in their official names, this term is used among the European academic community. Today it is used in the names of journals, scientific institutions, organization units of higher education institutions and subject curricula. It may be concluded that the term kinesiology is increasingly recognized and accepted as the adequate term for the science dealing with an extensive scope of diverse study of human movement, regular physical activity of various duration, intensity, purpose and contents, as well as its effect on the body and life of an individual and society as a whole. Kinesiology as a fundamental science finds application of its theory, concept, developments and principles in various areas of human everyday activity, such as sport, physical education, therapeutic exercise, recreation, exercise, physical therapy, sport management, etc. Given that kinesiology includes fundamental principles which apply to all of them, the acceptance of the term kinesiology as a global and universal term for science and professional practice is merely a matter of academic and scientific consensus. Kinesiology is the scientific study of movement, or more generally, scientific study of physical activity. The term kinesiology represents a set of all criteria for denoting the area of university physical activity and makes useful contribution to impartiality in many current discussions which emphasize scientific and professional dimensions of activity and their sub-areas.

Fundamental problems that practice puts before the kinesiological study can be categorized as follows:

KINESIOLOGICAL STUDY PROBLEMS

1. kinesiological analysis of motor structures
2. diagnostics of subject's state, which includes integral assessment of morphological characteristics, functional characteristics of organ systems, motor abilities and skills, intellectual abilities, personal traits, dynamic characteristics, especially motives, attitudes and interests, and status of an individual in social environment
3. anthropological prognostics includes evaluation of state of development of integral system of anthropological characteristics and motor skills under the influence of genetic or exogenous factors, or under the influence of individual or group activity
4. analysis of transformation operators includes determining the contents, modality and scope, and intensity of the activity, directed towards achieving some explicitly defined and socially valorized goal in education, sport, recreation, kinesitherapy and other possible areas of applied kinesiology (*Mraković, 1997*).

STRUCTURE OF KINESIOLOGY

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Kinesiology belongs to the group of social sciences and its scope of activities is primarily reflected in this scientific field. In cooperation with other scientific fields in the area of social sciences, kinesiology is rightfully given the opportunity to be interdisciplinary in some types of research. Almost all sciences in the social area are more or less intertwined, therefore it is clear that findings from different fields are used and transferred between the sciences, only in different relations.

Contemporary scientific findings prove that it is practically impossible to investigate only one scientific area. Thus, kinesiology has correlations with other scientific areas, not only its primary scientific area. Research of kinesiological problems certainly takes interest in the humanities, primarily in anthropology, followed by the scientific area of biomedicine and healthcare where there are a number of scientific fields and branches closely related to kinesiology, e.g., human physiology or anatomy, public healthcare, epidemiology and sports medicine. Moreover, kinesiological research can be applied in the area of natural sciences, even though to a lesser extent. Furthermore, findings from the area of pedagogy or medicine can also be applied in kinesiology, and testing of these findings in kinesiological problems will expand them, so they will make their contribution to the original scientific hypothesis (*Prskalo, 2004*).

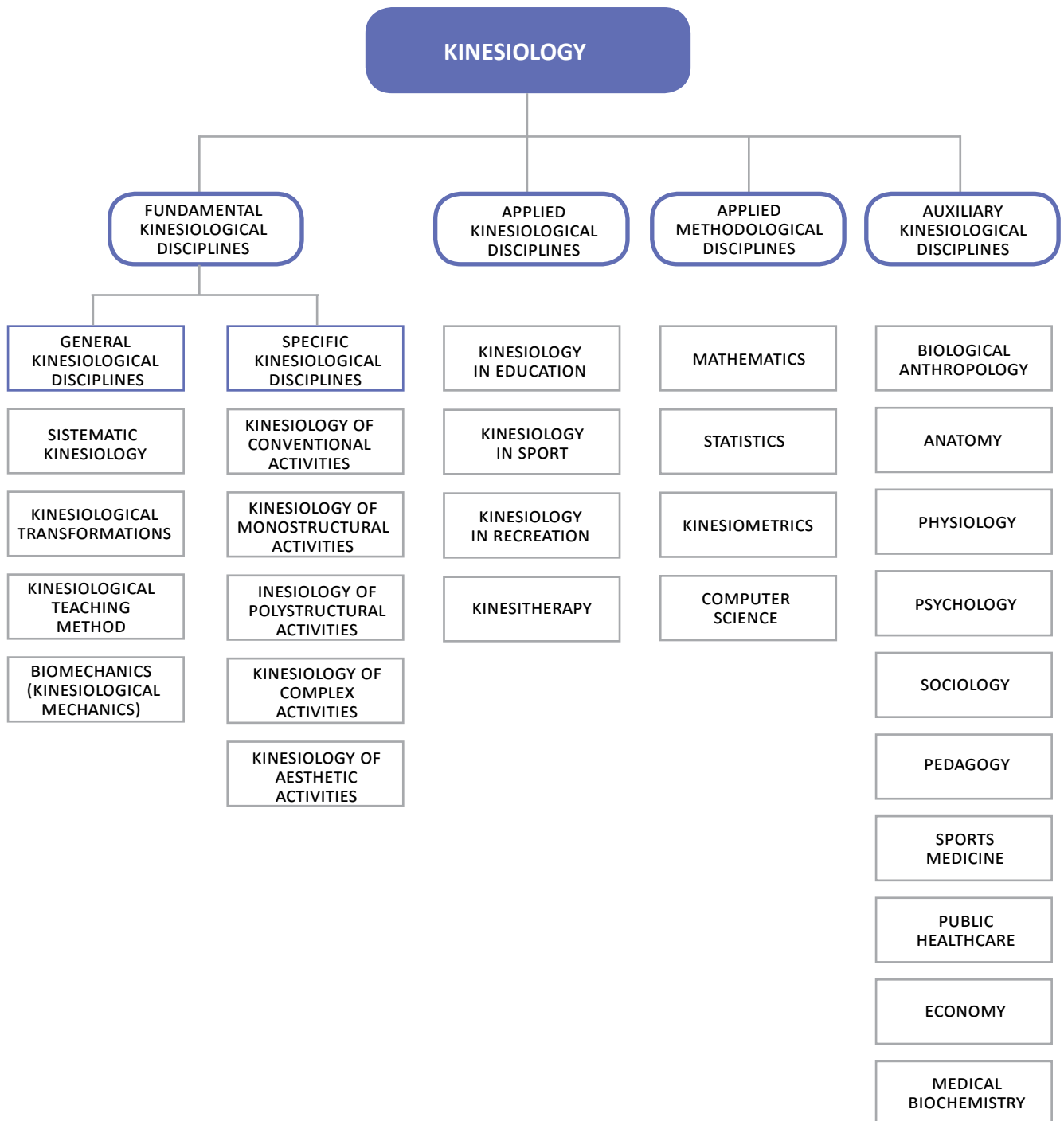


Figure 3. Structure of kinesiology (modified according to Mraković, 1997).

FUNDAMENTAL KINESIOLOGICAL DISCIPLINES

They define general laws of movement efficiency, principles of generating and adopting dynamic stereotypes of movement and laws that regulate transformation of anthropological characteristics under the influence of motor activities (Prot, 2012). Fundamental kinesiological disciplines include general kinesiological disciplines and special kinesiological disciplines.

GENERAL KINESIOLOGICAL DISCIPLINES

General kinesiological disciplines study general principles of governing the exercise process and consequences of those processes, principles of movement efficiency and principles of transformation of anthropological characteristics and motor skills under the influence of physical activities, which do not necessarily belong to any concrete class of kinesiological activities (*Prskalo, 2004*). This group includes:

SYSTEMATIC KINESIOLOGY

The subject of study of systematic kinesiology are general principles of the effect kinesiological stimuli have on human beings, general principles that regulate motor efficiency in people, and testing of historical and social conditions under which the development of physical education occurs (*Prot, 2012*).

KINESIOLOGICAL TRANSFORMATIONS

Branch of applied kinesiology which studies the most efficient training processes, i.e., kinesiological transformation processes which can efficiently change (improve and/or maintain at achieved level): functional abilities, motor abilities, morphological characteristics, health status and motor skills.

Kinesiology of non-conventional activities studies planning, programming, realization, control and analysis of such kinesiological transformation procedures whose basic aim is:

- transformation of abilities and characteristics (primarily of motor, functional and morphological dimensions);
- acquisition and mastering of fundamental motor skills which have high applicability in urgent situations or everyday life situations (*Mraković, 1997*).

KINESIOLOGICAL METHODICS

According to *Findak (1993)*, kinesiological methodics (teaching methods) refers to the science that studies the educational principles in education, sport, sports recreation and kinesiotherapy. The subject of study in kinesiological teaching methods includes all organizational types of work that exist in the areas of applied kinesiology. Therefore, in relation to kinesiology as a substratum science, kinesiological methodics has its narrow area of scientific interest or, more precisely, its research focus is oriented towards the study of educational principles in organizational types of work in the areas of kinesiological education, sport, sports recreation and kinesiotherapy, as well as their interpretation in relation to age, gender and type of educational activity (*in Prskalo & Sporiš, 2016*).

BIOMECHANICS

It studies principles of mathematics and physics which determine efficiency of movement structures. This discipline includes procedures for description of motor structures, procedures for analysis of movement structures, procedures for determining physical and morphological factors upon which movement structures depend, and procedures for motion simulation and optimization of movement (*Mraković, 1997*).

SPECIFIC KINESIOLOGICAL DISCIPLINES

The specific discipline of conventional Kinesiology activities represent a synthesis of that part of the principle of exercise processes which is typical for certain activity or group of relatively homogenous kinesiological activities, which are divided into four groups:

MONOSTRUCTURAL ACTIVITIES include activities which always have a physical goal of covering a distance by one's body or a projectile and which is objectively measurable, it is dominated by cyclical structure of movement and the result generally does not depend on cooperation between group members. This includes sports such as: athletics, swimming, skiing, rowing, shooting, bocce, weight lifting, bowling, kayak, archery, cycling.

POLYSTRUCTURAL ACTIVITIES include acyclic activities which have the goal of symbolically destroying one's partner and movement is executed and restricted through contact with the partner. Polystructural activities include the following sports: boxing, wrestling, judo, karate, fencing, table tennis.

COMPLEX ACTIVITIES include activities which have the goal of hitting certain target in space, by guided or ejected projectile, they have a complex structure of cyclic and acyclic movement, and their result depends on cooperation between group/team members. The following sports are an example of such complex activities: soccer, handball, water polo, rugby, hockey, ice hockey.

AESTHETIC ACTIVITIES include conventional activities which aim to achieve some aesthetic criterion by executing allowed movements, they are dominated by acyclic movement which is executed in accordance with some conventional system. These are sports such as: gymnastics, ice skating, figure skating, rhythmic-sports gymnastics, diving, etc.

APPLIED KINESIOLOGICAL DISCIPLINES

They study methods and principles of fundamental kinesiological knowledge in different activities in the area of physical education. This includes the following:

- kinesiological teaching methods in education,
- kinesiological teaching methods in sport,
- kinesiological teaching methods in recreation,
- kinesiological teaching methods in kinesitherapy.

KINESIOLOGICAL TEACHING METHODS IN EDUCATION

The subject of interest is physical education teaching and all other forms of educational activity related to the structure of the teaching area of physical education. This discipline includes principles of motor learning and their theoretical and practical aspects within physical education area, differentiated according to age, sex and level of educational system.

KINESIOLOGICAL TEACHING METHODS IN SPORT

It studies principles of programming specific processes directed toward achieving maximum sports efficiency. It includes methods and models of procedures for orientation, selection and specialization, in accordance with the principles of growth and development and equations of specifications of respective sport, methods and models of content selection of respective sport, and methods and models of selection of content, volume and modality of transformation operators.

KINESIOLOGICAL TEACHING METHODS IN RECREATION

It studies characteristics of sports-recreational activities and the effect they have on anthropological characteristics in adults, related to the phenomena of leisure time and applied sports recreation as a content of active holiday, its planning and programming in the work process, in the family, in and outside the place of residence, especially in the function of improving tourism as a direct or indirect economic category.

KINESIOLOGICAL TEACHING METHODS IN KINESITHERAPY

The subject of kinesitherapy includes primarily science-based kinesiological transformation processes which are applied in prevention and therapy of illnesses, injuries or impairments, and organization and enforcement of athletic lifestyle among persons with disabilities.

METHODOLOGICAL KINESIOLOGICAL DISCIPLINES

A set of scientific disciplines that study principles, systems and procedures of measuring, gathering and analyzing data and use of computer in solving kinesiological problems. It includes the following four scientific disciplines: mathematics, statistics, kinesiometrics and computer science.

MATHEMATICS

Mathematics in kinesiology is represented by mathematical models and methods based on which kinesiological principles are formulated.

STATISTICS

The subject of study in statistics are methods and algorithms for analyzing data and testing hypotheses. This discipline includes distribution functions, evaluation of parameters, correlation, regression and canonical analysis, component and factor analysis, trend analysis and analysis of changes and methods for analysis of numerical data. It deals with gathering, organizing, summarizing and graphic presentation of data obtained by measuring (descriptive statistics) for further data analysis and drawing concrete conclusions about the primary group on which the measuring was carried out. Based on the conclusions inferred in the basic group and the probability theory, its role is expanded to inferring about the characteristics of the whole (population).

KINESIOMETRICS

Kinesiometrics studies principles, models and methods of theory of measurement applied on measuring and assessment of kinesiological phenomena. This discipline includes formation of the measuring model, procedures for assessing reliability, homogeneity and discriminability, and procedures for determining factorial and pragmatic validity.

COMPUTER SCIENCE

It studies principles of programming and application of computers in analysis of kinesiological data and information systems of individual areas of applied kinesiology. This discipline includes architecture of information systems, operating systems, systems for working with databases and specialized programs for numerical and statistical analysis (*Findak & Prskalo, 2004*).

AUXILLIARY KINESIOLOGICAL DISCIPLINES

They represent fundamental scientific areas, fields or branches that are related to kinesiology or fundamental science and have similar methodology, and research results certainly contribute to new scientific findings.

BIOLOGICAL ANTHROPOLOGY

Biological anthropology studies biological principles which are the basis for the formation of procedures of orientation and selection, programming and controlling kinesiological transformation procedures. This discipline includes morphology and technique of anthropometric and somatotype procedures, basic principles of genetics, and biological and anthropological principles of growth and development which are important for kinesiological activities. Functional anatomy studies elements of human body structure and anatomical bases of functioning of the human body. It is an important link to biomechanics.

ANATOMY

Anatomy is the scientific discipline that studies the structure of human body and anatomical basics of function of organ systems.

PHYSIOLOGY

Physiology studies the principles of organ systems' functioning upon which motor efficiency depends in kinesiology-directed activities and which regulate the effect of kinesiological treatment on development of physiological functions.

PSYCHOLOGY

Psychology studies principles of adaptive reactions upon which efficiency in kinesiology-directed activities depends and principles that regulate the effect of kinesiological treatment on development of adaptive abilities. This discipline includes general psychological principles, principles of development, principles of learning and exercise, cognitive and motor abilities and conative characteristics congruent with kinesiological goals.

SOCIOLOGY

Sociology for planning and programming of educational processes in general, and separately of education, sport, kinesiological recreation and kinesitherapy. This discipline includes structure and development of differentiation and mobility dimensions, and their position in the system of anthropological dimensions which are important for kinesiological efficiency, as well as group dynamics, socialization and sociopathological phenomena and the effect of kinesiological activity on the efficiency of sociology. It studies the educational process, so called physical education, as a social phenomenon.

PEDAGOGY

Pedagogy is the scientific study of education, i.e., its principles. From kinesiological point of view, pedagogy includes educational principles primarily in physical education teaching.

SPORTS MEDICINE

Sports medicine is part of primary healthcare of sports participants, which takes care of protection and improvement of health of sports participants, and which determines and assesses their anthropometric and functional status with the aim of selection or monitoring the effect of training, and, independently or with other specialities if necessary, cares for treatment and rehabilitation of injured and sick athletes.

PUBLIC HEALTHCARE

Public healthcare as part of the healthcare system deals with health risks in the population. Findings in this area enable planning and programming of appropriate intervention procedures directed toward protection and improvement of health, i.e., prevention of unwanted health conditions and illnesses.

ECONOMY

Economy is the scientific discipline that studies how societies use limited resources to produce certain goods and services and distribute them among people.

MEDICAL BIOCHEMISTRY

Medical biochemistry is the branch of medicine that studies and measures biochemical disorders in population illnesses.

For kinesiological needs, the following has great importance:

- *within anthropology* – the most integral way possible of gaining knowledge about the structure of human body, developmental characteristics and variability of human traits and abilities over a lifetime, as well as the effect they have on success in different kinesiological activities;
- *within methodology* – learning the principles of measuring, methods for data analysis and use of computer in solving parameters of the governed exercise process;
- *within teaching methods* – comprehension of methods, models and modalities of the most efficient organization and implementation of the exercise process in general in all four areas of applied kinesiology;
- *within expert knowledge* – knowledge on kinesiological operators which can affect the transformation of anthropological characteristics, motor skills and health, and which do not necessarily belong to either known kinesiological activity.

BASIC TERMS IN KINESIOLOGY

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Considering the fact that kinesiology is a relatively young science and that there are a number of different terms used in kinesiology, which are often not standardized or used unambiguously, and considering there are often different names for the same concepts, we hereby offer a list of basic kinesiological terms in alphabetical order.

A

ABILITIES are genetically endowed perceptual, cognitive, motor, metabolic, and personality characteristics which are sensitive to small or non-existing changes through practice or training (*Hoffman, 2008*).

ACQUISITION is a mental process of forming an idea and establishing performance of motor movement (*Neljak, 2013*).

ACTIVE MOBILITY

- the possibility of achieving maximum amplitude of movement by one's own muscle power (*Prskalo, 2004*).

- is the ability of performing movement of the highest possible amplitude by one's own muscle power (*Findak & Prskalo, 2004*).

ACYCLIC MONOSTRUCTURAL SPORTS ACTIVITIES are underlain with complex movement structures of semi-open and open type which consist of several phases. Activities are performed in standard forms, respecting the biomechanical principles when covering a distance by one's body, a projectile or with the assistance of external force (athletic jumps and throws, alpine skiing, weight lifting, sailing) (*Milanović, 2013*).

ACYCLIC MOVEMENT is complex motor movement in which a body moves by different speed in irregular

time periods in different spaces without tendency to repeat the same movements. Characteristic examples of such movements exist in games, combat sports, artistic gymnastics, etc. (*Findak & Prskalo, 2004*).

ADAPTATION OR ADJUSTMENT

- process of changing athlete's characteristics and abilities which enable achievement of the best, or at least acceptable functioning in set or variable conditions of training or competition. Both training and competitive performance always set a well-defined level of demands, in energy and information sense alike, to which an athlete must adapt to participate in sport successfully (*Milanović, 2013*).

- long-term adaptation of human organism to environmental life conditions, environmental influences; long-term adaptation caused by planned transformation process during which changes occur in all important dimensions of a person, directed toward personal progress (*Neljak, 2013*).

- process by which one adapts to environmental conditions by self-improving the system (*Findak & Prskalo, 2004*).

- adaptation; organism's ability to adapt to its environment or new life circumstances (*Neljak, 2013*).

ADIPOSE TISSUE represents the amount of fat tissue which has a negative impact on organism's ability. Fat tissue is composed of "essential" and "nonessential" fat. "Essential" fat is made of 2-5% of non-fat body mass in form of lipid substances of the cells, and the "nonessential" or storage fat is made of subcutaneous fat tissue, yellow bone marrow and so called genital, perirenal, mesenteric and omental component. The upper limit of fat percentage for men is 25%, and for women 30%, whereas the minimal value of this percentage for men is 5-10%, and for women 15-18% (*Findak & Prskalo, 2004*).

AEROBIC ABILITIES

- the totality of organ functions upon which oxygen uptake and its utilization in tissues depends, with the heart stroke volume being the limiting factor (*Findak & Prskalo, 2004*).

- maximum work possibility of an organism with the presence of oxygen (*Sports lexicon, 1984*).

- work with the presence of oxygen (*Hoffman, 2008*)

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AEROBIC CAPACITY

- the highest level of transmission and release of aerobic energy in time unit of one minute. It is an important indicator of cardiovascular physical fitness. Training for improvement of aerobic capacity must affect primarily the physiological components of the oxygen transport system. The measure of aerobic capacity is the maximal oxygen uptake (VO_2 max) (*Heimer & Jaklinović-Fressl, 2006*).

- total amount of energy at organism's disposal, for the use of which it needs oxygen (*Sports lexicon, 1984*).

AEROBIC ENERGY refers to cellular (muscle) release of energy from those sources that are degraded in mitochondria (cellular power plants) with presence of oxygen (carbohydrates, fats, proteins) (*Heimer & Jaklinović-Fressl, 2006*).

AEROBIC FUNCTIONAL ABILITIES are defined as abilities of oxygen transport and utilization system and muscle system to deliver and, in biochemical processes for energy production, utilize oxygen for the purpose of performing muscle work (*Sekulić, Metikoš, 2007*).

AEROBIC THRESHOLD is the load level at which the concentration of lactic acid is 2mmola/l blood (*Heimer & Jaklinović-Fressl, 2006*).

AEROBIC TRAINING In less demanding training and competitive activities of prolonged duration, aerobic energy processes prevail, which enable constant compensation of the consumed anaerobic energy reserves by transporting oxygen on the periphery of the locomotor system for oxidative or metabolic activity and by removing and extracting waste products (*Milanović, 2013*).

AEROBICS is a system of exercises which are performed according to certain choreography, accompanied by suitable music, on dry land or water (aqua-aerobics).

The main goal is to improve abilities of the oxygen transport system (*Heimer & Jaklinović-Fressl, 2006*).

AESTHETIC ACTIVITIES are conventional activities whose basic aim is to reach some aesthetic criterion by performing allowed movements, and they are dominated by an acyclic type of movement which is performed according to some conventional system. This includes sports such as artistic gymnastics, ice skating, skating, dancing, rhythmic-sports gymnastics, diving, etc. (*Findak & Prskalo, 2004*).

AGILITY

- is the speed of movement direction change (*Prskalo, 2004*).

- the ability of efficient change of course and/or direction of movement (*Sekulić, Metikoš, 2007*).

- is coordinated motor activity of a body (*Heimer & Jaklinović-Fressl, 2006*).

AMATEUR ATHLETE is an athlete whose main occupation is not his sports activity (training and participating in sports competitions), i.e., who does not have a signed professional contract nor is he/she the employee of the club, and his/her income does not exceed the expenses of doing the sports activity (cost of sports equipment, gym rent, vitaminization, etc.).

AMATEUR SPORT

- in the sense of team sport, it refers to the segment of sport in which clubs are participants of competitions as amateurs according to the status defined by the international and/or national sports federation, i.e., by positive state regulations, and their athletes do not have signed professional contracts nor are they employed.

- in the sense of individual sport, it refers to the segment of sport in which participants in the competitive system do not have income other than that which represents the expenses of doing the sports activity (cost of sports equipment, gym rent, vitaminization, etc.).

ANAEROBIC ABILITIES

- abilities of phosphagen and glycolytic energy mechanism. Their indicator is "oxygen debt", which is the amount of oxygen an organism compensates for after it finishes work, based on energy demands in anaerobic conditions (*Findak & Prskalo, 2004*).

- anaerobic ability, maximum possibility of work of an organism without the presence of oxygen (*Sports lexicon, 1984*).
- work without the presence of oxygen (*Hoffman, 2008*).

ANAEROBIC ENERGY refers to cellular (muscle) release of energy from those sources that disintegrate without oxygen (*ATP, CP, anaerobic glycolysis*) (*Heimer & Jaklinović-Fressl, 2006*).

ANAEROBIC FUNCTIONAL ABILITIES are defined as organism's abilities to use glycolytic sources in anaerobic production of energy for performing muscle work and to efficiently tolerate biochemical changes that then occur in muscle cells (*Sekulić, Metikoš, 2007*).

ANAEROBIC THRESHOLD is the highest level of lactic acid concentration in the blood during load, at which aerobic energy processes maintain that concentration constant (4 mmol/l of blood). Further increase of intensity leads to prevalence of anaerobic glycolytic mechanism of energy release and sharp increase of lactic acid concentration in the blood, with the consequence of acidification and forced increase of intensity or even termination of activity. Anaerobic threshold is, therefore, a qualitative measure of the highest intensity of an activity performed based on oxidative phosphorylation without excessive use of the anaerobic energy mechanism. In other words, anaerobic threshold expresses the highest intensity of an activity in which the speed at which pyruvate is produced exceeds the speed of oxidative phosphorylation (*Heimer & Jaklinović-Fressl, 2006*).

ANALYTIC METHOD OF TEACHING (LEARNING)

- in sport implies a division of global movement structure into several phases, i.e., elements, which are learned separately and then, after certain time, technique elements learned in such manner are integrated into a whole (*Milanović, 2013*).
- implies division of the motor task which is being learned into its constituent parts. This method is applied mostly when learning motor tasks of high complexity (*Sekulić, Metikoš, 2007*).
- consists of piecewise learning of movement. Movement is decomposed, each part is learned separately and when those parts are learned, they are integrated into a whole. For a more successful

application of this method, one must be especially careful that every element of movement makes a logical unit, that students' individuality is not forgotten and that piecewise learning of movement does not take too long so they would not reach automatization, i.e., inability to integrate them into a whole (*Findak & Prskalo, 2004*).

ANTHROPOLOGICAL CHARACTERISTICS

- organized systems of all characteristics, abilities and motor information and their mutual relations. Anthropological characteristics include anthropometric characteristics, motor, functional and cognitive abilities, conative traits or characteristics of personality and social status (*Findak & Prskalo, 2004*).
- all systems of human characteristics. They include anthropometric characteristics, motor, functional and cognitive abilities, conative traits and social status of movement (*Neljak, 2013*).

ANTHROPOLOGY in kinesiology represents a number of scientific areas which connect kinesiology and anthropological scientific studies on one hand directed toward solving kinesiological problems, and on the other hand building kinesiological findings into them. Anthropology embraces biological anthropology, functional anatomy, physiology, pedagogy, psychology, sociology and medicine (*Findak & Prskalo, 2004*).

ANTHROPOMETRIC CHARACTERISTICS are part of anthropological characteristics defined as trait responsible for the growth and development dynamics and characteristics of built of morphological characteristics which include longitudinal and transverse bone growth, muscle mass and subcutaneous fat tissue (*Findak & Prskalo, 2004*).

ANTHROPOMETRICS is a set of methods and results of measuring that can be conducted on a living human being or a skeleton, and which enable quantitative determination of his morphological characteristics (*Sekulić, Metikoš, 2007*).

APPLIED KINESIOLOGICAL DISCIPLINE is related to teaching methods, and it studies specific educational principles in education, sport, sports recreation and kinesitherapy (*Findak & Prskalo, 2004*).

B

BALANCE

- is maintenance of body in balanced position (static in standing in certain position; dynamic in movement) (Prskalo, 2004).
- the ability of maintaining a stable position based on information from visual and kinesthetic analyzers and vestibular system (Neljak, 2013).
- the ability of maintaining a balanced position with the analysis of information about the position of the body which is obtained from kinesthetic and visual receptors (Sekulić, Metikoš, 2007).

BASIC KINESIOLOGICAL TRANSFORMATIONS scientific-teaching discipline which studies the most efficient training processes (kinesiological transformation processes) which can be used to improve functional, motor and anthropometric dimensions of human beings and maintain them at the attained level, regardless of age, sex and previously acquired motor skills (Sekulić, Metikoš, 2007).

BASIC ANTHROPOLOGICAL CHARACTERISTICS represent primary human capacities which enable optimal functioning of all organs and organ systems, i.e., abilities and characteristics of athletes which greatly affect success, i.e., performance quality of some sports activity. During an athlete's life, or more accurately, athlete's career, they are developed under the influence of biological determinants of growth and development (maturation), and under the influence of sports preparation (Milanović, 2013).

BIOLOGICAL ANTHROPOLOGY is a scientific discipline which studies biological laws on which procedures of orientation, selection, programming and monitoring of transformation processes are based. This discipline includes anthropometrics, basics of human genetics and principles of growth and development (Findak & Prskalo, 2004).

BIOMECHANICAL ANALYSIS represents a set of procedures for determining basic kinematic, kinetic and electromyographic parameters of movement structure in sport. It includes registration and analysis of space, time and space-time parameters, as well as values of forces which are developed in muscles and muscle groups when performing simple and complex motor activities in training or competitive conditions (Milanović, 2013).

BIOMECHANICAL, HUMAN MOVEMENT studies the structure and function of human beings; it uses principles and methods of mechanics in physics and technique (Atwater 1980; Hatze 1974; Winter, 1985 in Hoffman, 2008).

BIOMECHANICS is a science which applies mechanical laws to human beings, studying mathematical and physical principles which determine the efficiency of movement structures (Findak & Prskalo, 2004).

BIOTIC MOTOR SKILLS

- or natural types of movement include those motor programs (motor skills) which allow movement through space, overcoming obstacles, overcoming resistance from different external objects, manipulating objects (Sekulić, Metikoš, 2007).
- are a genetically conditioned human need which has a twofold function. Firstly, to acquire and perfect those motor skills that are important for solving everyday motor tasks over a lifetime, and secondly, to ensure optimal development of the highest number of anthropological characteristics, especially morphological, motor and functional characteristics (Findak & Prskalo, 2004).

BODY MASS INDEX (BMI)

- the ratio of body mass in kilograms divided by squared body height in meters (kg/m_2) (Heimer & Jaklinović-Fressl, 2006).
- ratio of body mass value, expressed in kilograms, and squared body height value, expressed in meters (Mišigoj-Duraković, 2008).

C

CIRCUIT TRAINING is training which can be conducted in several circuits, and only one series is performed at a work task, with a set number of repetitions with somewhat shorter recovery periods between series, i.e., work tasks and circuits (Milanović, 2013).

COGNITIVE ABILITIES

- or mental abilities enable reception, transfer and processing of information which is realized in person's contact with the environment. Even though they represent the basis of cognitive conscious activity, without them, it would be impossible to control the educational process (Findak & Prskalo, 2004).

- enable reception, transfer and processing of information which a person exchanges in contact with the environment. As they are essentially the basis of conscious human activity, any form of education process would be impossible without them (*Neljak, 2013*).
- comprehensive term referring to athlete's mental capacities which enable reception, processing, storage and use of motor information, and are a very important factor of success in sport. Cognitive or mental processes are perception, attention, visualization, reasoning and memory. Their influence in sport increases with the structural complexity of the sport (*Milanović, 2013*).
- cognitive abilities of human beings (*Sekulić, Metikoš, 2007*).
- human actions which require complex ways of thinking, including rational analysis and problem solving, in order to achieve a predefined goal. Most experts relies on highly developed cognitive abilities (*Hoffman, 2008*).

COMBINED METHOD OF LEARNING actually consists of analytic and synthetic method, and it is applied only in complex motor tasks. This method implies that a certain part of the task is done in a synthetic way, and the rest is done in an analytic way. In the end it is all combined (*Sekulić, Metikoš, 2007*).

COMPLEX ACTIVITIES

- study open systems which consist of complexes of monostructural and polystructural movements and network of roles within a certain inter-cooperative and external-agonistic activity in accordance with the principles for regulating maximal efficiency of those systems and planning and programming learning and exercise. This discipline includes ice hockey, hockey, basketball, soccer, volleyball, rugby, handball and water polo (*Mraković, 1997*).
- refer to activities whose aim is to hit a certain goal in space by a guided or thrown projectile, and which include a complex movement structure of cyclic and acyclic type, whose result depends upon cooperation among group (team) members. The examples of complex activities are the following sports: soccer, handball, basketball, volleyball, water polo, rugby, hockey, ice hockey (*Findak & Prskalo, 2004*).
- consist of complexes of simple and complex movements of one or more athletes in conditions of sports competition between individuals or teams. In

team sports, it is important for the level of cooperation between team members during a game to be as high as possible. The aim of this cooperation is to achieve player, i.e., result dominance over the opponent individuals or team. Activities can be differentiated as one-subject and two-subject (tennis, table tennis) and multi-subject (team sports games). In those sports branches the highest possible demands are made in relation to types of tactical decision making and action (*Milanović, 2013*).

- complex sports—studying open systems which consist of complexes of monostructural and polystructural movements and networks of roles within some inter-cooperative and external agonistic activity in terms of principles which regulate maximal efficiency of those movements and planning and programming of learning and exercise. This discipline includes ice hockey, hockey, basketball, soccer, volleyball, rugby, handball and water polo (*Momirović, 1984*).

COMPUTER SCIENCE in kinesiology studies the principles of programming and computer application in the analysis of kinesiological data and information systems of separate areas of applied kinesiology. This discipline includes computer system architecture, operating systems, systems for working with databases and specialized programs for numerical and statistical analysis (*Findak & Prskalo, 2004*).

CONATIVE DIMENSIONS

- or characteristics of personality are responsible for modalities of human behavior. As there are normal and pathological modalities of behavior, there are also normal and pathological conative factors (*Findak & Prskalo, 2004*).
- represent emotional and motivational aspects of psychological processes. Conative dimensions of personality can be crucial for efficient adaptation to conditions which represent sport and sports training, and consequently to sports success (*Milanović, 2013*).
- personality traits, they define types of behavior in various situations in which human beings find themselves during a lifetime (*Sekulić, Metikoš, 2007*).

CONDITION is psychophysical state of athlete's physical fitness, expressed by the level of development of speed, power and endurance, and appropriate psychological characteristics. Condition is one of important factors for achieving top sports results and

determines the limits of possibility of physical and psychological load put on athletes during training and competition (*Sports lexicon, 1984*).

CONDITIONAL TRAINING

- i.e., conditional preparation represents a set of training procedures for development and maintenance of athlete's functional and motor abilities and morphological characteristics in accordance with the demands of a certain sport (*Milanović, 2013*).

- systematic exercise directed toward perfection of abilities of power, speed and endurance. In general conditional training, exercises for extensive basic development, perfection and stabilization of power, speed and endurance are applied. In special conditional training specific exercises are used which are appropriate for certain sports branch, i.e., discipline (*Sports lexicon, 1984*).

CONTINUOUS EXERCISE METHOD is used in situations when equal consumption of energy is maintained constantly during training (*Sekulić, Metikoš, 2007*).

CONTINUOUS OR CONSTANT TRAINING METHOD can be conducted by standard (uniform) or variable (alternative) load. Continuous-standard method means that the attained level of load was evenly maintained from the beginning to the end of training activity, whereas continuous-variable method (discontinued method) means that load intensity during training activity was altered (*Milanović, 2013*).

CONVENTIONAL ACTIVITIES are activities whose contents are limited by rules, and their primary function is development of motor (*Findak & Prskalo, 2004*).

CONVENTIONAL MOTOR SKILLS are determined by rules, i.e., conventions, and are characteristic for specific sports disciplines and pertaining competitions (*Sekulić, Metikoš, 2007*).

CONVENTIONAL SPORTS Studying movement structures which are determined by conventions and mostly acyclic, in terms of principles that regulate maximal efficiency of those movements and planning and programming of learning and exercising. This discipline includes artistic gymnastics, ice skating, skating, rhythmic gymnastics and diving (*Momirović, 1984*).

CONVENTIONAL – AESTHETIC SPORTS ACTIVITIES include aesthetically shaped and choreographically set acyclic movement structures. They are usually performed in standard, but also in variable conditions. This group includes figure skating, rhythmic or artistic gymnastics, diving, dance, etc. (*Milanović, 2013*).

COORDINATION RHYTHM

- is the ability which allows performance of complex motor structures by following a given rhythm (movement is adapted to the given rhythm) or by changing the rhythm of movement structure performance without disrupting the basic characteristics of the movement structure (arbitrary adaptation of rhythm to the required movement structure) (*Sekulić, Metikoš, 2007*)

- is the ability to perform given movements in given or arbitrary rhythm (*Metikoš, Hošek, 1972*).

COORDINATION

- is the ability to control movements of the whole body or body parts, and it is manifested in quick and precise performance of motor tasks, i.e., solving motor problems quickly (*Milanović, 1997*).

- ability of motor task performance which is efficient in terms of time and space and rational in terms of energy consumption (*Sekulić, Metikoš, 2007*).

- denotes optimal mutual activity of the central nervous system and skeletal muscles in performing a purposeful motor act. Good coordination implies optimal time wise and topographic activity of those systems with minimal energy consumption (*Heimer & Jaklinović-Fressl, 2006*).

- is the ability to control body movements. It is manifested in quick and precise performance of complex motor tasks, i.e., solving motor problems as quickly as possible. To solve tasks in which this ability is manifested, higher regulation centers of the nervous system must be synchronized with the peripheral parts of the musculoskeletal system (*Prskalo, 2004*).

- is the ability to control movements of the body or its parts, it is manifested in quick and precise performance of complex motor tasks, i.e., solving motor tasks as quickly as possible. To solve tasks in which this ability is manifested, it is important for higher regulation centers of the nervous system to be synchronized with the peripheral parts of the musculoskeletal system. Action factors of coordination are speed coordination, rhythmic

coordination, speed of learning new motor tasks, timeliness, space-time orientation, agility, and balance (*Findak & Prskalo, 2004*)

- motor ability of efficient harmonization of movements of the whole body or its limbs in space, time and energy elements (*Sports lexicon, 1984*).

• ability of performing complex structures of motor movements (*Neljak, 2013*).

CORRECTION of motor movement is part of the teacher's oral presentation which is oriented toward warning about mistakes and their causes, and instructing students about possible ways of eliminating mistakes (*Findak & Prskalo, 2004*).

CURRICULUM is a document with prescribed names and number of the subjects and other school activities, as well as weekly and annual number of lessons for each subject and each class (*Neljak, 2013*).

CYCLIC ACTIVITIES denote activities in which movement structure is continually (cyclically) repeated (*Sekulić, Metikoš, 2007*).

CYCLIC MONOSTRUCTURAL SPORTS ACTIVITIES, in their basis, are simple movement structures of closed or semi-open type, which are repeated successively. This refers to the repetition of the same movements, i.e., cycles, such as the step in walking or running, pull in swimming or rowing, pedaling in cycling, etc. (*Milanović, 2013*).

CYCLIC MOVEMENT represents movement of a body through space by repeating a series of simple movements in equal time intervals. Characteristic examples of such movements are, e.g., running, swimming, rowing, etc. (*Findak & Prskalo, 2004*).

D

DYNAMIC FORCE is the measure of force of movement at concentric or eccentric muscle contraction (*Heimer & Jaklinović-Fressl, 2006*).

E

ECCENTRIC CONTRACTION is one in which a muscle does not succeed in overcoming the force which it is trying to resist, so, even though it is being maximally flexed, it becomes stretched (*Sekulić, Metikoš, 2007*).

EDUCATIONAL PROCESS is an organized process of influencing subject's anthropological characteristics, an organized process of learning (acquisition and perfection of skills, motor skills) motor movements, and organized process of influencing the educational effects in working with students (participants of the educational process), under direct teacher's guidance (*Findak & Prskalo, 2004*).

ELASTIC OR PLYOMETRIC STRENGTH-POWER

- represents a force created due to the synchronization of eccentric and concentric motor activity, e.g., depth jump (*Prskalo, 2004*).

- enables an athlete to act efficiently when, after amortization at landing, he has to take off immediately, i.e., when efficient synchronization of eccentric and concentric part of muscle activity is necessary (*Milanović, 2013 in Zaciorski, 2002; Dick, 2007*).

ELEMENTARY GAMES are characterized by simple rules, their contents represent elements from human or animal life, i.e., natural movement forms, and are therefore available to everyone (*Findak & Prskalo, 2004*).

ELITE SPORT is distinct orientation toward maximal development of factors which affect achievement of sports result, discrimination in selection of those at which it is aimed, professionalization of most of its participants (athletes, coaches, judges and other sports personnel), and specific technology of preparation, implementation and control of the training process (*Milanović, 2013*).

ENDOGENOUS LIMITING FACTORS are limiting factors form an internal source, i.e., source which comes from the subject itself. This group of endogenous limiting factors includes the ratio of innate and acquired portion of variance of human characteristics and abilities, changes of human characteristics and abilities over a lifetime, health status (*Findak & Prskalo, 2004*).

ENDURANCE

- is the ability to maintain given exertion for as long as possible. It is divided into general and local endurance (the criterion is the amount of activated muscle mass: more or less than 1/7-1/6). Endurance is also divided into aerobic and anaerobic, and static and dynamic. Endurance can be viewed as the ability of resistance (*Heimer & Jaklinović-Fressl, 2006*).

- is the ability to perform activities for a long period of time without lowering the level of its efficiency (*Prskalo, 2004 according to Zaciorski, 1972*).

- is the ability to perform activities for a long period of time without lowering the level of its efficiency. Endurance is determined by physiological, psychological, biochemical, biomechanical and motor factors (*Findak & Prskalo, 2004*).

- organism's ability to endure long-standing exertion. The level of endurance in sport is primarily affected by competitors' motivation and readiness to endure exertion (*Sports lexicon, 1984*).

- the ability of maintaining physical activity for a long period of time (*Hoffman, 2008*).

ENERGY COMPONENT OF LOAD has two basic components. The first one is intensity, i.e., strength and speed of stimulus, and the second one is extensity, i.e., duration and number of repetitions of stimulus (*Milanović, 2013*).

EVALUATION is related to the most objective way possible of determining the state of anthropological characteristics, level of motor skills and motor achievements, and pedagogical effects of work (*Findak & Prskalo, 2004*).

EXERCISE METHODS

- have a purpose of developing and maintaining functional and motor abilities and morphological characteristics of athletes. In the application of the exercise methods, energy processes and/or mechanisms of nervous-muscular regulation which can ensure intensity, duration and control of motor performance become more activated (*Milanović, 2013*).

- are methodological procedures used to create preconditions for a motor skill that has already been learned at a satisfactory level to be applied in terms of development and/or maintenance of distinct dimensions of anthropological status (*Sekulić, Metikoš, 2007*).

- are applied for development and maintenance of different anthropological characteristics. Out of the exercise methods, the following can be considered: methods of standard repeated exercise, methods of variable exercise and situation-based method of exercise (*Findak & Prskalo, 2004*).

EXERCISE PROCESS This concept refers to the application of quite specific structures of kinesiological stimuli with regard to the contents, volume and modalities of work (*Findak & Prskalo, 2004*).

EXERCISE

- is the act of managed or autonomous realization of motor tasks, the act of performing a motor task (*Neljak, 2013*).

- physical activity intended for improvement of one's health or changing the appearance of one's own body (*Hoffman, 2008*).

EXOGENOUS LIMITING FACTORS are limiting factors from an exogenous source, a source on which the subject does not have direct influence. This includes available time for exercise, material work conditions and personnel, and social interest for certain activity (*Findak & Prskalo, 2004*).

EXPLOSIVE POWER

- refers to the performance of a motor task during which maximal amount of anaerobic energy is released in the shortest time possible (throws, jumps, sprint, hits). It enables achievement of maximal acceleration of either one's body or an object or body which is being thrown or hit (*Heimer & Jaklinović-Fressl, 2006*).

- ability of activating a maximal number of muscle fibers in a unit of time (*Neljak, 2013*).

- ability of absolute excitation of a maximal number of muscle (motor) units in a unit of time, in a movement which is determined by the necessity of giving one-time acceleration to a body or external object, which results in efficient overcoming of distance (*Sekulić, Metikoš, 2007*).

- ability which enables an athlete to give maximal acceleration to his own body, some object or a partner. It is manifested in activities of throwing, shot put, jumping, hitting and sprint (*Milanović, 2013*).

- motor ability of overcoming certain resistances by high work intensity in a short time period. It is manifested in quick, explosive performance of

movements, i.e., short-term and maximal muscle contractions which are induced by high intensity of stimuli (*Sports lexicon, 1984*).

- is a dynamogenous ability which enables one to give maximal acceleration to one's own or some other body. It is manifested in activities such as throwing, jumping, hitting and sprinting (*Findak & Prskalo, 2004*).

EXTENSITY is a determinant of physical exercise execution which describes the duration of stimuli (*Neljak, 2013*).

FACTOR STRUCTURE OF SPORT consists of a number of athlete's abilities, characteristics and skills which affect success in individual sports branches. All basic and specific anthropological dimensions, as well as all components of technical-tactical preparedness have a clearly defined interactive relationship defined by correlation levels. In this way, they set up a unique factor structure and each factor, but also all factors together, determine success in different sports (*Milanović, 2013*).

FATIGUE is the state of temporary decline of the ability to perform work of certain intensity which is caused exactly by that work or some other activity. The occurrence of fatigue in sport primarily limits endurance, but also decreases the level of other functional-motor abilities. Fatigue is a reversible state of discomfort and temporary decline of work ability which is the consequence of prolonged or excessive strain. It is possible to differentiate between physical (muscular) and psychological (mental), and acute and chronic fatigue (*Heimer & Jaklinović-Fressl, 2006*).

FINAL STATE

- is the state of parameters at the end of some transformation process and is usually congruent with the state at the end of a school year (*Findak & Prskalo, 2004*).

- is that which is achieved as the consequence of the exercise process (*Mraković, 1997*).

- is the real and interpretable state of anthropological dimensions at the end of a transformation process.

FINAL TESTING

- is conducted at the end of a certain educational period, with the aim of determining the extent of the program that has been realized and determining the effects of that program (*Findak & Prskalo, 2004*).

- refers to the testing of anthropological dimensions at the end of a transformation process to determine the real final state of fitness of an individual or group.

FITNESS

- denotes a number of characteristics of an organism which are related to the ability to perform kinesiological activity. Another definition states that fitness is the ability to perform work. This definition refers primarily to performance of physical work (physical fitness). It is generally accepted that fitness is a functional-motor ability to perform professional and everyday activities without feeling overloaded. In sport and sports recreation, being fit means to have a high level of ability to perform given physical loads without feeling particularly overloaded (*Heimer & Jaklinović-Fressl, 2006*).

- ability, health, good physical fitness (*Sports lexicon, 1984*).

- developing capacity through exercise by enabling performance of important activities of everyday life, including an active lifestyle in leisure time and having enough energy left to meet unexpected demands in emergencies (*Hoffman, 2008*).

- a set of attributes a person has with regard to their ability to perform physical activities that require aerobic fitness, endurance, strength, or flexibility, and is determined by the combination of regular activity and genetically inherited ability (*Centers for Disease Control and Prevention*).

- five components of fitness include cardiorespiratory (heart and lungs) endurance, muscular strength, muscular endurance, body composition and flexibility. Cardiorespiratory endurance is the ability to perform sustained physical activity such as walking, swimming or running. Muscular strength and endurance are linked and are improved through use of weight-bearing exercise, such as weightlifting or using resistance bands. The proportions of muscle, fat, and body water make up body composition. Flexibility is related to range of motion and is improved by gently and consistently stretching muscles and the connective tissues surrounding them (*"Patient Page Fitness" 2005 December 21, Journal of the American Medical Association*).

FLEXIBILITY/ ELASTICITY– PLIABILITY:

- denotes the ability to perform maximal amplitude in one or more joints. It is the ability to, with restrictions put by the structure of the joint itself, stretch the muscle-tendon and connective system of

movement. Flexibility is specific for each joint or joint system, therefore the approach of assessing general flexibility should be avoided (*Heimer & Jaklinović-Fressl, 2006*).

- the ability of human locomotor system to perform one-time maximal amplitude of movement (*Neljak, 2013*).

- the ability to achieve maximal amplitude of voluntary movements in one or more joints (*Sekulić, Metikoš, 2007*).

- the ability to perform movements by great amplitude. The most common measure of flexibility is maximal amplitude of movements of body parts in distinct joint systems (*Milanović, 2013*).

- motor ability of performing movements of greater amplitude. The range of possible movement in one or more joints. Flexibility depends upon anatomic structure of the joint, i.e., upon attachments and extensibility of muscles and ligaments around the joint which performs the movement (*Sports lexicon, 1984*).

- flexibility is the ability to perform movements of greater amplitude. Measure of flexibility is maximal amplitude of movement in a joint system. Reaching maximal amplitude of movement by one's own muscle force is called active flexibility, and affected by some external force passive flexibility (*Findak & Prskalo, 2004*).

FORCE (DYNAMOMETRIC)

- is every action that changes the standstill state of some body or changes its uniform linear motion. Physical units are kilopond (kp) and newton (N). In muscle activity, force is the basic characteristic of contraction (*Heimer & Jaklinović-Fressl, 2006*).

- ability of absolute excitation of the maximum number of motor units in terms of achieving force with overcoming supramaximal resistance (*Sekulić, Metikoš, 2007*).

- which is developed and manifested by a muscle depends upon the number of activated motor units, where motor unit refers to a single nervous cell and all its pertaining muscle cells (excited by the nervous cell), and upon the frequency of activation of motor units in time (*Milanović, 2013*).

- is the basic effect of muscle contraction and therefore one of the basic parameters of function of the locomotor system. Force can be static and dynamic. Static force is underlain by isometric contraction, and dynamic force is underlain by isotonic or auxotonic contraction, and the result

is performed movement. A muscle can manifest force during lengthening in amortization plyometric regime (*Findak & Prskalo, 2004*).

FRONTAL INSTRUCTION is a methodical organizational work form in which all students perform the same task at the same time under direct guidance and supervision of the teacher (*Findak & Prskalo, 2004*).

FRONTAL TRAINING is an organizational work form in which the whole team simultaneously performs set training or training task under direct leadership form the coach (*Milanović, 2013*).

FUNCTIONAL ABILITIES

- may be defined as organism's abilities which are responsible for transport and production of energy in human body (*Sekulić, Metikoš, 2007*).

- abilities which determine the efficiency of the energy utilization system when performing work in different regimes (*Sekulić, Metikoš, 2007*).

- they are related to the efficiency of the oxygen transport system (aerobic ability), which ensures constant supply of the necessary amount of energy to muscles and other organs, which is essential for functioning and moderately intense work, as well as with efficiency of anaerobic energy capacities which enable successful performance of high-intensity sports activity when oxygen uptake is smaller than need for oxygen due to the inertia of the oxygen transport system and aerobic metabolism, so the difference in necessary energy is compensated from the glycolytic or phosphagen compounds by anaerobic metabolism. Depending on the intensity and duration of motor activity, one or the other energy system is activated (anaerobic glycolytic or anaerobic phosphagen capacity) (*Milanović, 2013*).

- include abilities of range and stability of transport system regulation, i.e., ability of releasing an adequate amount of energy in cells which enable maintenance of homeostatic conditions in the organism and carrying out specific functions of its separate parts (*Findak & Prskalo, 2004*).

- work efficiency of some organ system. Ability of the organism to endure exertion of certain intensity (*Sports lexicon, 1984*).

FUNCTIONAL ANATOMY is a scientific discipline that studies human body build and anatomical basics of organ systems' functions (*Findak & Prskalo, 2004*).

FUNCTIONAL DIAGNOSTICS is a system of measures and procedures for assessing functional abilities of organ systems (*Heimer & Jaklinović-Fressl, 2006*).

FUNDAMENTAL KINESIOLOGICAL DISCIPLINES

- determine general principles of efficient movements and laws that regulate transformation of anthropological characteristics under the influence of motor activities (*Momirović, 1984*).
- include general kinesiological disciplines and special kinesiology of conventional activities (*Findak & Prskalo, 2004*).

G

GENERAL KINESIOLOGICAL DISCIPLINES

- study general principles of governing the exercise process and consequences of those processes, laws of efficient movement and laws of regulating the transformation of anthropological characteristics and motor skills affected by the exercise process, which do not necessarily belong to some concrete class of kinesiological activities (*Mraković, 1997*).
- study general principles of governing the exercise process and the consequences of those processes, principles of efficient movement and principles of transformation of anthropological characteristics and motor skills affected by physical activities, which do not necessarily belong to some concrete class of kinesiological activities. This group includes systematic kinesiology, biomechanics and kinesiology on unconventional movements (*Findak & Prskalo, 2004*).

GENERAL KINESIOLOGICAL MOTOR SKILLS

- represent the most efficient exercise for the development of individual motor and functional abilities and morphological characteristics (*Sekulić, Metikoš, 2007*).
- include those motor movement structures whose primary function is that of development and promotion of distinct basic functional, motor and morphological characteristics (*Findak & Prskalo, 2004*).

GENERAL OR MULTILATERAL CONDITIONING is usually understood as the process of balanced and harmonious development of functional, motor

and some morphological characteristics, without particular emphasis on specific demands of certain sport (*Milanović, 2013*).

GOVERNED KINESIOLOGICAL PROCESS

- every governed process of work, i.e., system whose characteristic is constant information flow between the governing system and the governed system is called a kinesiological process (*Mraković, 1997*).
- is such governed process of work whose characteristic is constant information flow between the governing system and the governed system. Within the system there is a circular flow which is the difference between cybernetic and linear system, by which, in addition to governing, regulation is achieved (*Findak & Prskalo, 2004*).

GOVERNING EXERCISE PROCESS this concept includes all elements of dynamic relations of the governing system and the governed system, which relate to procedures of planning, programming, realization and control of the effects of certain exercise process (*Findak & Prskalo, 2004*).

H

HEALTH CHARACTERISTICS are the health status (indicates the health status of organs and organ systems) (*Sekulić, Metikoš, 2007*).

HEALTH

- is a state continuum which does not merely imply the absence of disease or infirmity, but it represents a capacity for successful endurance of everyday challenges and full achievement of life potential (definition of World health organization and International Federation of Sports Medicine—WHO and FIMS) (*Heimer & Jaklinović-Fressl, 2006*).
- a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (*Findak & Prskalo, 2004*).

I

IDEAL FINAL STATE

- can be defined as possible maximal final state, certainly far above average, because of which it is hard to achieve, especially in those activities for

which it is believed that the results are close to the limitations of human abilities (*Mraković, 1997*).

- is an optimal final state far above average, hard to achieve especially in those activities for which it is believed that the results are close to the limitations of human abilities. In competitive activities this would be the state of a champion athlete, and for each sport separately (*Findak & Prskalo, 2004*).

IDEOMOTOR TEACHING METHOD is part of other methods of acquisition and improvement in sport. Athletes mentally reproduce a given motor activity, which means that they try to repeat the motor task they are learning "in their head" (*Milanović, 2013*).

INFORMATION COMPONENT OF LOAD is made of the number (extensity) and difficulty, complexity (intensity) of information which a coach passes on to an athlete, and the athlete is supposed to understand it, i.e., decode it in optimum time (*Milanović, 2013*).

INITIAL STATE

- is the state which is determined before the beginning of some transformation process, and most frequently it is congruent with the state at the beginning of a school year (*Findak & Prskalo, 2004*)

- is related to the state of a man (for whom the exercise program is being designed) immediately before the beginning of kinesiological treatment. That state must be determined in the space of variables which describe the desired final state and it represents the basis for programming the exercise process (*Mraković, 1997*).

INITIAL TESTING is conducted to determine the actual state of the subject before the beginning of kinesiological treatment (*Findak & Prskalo, 2004*).

INTERVAL TRAINING METHOD

- basic meaning of this type of training is work with interruptions, which means intervals of work and intervals of rest alternate. The purpose of the interval of rest, i.e., pause, is twofold: to ensure organism's recovery from previous exertion and to prepare it for the next one (*Milanović, 2013*).

- periods of extremely intensive work and periods of "real"-passive rest are alternated (*Sekulić, Metikoš, 2007*).

- is a very efficient form of aerobic training in which, following some doctrine specific for certain sport or discipline, phases of high and low intensity of activity,

i.e., phases of stimulus and phases of recovery are alternated (*Heimer & Jaklinović-Fressl, 2006*).

- planned work on developing endurance in which alternation of phases of exertion and rest, i.e., intervals, is programmed. Periods of rest are planned so as to lead only to athlete's incomplete recovery. In interval training, phases of exertion and rest are repeated in certain rhythm, order and intensity (*Sports lexicon, 1984*).

INTERVAL - VARIABLE METHOD is significant change of workload which can be achieved by changing the section length or weight mass, tempo of performance, duration of rest and type of activities during the rest period (*Milanović, 2013*).

INTERVENTION RESEARCH is a research in which researchers attempt to change the target variable or target variables in some population sample by applying the correct procedure (*Heimer & Jaklinović-Fressl, 2006*).

ISOKINETIC TRAINING is related to generating muscle force against variable external resistance, where the movement is performed by constant linear or angular speed. In this way, a muscle can develop maximal force during the whole amplitude of movement (*Heimer & Jaklinović-Fressl, 2006*).

ISOMETRIC CONTRACTION

- in which a muscle maintains its length during work performance, but increases its tone (muscle tension). This contraction is also called static or isocentric ("constant-centric") (*Sekulić, Metikoš, 2007*).

- muscle activity during which muscle attachments remain always at the same distance, i.e., during the activity neither shortening nor extension of the fibers occurs. The contracted muscle is in balance with external forces and even though it does not perform any kind of work, it consumes significant amounts of energy. At isometric contraction, the exchange of nutrients in muscles is hindered, so fatigue which occurs during and after the activity is even greater (*Sports lexicon, 1984*).

ISOMETRIC TRAINING is the exercise system which generates muscle force against resistance which is biomechanically equal as that force, and there is no visible performance of movement (*Heimer & Jaklinović-Fressl, 2006*).

ISOTONIC CONTRACTION in which a muscle maintains tension during work performance, but the length (metrics) of the muscle is changed and in a way that it alternately shortens (during contraction) and lengthens (during relaxation). This contraction is also called dynamic contraction or “concentric” (“toward-center”) (Sekulić, Metikoš, 2007).

ISOTONIC TRAINING is the system of exercises against resistance during which muscle force is generated which is greater than the resistance, and concentric movement with different speed is performed. Aside from weights and machines, this type of training can be conducted against resistance from one’s own body mass (Heimer & Jaklinović-Fressl, 2006).

K

KINEMATIC ANALYSIS OF MOVEMENT is related to determination of precisely defined space, time and space-time values and relation between body segments, athlete’s body and the ground, and object, projectile in space in some movement structure, i.e., performance of technical or technical-tactical element (Milanović, 2013).

KINESIOLOGICAL ACTIVITY

- is a concept which is related to all motion activities. It is a broader concept than sport (modern dance, twirling, darts) (Neljak, 2013).

- different purposeful movement structures conditioned by biomechanical, utilitary characteristics determined by conventions of particular activities. Kinesiological activity can be monostructural, polystructural, acyclic (Sports lexicon, 1984).

KINESIOLOGICAL OPERATOR is a set of different movement structures which satisfy the aim of transformation processes to the maximum. These are exercises which are most efficient at affecting some characteristic or ability, motor information and health (Findak & Prskalo, 2004).

KINESIOLOGICAL PSYCHOLOGY studies the principles of adaptive reactions upon which the effect in kinesiologicaly oriented activities depends, and principles which regulate the effect of kinesiological treatment on development of adaptive abilities. This discipline includes general psychological principles, laws of development, learning and exercise principles, cognitive and motor abilities and conative

characteristics suitable for kinesiological goals (Findak & Prskalo, 2004).

KINESIOLOGICAL SKILLS are skills whose function is to realize certain characteristics and abilities and to achieve results in some kinesiological activity (Findak & Prskalo, 2004).

KINESIOLOGICAL SOCIOLOGY studies the structure and development of sociological characteristics which are significant for planning and programming of educational processes in general, and education, sport, recreation and kinesitherapy in particular. This auxiliary kinesiological discipline includes structure and development of dimensions of social differentiation and social mobility and their position in the system of anthropological dimensions related to kinesiological efficiency, group dynamics of school, kinesiological and other related groups, socialization and sociopathological phenomena and the effect of kinesiological activity of efficiency of socialization. A separate part of this discipline studies the educational process and kinesiological culture as a social phenomenon (Findak & Prskalo, 2004).

KINESIOLOGICAL STIMULUS

- is a combination of kinesiological operators and energy necessary for transformation processes (Findak & Prskalo, 2004).

- is a certain physical exercise or complex of exercises applied by a kinesiologist to conduct a transformation process on some subject. Its dosage depends on data and information about the kinesiological subject (Sports lexicon, 1984).

KINESIOLOGY OF AESTHETIC ACTIVITIES is the study of movement structures which are determined by conventions and mostly acyclic, in accordance with the principles of regulating maximal efficiency of those movements and planning and programming of learning and practice. This discipline includes gymnastics, figure skating, skating, rhythmic gymnastics and diving (Mraković, 1997).

KINESIOLOGY OF UNCONVENTIONAL MOVEMENT

- studies planning, programming, implementation, control and analysis of those transformation processes whose main aim is transformation of abilities and characteristics (primarily motor, functional and morphological dimensions), acquisition and improvement of basic motor information which have high utility in urgent situations, high utility in everyday life situations and high utility in acquisition

of new motor skills from different kinesiological activities (*Mraković, 1997*).

- is a general kinesiological discipline which studies planning, programming, implementation, control and analysis of those kinesiological transformation procedures whose main aim is transformation of abilities and characteristics (primarily motor, functional and morphological dimensions), acquisition and improvement of basic motor information which have high applicability in urgent situations or everyday life situations (*Findak & Prskalo, 2004*).

KINESIOLOGY

- is the scientific study on movement of the human body, principles of movement, governing the exercise and training processes and their effects on psychosomatic status of man (*Milanović, 1996*).

- kinesiology particularly studies those systematic movements (exercise, training) whose aim is organism's optimal development, improvement and maintenance of health, functional and work abilities, and especially reaching and maintaining characteristics, abilities and motor skills which are characteristic for competition-oriented sports activities and achieving top sports results (*Mraković, 1997*).

- a specific area of kinesiology is related to the study of the principles of movement in clinical and rehabilitation area of medicine, with the aim of increasing efficiency of medical treatments of certain illnesses (*Heimer & Jaklinović-Fressl, 2006*).

- scientific study on kinesiological phenomena, characteristics and structures in their numerous mutual relations with physical, biological, psychological and social conditions and effects (*Prot, 2003*).

- is a word of Greek origin (kinezis/-movement, motion and logos/-word, evidence, theory, affirmation, which means study of movement).

- kinesiology is the scientific study on the principles that regulate maximal efficiency of human movement and on transformation processes affected by motor activity (*Findak, 1995, Findak & Prskalo, 2004*).

- is a science which studies motion and human movement in all its forms and mutual relations, as well as relations of motion and movement with all other forms of human existence and activity (*Prot, 2001*).

- is a science which studies the principles of the governed exercise process and consequences of

the effect of those processes on human organism (*Mraković, 1997*).

- is the scientific study on specially conditioned movement, whose aim is to determine the principles of transformation processes affected by that movement (*Mraković, 1971*).

- is the scientific study on the principles which regulate maximal efficiency of human movement and on transformation processes affected by motor activity (*Findak & Prskalo, 2004*).

KINESIOMETRICS is a discipline which deals with problems of measuring in kinesiology (*Sports lexicon, 1984*).

KINESITHERAPY

- is a part of applied kinesiology which studies the effects of passive and active movements in correction of certain states, therapy and rehabilitation of some illnesses and injuries. Its findings are applied as complementary with other clinical and physical therapy procedures (*Heimer & Jaklinović-Fressl, 2006*).

- application of physical exercise with the purpose of medical treatment. Therapy with the aim of activating the organism and improving impaired functions. Exercises can be performed on one's own (active exercises) or with the help of a therapist or various aids (passive exercises) (*Sports lexicon, 1984*).

KINETIC ANALYSIS OF MOVEMENT is related to registration and evaluation of internal and external forces which are the result of activation of the nervous and muscular systems and which represent the prime mover of the body or its parts, as well as an object and and/or different apparatuses. Kinetic parameters are mutually related and, by interacting, they affect the quality and final effect of motor performance (*Milanović, 2013*).

L

LEARNING METHODS

- are applied in the learning process, i.e., mastering certain motor movement, as well as during the phase of its perfection. Basic learning methods in terms of attaining motor information (acquisition of motor skills and motor habits) are synthetic method, analytic method and combined method (*Findak & Prskalo, 2004*).

- are a set of methodological procedures which are used to create preconditions for learning some new motor skill or to perfect an existing motor skill (Sekulić, Metikoš, 2007).

LIMINAL STIMULUS is a combination of kinesiological operators and energy which is at threshold level and does not induce a process of adaptation, but maintains functions at a given level (Findak & Prskalo, 2004).

LOAD is the resistance an organism overcomes by its own muscles or the work an organism performs by its muscle activity. Load is expressed in units of mass, force, work or heart frequency level or energy consumption (Heimer & Jaklinović-Fressl, 2006).

LOAD VOLUME is an indicator of quantitative component of training work, quantitative measure of physical and mental exertion, the total amount of work performed per training unit, microcycle, mesocycle or macrocycle. It is expressed by amount of work of given intensity, i.e., number of repetitions, time spent on exercise, total weight lifted, meters ran, or energy consumption (Heimer & Jaklinović-Fressl, 2006).

LOCAL MOBILITY is the possibility of reaching maximal amplitude of movement in certain (topological) regions (Prskalo, 2004).

LONGITUDINAL RESEARCH METHOD

- implies monitoring one sample of subjects formed based on different criteria over the planned time of research duration. Changes in results in the measuring instruments are recorded over precisely determined time periods in continuity during the research (Prskalo, Sporiš, 2016)

- requires monitoring indicators of growth and/or development in the same examined group of children across several years (Mišigoj-Duraković, 2008).

M

MACROCYCLE

- is a time period of sports preparation which consists of two or three mesocycles and it is subject to competitive goals (Heimer & Jaklinović-Fressl, 2006).

- integral part of the training process which includes one or more year-long training cycles. Most

frequently it is a 4-year cycle, so called the Olympic cycle (period between two Olympics) (Sports lexicon, 1984).

MAXIMAL LOAD is related to the intensities in the level of anaerobic or aerobic capacity, i.e., application of resistance which is at the level of movement strength (Heimer & Jaklinović-Fressl, 2006).

MAXIMAL OXYGEN CONSUMPTION is the total amount of oxygen which can enter an organism in 1 minute, which determines aerobic capacity of an individual (Sports lexicon, 1984).

MAXIMAL OXYGEN UPTAKE is the highest amount of oxygen an organism can consume in one minute. Its symbol is VO₂max. Absolute VO₂max is expressed in liters of oxygen per minute (LO₂/min), and relative by millimeters of oxygen per kilogram of body mass per minute (mlO₂/kg x min⁻¹). Maximal oxygen uptake is a measure of aerobic energy capacity (Heimer & Jaklinović-Fressl, 2006).

MECHANISM OF MOVEMENT STRUCTURING is also called the general coordination factor because different coordination abilities underlie the controlling function of this mechanism (Sekulić, Metikoš, 2007).

MECHANISM OF SYNERGISTIC REGULATION AND TONE REGULATION is a regulative and integrative system which simultaneously controls the order, ratio and intensity of activation and deactivation of agonist and antagonist muscle groups, as well as the size of the force generated within them (Sekulić, Metikoš, 2007).

MEDICINE in kinesiology analyses pathological phenomena and processes which may occur during kinesiological activity, as well as their prevention and therapy. This discipline includes sports illnesses and sports injuries (Findak & Prskalo, 2004).

MESOCYCLE is time unit of training related to implementation of several microcycles. It lasts 3-6 weeks, and most often 4. Every mesocycle has some primary task. Dynamics of load in a mesocycle changes following a principle of gradual or interrupted load, i.e., increased load (Sports lexicon, 1984).

METHOD OF SITUATIONAL EXERCISE is somewhat more frequently applied in sports games and sports in which

some acquired motor skill is “tested” in situational conditions (training match, competition), but it is not rare within Basic kinesiological transformations. Some of the examples are different obstacle courses or relay races whose constituent parts are essentially different learned motor skills. The basis of application of this method is the high level of acquisition of the motor skill which is performed (Sekulić, Metikoš, 2007).

METHODICAL ORGANIZATIONAL WORK FORMS

- represent a manner of organization of exercise processes and achieving the aims of physical education, and they can be divided into frontal, group and individual method (Findak & Prskalo, 2004).
- represents a selection of organizational form in which training will be carried out (Sekulić, Metikoš, 2007).

METHODICAL PRINCIPLES point to the general guidelines for working in all organizational work forms in physical education teaching, as well as to the specificities that arise from their implementation in different conditions (Findak & Prskalo, 2004).

METHODICAL PROCEDURE is related to a series of specific alternating actions taken by a teacher towards a student (students) with the aim of easier performance of certain motor movement (exercise) and its more successful mastering (Findak & Prskalo, 2004).

METHODICS (TEACHING METHODS)

- is a science which studies educational principles in physical education teaching (Findak, 1999).
- is a science which studies educational principles in education, sport, sports recreation and kinesitherapy (Findak & Prskalo, 2004).
- scientific-teaching discipline which studies and applies principles of kinesiology in the area of education (Neljak, 2013).

METHODOLOGY

- represents an independent set of disciplines which study principles, systems and procedures of measuring, gathering and analyzing data and use of computer in solving typical kinesiological problems (Mraković, 1997).
- represents an independent set of disciplines which study principles, systems and procedures of

measuring, gathering and analyzing data and use of computer in solving typical kinesiological problems. These disciplines are kinesiometrics, statistics and computer science (Findak & Prskalo, 2004).

MICROCYCLE

- it makes basic cycle structure of the sports training process. Every microcycle is a relatively closed unit which is constantly repeated, with bigger or minor corrections, depending on the achieved effects under the influence of the work program in the previous microcycle (Milanović, 2013).
- an integral part of the training process which lasts for 6-14 days, usually one week (e.g., time between two competitions, i.e., two matches). Training sessions in a microcycle are planned and implemented according to the day, and character and dynamics of the load are similar to those in a mesocycle, the only difference being that immediate effects of each training session are being recorded (Sports lexicon, 1984).

MODEL CHARACTERISTICS are numerically expressed results achieved by top athletes in tests assessing basic and specific dimensions of physical fitness, as well as standard variables of situation-related efficiency during competition.

MONOSTRUCTURAL CYCLIC ACTIVITIES are those activities in which the whole activity consists of only one movement structure (Sekulić, Metikoš, 2007).

MONOSTRUCTURAL KINESIOLOGICAL ACTIVITIES

- include activities whose physical aim is always to travel a distance by one's own body or a projectile and which can be measured objectively, and it is dominated by a cyclic movement structure and the result usually does not depend on cooperation between group members (Mraković, 1997).
- include activities whose physical aim is always to travel a distance by one's own body or a projectile and which can be measured objectively, and it is dominated by a cyclic movement structure and the result usually does not depend on cooperation between group members. This includes the following sports: track and field, swimming, skiing, rowing, shooting sport, boccie, weight lifting, bowling, kayaking, archery, cycling (Findak & Prskalo, 2004).

MONOSTRUCTURAL SPORTS ACTIVITIES They include one or more closed movement structures of cyclic or acyclic character. They are defined by standard movement forms with very small variability of biomechanical parameters (*Milanović, 2013*).

MONOSTRUCTURAL SPORTS Studying movement s which make up one or more closed structures, in terms of principles which regulate maximal efficiency of those movements and planning and programming of learning and exercise. This discipline includes athletics, cycling, boccie, weight lifting, kayaking, bowling, swimming, skiing, archery, shooting sport, rowing (*Momirović, 1984*).

MORPHOLOGY is a scientific discipline which studies the structure and development of living organisms and their constituent parts at the level of visibility to the naked eye and microscope (*Sekulić, Metikoš, 2007*).

MOTOR ABILITIES DIAGNOSTICS provides information on the level of basic and specific fitness abilities which belong to the group of quantitative (power, speed, endurance, flexibility), i.e., qualitative (coordination, agility, precision, balance) abilities (*Milanović & Heimer, 1997*).

MOTOR ABILITIES

- are significantly involved in realization of all types of movement. They are underlain with the efficiency of organ systems of the human body, especially of the nervous and muscular system which is responsible for the intensity, duration and structural regulation of movement. Motor abilities enable strong, quick, long-term, precise or coordinated performance of different motor tasks. Athlete's motor, i.e., physical potential represents a maximal limit of physical, working ability achieved by an individual under the influence of hereditary factors and systematic training (*Milanović, 2013*).

- abilities which determine the possibilities of different motor manifestations of individual human entities (*Sekulić, Metikoš, 2007*).

- abilities which determine person's potential in performing motor manifestations, i.e., simple and complex voluntary movements which are performed by skeleton muscles activity (*Sekulić, Metikoš, 2007*).

- those aspects of intensity (strength or speed) and extensity (duration and number of repetitions) of motor activity which can be described by the same

parametric system, measured and assessed by an identical set of measures and in which analogue physiological, biochemical, morphological and biomechanical mechanisms are in action (*Zaciorski, 2002 in Milanović, 2013*)

- they are conditionally defined as latent motor structures which are responsible for practically an infinite number of manifest reactions and can be measured and described (*Findak & Prskalo, 2004*).

- psychomotor ability is a characteristic by which certain motor action is achieved. Regarding movement structure and space-time elements in which it is performed, there are psychomotor abilities of speed, flexibility, endurance, coordination, precision, power and balance (*Sports lexicon, 1984*).

MOTOR ACHIEVEMENT is a coupling of motor skills and motor abilities, and it is expressed through student's readiness to connect them and use them to the maximum for achievement of the best possible result in a concrete motor situation (*Findak & Prskalo, 2004*).

MOTOR MOVEMENT is a motor structure directed toward solving a certain motor task (*Findak & Prskalo, 2004*).

MOTOR PROFICIENCY is an acquired ability of performing learned motor movements (structures) at a higher level easily, quickly, rationally and efficiently (*Findak & Prskalo, 2004*).

MOTOR SKILLS

- represent the degree at which distinct motor structures have been mastered, and they can be at different levels (*Findak & Prskalo, 2004*).

- perfected motor record situated in respective motor zones of the central nervous system which enables performance of purposeful motor movement (*Neljak, 2013*).

MOVEMENT is the result of one or more dynamic muscle contractions (*Findak & Prskalo, 2004*).

MOVEMENT of body parts or the whole body, which is performed spontaneously or consciously. In physical education, movement is designed in the form of physical exercises which fulfill specific purposes of physical education, sport, recreation or kinesitherapy (*Sports lexicon, 1984*).

MOVEMENT SPEED refers to the distance traveled by the given point of body part per unit of time (measuring units at linear movement is m/s, and at circular movement degree per second-angular speed-°/s) (Heimer & Jaklinović-Fressl, 2006).

MUSCULAR ACTIVITY refers to muscular work with the associated increase of energy consumption above the level at rest (Heimer & Jaklinović-Fressl, 2006).

MUSCULAR ENDURANCE

- is defined as athlete's ability to perform training or competitive activities of certain load (at which given external load or weight on one's own body is overcome) for as long as possible without significant signs of fatigue (Milanović, 2013).

- refers to the ability of long-term performance of repeated movements with significant resistance from either one's own body or external load (Heimer & Jaklinović-Fressl, 2006).

- is defined as the ability of long-term work in which one must overcome certain load. If this refers to overcoming external loads (weight or partner), it is absolute strength, and when an athlete repeatedly overcomes the weight of his/her own body (pull-ups, push-ups), it is relative repetitive strength (Milanović, 2013).

- is the ability of long-term work based on interchanging contractions and relaxations of muscles (Neljak, 2013).

- is the ability of performing long-term repeated work in which external load is lower than 75% of the maximum possibilities and it is also related to endurance the ability of repeated excitation of muscle (motor) units, determined by medial and submaximal load, manifested through repetition of some movement (Sekulić, Metikoš, 2007).

N

NATURAL MOVEMENT FORMS are physical exercises which are, in movement structure, adjusted to every individual. These include walking, running, jumping, throwing, climbing, crawling, lifting, carrying, dragging, tugging, tumbling and rolling. They are applied especially in physical education of pre-school children and children in lower classes of elementary school (Sports lexicon, 1984).

NEUROMUSCULAR REACTION TIME (NRT) is the shortest time from the moment of stimulus (light, sound or mechanical) to the performance of given voluntary motor act. It is measured in milliseconds (ms) (Heimer & Jaklinović-Fressl, 2006).

O

OPERATIONAL PROGRAM

- is essentially a content-based concretization of the global program, and thus a good basis for designing the executive program. This program adds up to formation of teaching units (refers only to the part of the teaching unit for the main "A" part of the lesson) for each lesson (Findak, 1999).

- represents a content-based concretization of the global program, or more precisely, of that part which refers to certain homogenous group or an individual that belongs to it. A part of that program, besides determination of appropriate contents, is also the dosage, distribution and control of load (Findak & Prskalo, 2004).

OVERTRAINING

- is the state which is, despite of training, characterized by limitation of further development of motor abilities or even their decline as a consequence of overemployment of training intensity or volume. Overtraining, apart from the mentioned criterion, does not have unique symptomatology, therefore it is sometimes difficult to recognize and avoid it. There are two types of overtraining: sympathetic and parasympathetic (Heimer & Jaklinović-Fressl, 2006).

- state of an athlete due to repeated training sessions in subcompensation (Sekulić, Metikoš, 2007).

OXYGEN UPTAKE is the absolute or relative amount of oxygen consumed by an organism in one minute (Heimer & Jaklinović-Fressl, 2006).

P

PARTICIPATION IN SPORTS COMPETITION refers to participation of an individual athlete or sports team at official competitions organized by legal persons in the sports system registered for sports activity of organization and direction of sports competition.

PEDAGOGY

- as a science studies the educational process and that is why this process, as part of social reality, is the subject of interest of pedagogy, and is being studied and improved (*Vukasović, 1998*).
- in kinesiology is the study of physical education teaching (*Hoffman, 2008*).
- from the kinesiological standpoint, pedagogy includes the educational principles primarily in physical education teaching.

PERFECTING is improving, advancing, making something flawless. Mental process of transformation of acquired motor skills (information) to make something better, the best, perfect (*Neljak, 2013*).

PERIODIZATION

- is defined as temporal planning of training, and it refers to the division of a larger cycle to several smaller cycles (*Matvejev, 1999; Bompa, 2006; Issurin, 2008 in Milanović, 2013*).
- of sports training is an important part of planning the training process in sport. Determining cycles (periodization) has become a widely accepted and scientifically based category of contemporary sport (*Milanović, 2013*).

PHYSICAL ABILITY is related to the level of maximal functional-motor abilities at optimal body build and structure. This ability can be viewed as general and specific for each sport (*Heimer & Jaklinović-Fressl, 2006*).

PHYSICAL ACTIVITY

- refers to muscle work with increased energy consumption in leisure time, recreation and sport, in professional activity and usual daily activities (*Heimer & Jaklinović-Fressl, 2006*).
- is defined as any bodily movement produced by skeletal muscles that requires energy expenditure (*WHO, 2010*).
- every activity dominated by physical movement with higher or lower physical strain. Synonym for physical exercise in physical education, sport and recreation (*Sports lexicon, 1984*).
- movement which is voluntary, intentional, and directed toward achievement of a recognizable goal (*Hoffman, 2008*).

PHYSICAL EDUCATION as part of general knowledge refers to overall material and spiritual goods,

achievements and activities of society directed toward development of man and fulfillment of his needs through motor activity (*Findak & Prskalo, 2004*).

- a form and part of culture which consists of material and spiritual values achieved through physical education, sport and recreational activity (*Sports lexicon, 1984*).

PHYSICAL EDUCATION CIRCUITS (EXERCISE ACTIVITY STATIONS)

is a form of group work in which a class is divided into several smaller groups which perform different, usually familiar or simple exercises in a predefined order, planned load and time necessary for recovery, so that each participant in the process of physical exercise goes through all the stations, i.e., performs tasks in all work places in the circle. There are several forms of PE circuits in practice. Circuits with a set number of repetitions and time for recovery, circuits with set time for exercise and recovery, circuits with a set number of repetitions of exercise and circuits with exercising until dismissal (*Findak & Prskalo, 2004*).

PHYSICAL EDUCATION is an integral and inseparable part of physical education teaching directed toward acquisition and perfection of motor skills, as well as acquisition of theoretical knowledge, especially those that are required and applicable in everyday life and work (*Findak & Prskalo, 2004*).

PHYSICAL EDUCATION

- is an integral part of education. By physical exercises and sports activities, psychosomatic characteristics of children and youth are built and developed, formation of motor skills is affected, as well as perfection of motor skills and motor achievements and shaping of personality and preparation for life and work. Physical education programs take part in satisfying the need for movement, and therefore in stimulating adaptation and creative abilities in children and youth. The goal of health culture is the acceptance of life-long physical activity as a factor of protection and improvement of health, prevention of some chronic non-infectious diseases and improvement of quality of life (*Heimer & Jaklinović-Fressl, 2006*).

- is a permanent and systematic process of influencing human beings, especially in their youth, which uses various means, especially physical exercises, to build and comprehensively develop a student, affects the

transformation of his anthropological characteristics, formation of motor skills, perfection of motor achievements, takes part in shaping his personality and prepares him for life and work (*Findak & Prskalo, 2004*).

- physical education is part of the general education process, planned and systematic pedagogical process of building and shaping personality by applying appropriate motor activities. In physical education, by deliberate physical exercise, motor skills, habits and abilities are developed, health and hygienic tasks are affected, work and immune ability is elevated, recreation and active holiday are provided and moral and aesthetic values are formed (*Sports lexicon, 1984*).

PHYSICAL EXERCISE

- is motor movement performed by man and applied to develop and perfect one's characteristics and abilities (*Findak & Prskalo, 2004*).

- in terms of form and contents, it is precisely determined movement and motion taken from everyday work and military life, complete or partial elements of technique of separate sports branches and specially constructed motion that has entered the practice of physical education. Kinesiologically, every movement that represents a positive stimulus on human organism. Physical exercise is a complex psychophysical and biodynamic process in which man searches for such form and intensity of movement by which it would be easiest to achieve his goal (*Sports lexicon, 1984*).

PHYSICAL EXERCISE

- is planned, programmed and repeated physical activity the result of which is improvement or maintenance of one or more components of physical fitness (*Heimer & Jaklinović-Fressl, 2006*).

- adaptation process in which through systematic application of a series of deliberate motor activities educational goals are realized, as well as competitive, recreational or rehabilitation tasks. Unique educational process which consists of methodologically organized repetition of physical exercises with the aim of acquiring certain knowledge, skills, abilities and habits (*Sports lexicon, 1984*).

- is a unique psychomotor process in which concrete tasks of physical education are realized through multiple methodically organized repetition of physical exercise (*Findak & Prskalo, 2004*).

- realization of the planned number of motor tasks in given time (*Neljak, 2013*).

PHYSICAL FITNESS

- is complex athlete's state which implies his optimal health state, high level and desirable structure of functional and motor abilities and morphological characteristics, top technical and tactical preparedness and psychological stability. Physical fitness determines the level of athlete's specific work ability, his actual capacity for successful training and participation at competitions (*Milanović, 2013*).

- sports preparedness, state which indicates the level of athlete's conditional, technical, tactical and motivational preparedness for higher sports achievements. Transformed state of an organism subjected to systematic training. The level of physical fitness coincides with the level of sports form and in the course of a year it oscillates according to phases of the annual training cycle (*Sports lexicon, 1984*).

PHYSICAL PREPARATION is one of the basic functions of training which includes development of athlete's motor-functional abilities. It implies working on development of power, speed, endurance, flexibility, etc. It makes a basis for successful achievement of technical-tactical tasks, as well as overcoming any major load in training and competition (*Sports lexicon, 1984*).

PHYSIOLOGY is an auxiliary kinesiological discipline, and the subject of its study are the principles of functioning of organ systems upon which motor efficiency in kinesiologicaly directed activities depends and which regulate the effect of kinesiological treatment on development of physiological functions (*Findak & Prskalo, 2004*).

PHYSIOLOGY OF SPORT is part of applied physiology, which studies the behavior of functional and regulatory mechanisms immediately before, during and immediately after (during recovery), and under the influence of sports physical activity (training or competition) (*Heimer & Jaklinović-Fressl, 2006*).

PLANNING

- of sports training is a complex governing action which determines the goals and objectives of the training process, time cycles for their achievement (periodization) and necessary technical, material and personnel conditions (*Milanović, 2013*).

- procedures of determination of work conditions, subject's state and determination of the goal and objective of some program of physical exercise (*Neljak, 2013*).

- implies that it is predicted beforehand what will be done in a given period, i.e., when speaking of the educational process, in the period of one school year (Findak & Prskalo, 2004).

POLYSTRUCTURAL ACYCLIC ACTIVITIES

- have a goal of symbolic destruction of partner. They are dominated by acyclic movement structure, and the result is a binary variable, in which movement is performed and restricted in contact with the partner (Mraković, 1997).

- are acyclic activities whose goal is the symbolic destruction of partner and movement is performed and restricted in contact with the partner. Polystructural activities include the following sports: boxing, judo, karate, fencing, table tennis (Findak & Prskalo, 2004).

POLYSTRUCTURAL SPORTS ACTIVITIES are dominated by semi-open and open motor structures. They are performed in variable conditions. They consist of complex movement structures of acyclic character in which direct wrestling (wrestling, judo) or indirect, kicking (boxing, karate, taekwondo, fencing) overpowering of the opponent occurs, or counteracting of the opponent's action (Milanović, 2013).

POLYSTRUCTURAL SPORTS Studying the system of movements which include open and semi-open movement structures, in terms of principles which regulate maximal efficiency of those movement systems and planning and programming learning and exercise. This discipline includes boxing, judo, fencing, wrestling, table tennis, taekwondo and (Momirović, 1984).

POWER

- can be defined the same as strength, but at the condition that an athlete generates maximal muscle force in the shortest time period possible. That means that two athletes who have the same strength can have different power. The one who generates maximal force in the shortest time is more powerful (Milanović, 2013).

- is work done per unit of time, i.e., the amount of energy used per unit of time (Findak & Prskalo, 2004).

- psychophysical ability manifested in overcoming resistance by muscular action. It depends on physiological cross-sectional area, morphological

structure of muscles, biochemical processes in the organism, blood flow, use of energy reserves, etc. (Sports lexicon, 1984).

- maximal amount of energy exerted by muscle groups (Hoffman, 2008).

PRACTICING is a physical act of frequent repetition of motor movement or motor activity that an exerciser is attempting to learn, i.e., acquire and improve (Neljak, 2013).

PRECISION

- is a degree to which repeated measurements give the same results. It is also called repeatability (Heimer & Jaklinović-Fressl, 2006).

- ability of efficiently hitting an external object by a guided and/or ejected projectile (Sekulić, Metikoš, 2007).

- is the ability in the throwing and aiming activity which enables hitting a fixed or moving target at certain distance. When shooting, the object is given an impulse and after that there is no more influence on that object (Findak & Prskalo, 2004).

PRINCIPLES OF TRAINING in the area of sport are formed as guidelines, principles or standards which, by different levels of generalization and specificity, determine the laws of the training process in the function of safe achievement of optimal work effects. Principles defined in this way represent a significant link between scientific findings, expert knowledge and practical experience about certain phenomenon or process (Milanović, 2013).

PROFESSIONAL ATHLETE is an athlete whose main occupation is training and participation in sports competitions, which ensures him/her an income which is higher than the expenses of his/her participation in sports activity, and he/she can have a signed professional contract or be employed by the club, or have professional status acknowledged by an international and/or national sports federation, i.e., positive state regulations.

PROFESSIONAL SPORT

- in the sense of team sport, it refers to the segment of sport in which clubs are participants in a competition which was declared professional by an international and/or national sports federation, i.e., positive state regulations define it as such, and athletes have

signed professional contracts or are employed by the clubs. In the sense of individual sport, it refers to the segment of sport in which sport participants have professional status acknowledged by an international and/or national sports federation, i.e., positive state regulations, and athletes have incomes higher than the expenses for participation in sports activity (cost of sports equipment, gym rent, vitaminization, etc.) - sports involvement occurs as a profession, i.e., athletes' occupation. Regarding the achievement level, athletes can achieve substantial financial profit (*Milanović, 2013*).

PROFESSIONAL SPORTS CLUB is a sports club founded for performance of sports activity of participation in sports competitions, if the majority of athletes in senior competition has professional status in accordance with positive regulations.

PROGRAMMING

- is related to precise definition of the goal which is to be achieved by the program, determination of conditions and procedures of its realization and at the same time the possibility of verification of the level to which the program has been realized (*Findak, 1999*).

- procedures of selection, evaluation and distribution of program contents of physical exercise (*Neljak, 2013*).

- of sports training, is a set of governing actions which are carried out momentarily and in time, which clearly define the contents, loads and methods of sports preparation, which includes selection, dosage and distribution of operators of training, competition and recovery in defined cycles of sports preparation (*Milanović, 2013*).

- in physical education it implies explicit definition of goals and objectives of the program, determination of conditions and procedures of its realization and manners of verification of the program effects (*Findak & Prskalo, 2004*).

- procedure by which, from a set of different types of training, those types are selected which will, with regard to athlete's personality, enable achievement of the desired state (*Sports lexicon, 1984*).

PROGRESSIVE RUN is gradual acceleration with the purpose of achieving the greatest running speed possible. Acceleration in training or competition in running disciplines (*Sports lexicon, 1984*).

R

RECREATION

- is applied scientific discipline in the area of kinesiology which establishes and defines the ways of applying sports-recreational contents and programs of physical activity for health preservation and improvement (*Andrijašević, 2010*).

- branch of applied kinesiology which studies the principles of influence and application of kinesiological stimuli with the purpose of prevention of human health and on processes of improvement, regeneration and maintenance of basic biological, especially motor functions, until old age (*Sports lexicon, 1984*).

- is a wide selection of various activities and contents which can satisfy person's interests, and it is usually the result of a need to do something following one's own wishes and in one's own way (*Andrijašević, 2010*).

- includes different forms and contents of sports activities. Sports recreation refers to participation in different sports contents with different aim. Sports recreation is part of a wide area of recreation, where physical activation satisfies general human needs (*Andrijašević, 2010*).

- is the area of applied kinesiology which studies organizational, program, personnel, health, ecological and economical effects of sports-recreational activities. It applies findings with the aim of improving psychophysical, social and health characteristics of population (*Heimer & Jaklinović-Fressl, 2006*).

- is a way of using free time in modern society by sports and physical activation, consciously affecting health preservation and improvement (*Relac, 1975 in Andrijašević, 2010*).

- a part of overall human activity outside professional work, directed toward application of resources from the area of physical education with the purpose of maintaining and improving health, psychological unloading and elimination of negative consequences of modern way of working and living. Physical education resources are applied without coercion and obligation, they are selected according to person's needs and interest with the aim of improving general, functional and immune abilities of an organism, development of person's personality, fulfilment and development of his creation and spending time outside work in a meaningful way.

This is achieved best with specific organizational, program, methodical, and other procedures with change of activity and physical load which is different than that in professional workplace (*Sports lexicon, 1984*).

RECREATIONAL SPORT – SPORT FOR EVERYBODY

- is part of sport in which society ensures appropriate objects, available to every potential user of sports-recreational contents, and personnel which are sufficiently educated that they can set up and carry out a quality program, and participants of the program usually participate in covering the expenses of the exercise programs (*Milanović, 2013*).

- includes various types of organized kinesiological activities such as fitness, aerobics, pilates and similar programs which may contain elements of several sports and sports games with the aim of improving psychophysical abilities and health, without participation in the official competition system in sports recognized in terminology of sports organized by authorized national sports federations.

RELATIVE FORCE is the percentage of movement strength. It is used to denote training load, e.g., relative force of 65% denotes action against resistance of 65% movement strength (*Heimer & Jaklinović-Fressl, 2006*).

RELATIVE STRENGTH is the strength of movement per kilogram of body mass. It is important in sports activities in which body mass must be moved (gymnastics, jumps). It is expressed in kiloponds or newtons per kilogram of body mass (kp/kg;N/kg) (*Heimer & Jaklinović-Fressl, 2006*).

- represents a relation of absolute strength and body mass (*Prskalo, 2004*).

S

SCHOOL SPORT

- is related to sports activities among students, which are carried out in school sports clubs. For implementation of extracurricular school sports activities of students, school boards in primary and secondary school establish sports clubs (*Milanović, 2013*).

- students' sports activity during regular physical education classes as part of their overall education and outside regular school hours, during leisure

and relaxation hours (primary school) or during classes from programs chosen by the students and especially in extracurricular activities which are organized in school sports club as sports exercise, sports training and competition (schools of directed education) (*Sports lexicon, 1984*).

SCHOOL SPORTS CLUBS are organizations without legal personality founded by school boards in primary and secondary schools for implementation of students' extracurricular school sports activities (*Sports Act*).

SCIENCE is the totality of organized and generalized knowledge which includes observation, experiments, research and explanation of the facts and phenomena in specific parts of human understanding of nature and society (*Anić, 2006*).

SENSITIVE PERIOD is the optimum child's age for development of anthropological characteristics (*Findak & Prskalo, 2004*).

SIMPLE MOVEMENT SPEED is the ability of maximally fast performance of simple movement without added load or with minimal added load (*Sekulić, Metikoš, 2007*).

SITUATIONAL CONDITIONAL PREPARATION represents a set of programs for development of those functional and motor abilities that are closely related to high-intensity or multiple long-term performance of patterns of typical situations in a game, fight or athletic race, which make the tactics of a concrete sport. In situational conditions, high level of conditional abilities is always required for performance of the activity, thus, situational conditional preparation comes closest to integrated preparation (*Milanović, 2013*).

SITUATIONAL TEACHING METHOD is an exercise method which is applied when the contents of organizational form of work are identical as the competition goal, or, more accurately, when work takes place in conditions which are similar or equal to the competitive, i.e., real conditions in which some sports game takes place (*Findak & Prskalo, 2004*).

SKILL

- is an organized series of actions which are performed skillfully, ably and economically because there is a flexible, but systematic time organization of movement (*Nejtek, 2013*).

- quality physical activity which is the basis for performance of motor skills (*Hoffman, 2008*).

SPECIAL KINESIOLOGICAL DISCIPLINES represent a synthesis of those parts of principles of the exercise process which are typical for certain activity or group of relatively homogenous kinesiological activities (*Mraković, 1997*).

SPECIFIC KINESIOLOGICAL MOTOR SKILLS are those skills that, during their perfection, require significant changes of morphological, motor and functional characteristics, because those characteristics are the basis of success in kinesiological activities (*Findak & Prskalo, 2004*).

SPEED COORDINATION is performance of motor tasks in the shortest time possible (*Prskalo, 2004*).

SPEED ENDURANCE

- denotes time in which maximal speed can be maintained (*Heimer & Jaklinović-Fressl, 2006*).

- motor ability of prolonged maintenance of high intensity in physical activities, regardless of the increasing need for oxygen (it is directly dependent on anaerobic endurance of the organism (*Sports lexicon, 1984*).

SPEED STRENGTH is the ability of neuromuscular system to overcome given resistance by maximally quick contraction (*Heimer & Jaklinović-Fressl, 2006*).

SPEED

- is the distance travelled per unit of time. Physical unit is meter per second (m/s) (*Heimer & Jaklinović-Fressl, 2006*).

- is defined as the ability of fast reaction and performance of one or more movements, and movement of a body through space. It is reflected in travelling the longest possible distance in the shortest time possible, i.e., shortest time in given conditions (*Prskalo, 2004*).

- ability of fast reaction and performance of one or more movements which is reflected in traveling the longest possible distance in the shortest time possible (*Milanović, 2013*).

- is defined as the ability of fast reaction and performance of one or more movements and movement of a body through space, which is reflected in traveling the longest distance possible in

the shortest time possible in given conditions. Basic forms of speed manifestation are reaction time, speed of individual movement, speed of repetitive movements, and locomotion speed (*Findak & Prskalo, 2004*).

SPORT FOR EVERYBODY is a global and national movement with the aim of increasing the number of participants in sports-recreational activities appropriate for persons of different gender and age. One of the main goals of sport for everybody is improvement of the fitness level, protection and improvement of health, prevention of some chronic non-infectious diseases and improvement of quality of life (*Heimer & Jaklinović-Fressl, 2006*).

SPORT FOR PERSONS WITH DISABILITIES is intended for persons with certain health problems which hinder them from the usual engagement in sports activity (*Milanović, 2013*).

SPORT

- is the branch of applied kinesiology which studies the principles of effect and application of kinesiological stimuli on anthropological characteristics with the purpose of achieving top results in (*Sports lexicon, 1984*).

- includes different motor activities of variable and dynamic character in which, in a specific way, in competition and training, athlete's abilities, characteristics and skills come to the fore fully. Sport can be elite or selective (aspires to the best results possible in international distribution of sports achievement, requires athletes to invest great effort in a long-term training process which often reaches the limits of biological and psychological potential), and non-selective or sport for everybody. There are several different systems in sport: professional sport, amateur sport, school sport, university sport, recreational sport, and sport for people with disabilities. There are also individual and team sports (*Heimer & Jaklinović-Fressl, 2006*).

- every person's need and right and ideal resource for learning necessary life skills (*Ogi, 2003 in Milanović, 2013*).

- common term for physical activity predominated by competitive spirit, nurturing of physical characteristics and abilities, their testing and improvement through playing, fighting and competition. Sport is related to rules, which in every sports branch, i.e.,

discipline, prescribe certain norms and conditions of competition (*Sports lexicon, 1984*).

- physical activity in which movement is performed in order to achieve certain goal, in a way that is specified by set rules (*Hoffman, 2008*)

- is a form of physical education which in the broadest sense denotes every motor activity done by people to achieve maximal results (achievements), and it is carried out in form of competition (*Findak & Prskalo, 2004*).

SPORTS ACTIVITIES are activities which can be performed by, or for which can be registered, legal entities in the sports system of a country. Sports activities are not an internationally accepted notion, nor has their classification been standardized, therefore we provide a list of sports activities defined by the Sports Act (*Official Gazette, No.: 71/06, 150/08, 124/10, 124/11, 86/12, 94/13, 85/15 and 19/16*) in the Republic of Croatia which includes: participation in sports competition, sports preparation, sports recreation, sports lesson, organization of sports competition, direction of sports competition, management and maintenance of sports facilities and extracurricular sports activities and student sports activities.

SPORTS COMPETITIONS

- are sports events which represent an important part of governing preparedness and sports form (*Milanović, 2013*).

- part of the process of sports preparation, defined as motor activities by which sports preparedness of individuals or groups according to set rules and norms can be compared (*Thiessu et al., 1978; Bompa, 2000; Željaskov, 2004 in Milanović, 2013*).

SPORTS DIAGNOSTICS is a set of procedures for measuring, assessing and evaluating athletes' physical fitness level. It is an inevitable activity for improvement of sport and sports results. In the process of sports preparation, testing should be carried out (using measuring instruments – manifest variables), based on which all relevant dimensions of athletes' physical fitness are evaluated (*Milanović, 2013*).

SPORTS FORM

- is the state that should be achieved during the preparation period before the beginning of the competition session, during which sports achievement should be stabilized, and sports results

should reach their highest level at main competitions.

- optimal sports form and high competitive results do not necessarily have to be congruent (*Milanović, 2013*).

- the level of athletes' physical fitness, preparedness which allows them to reach the desired competitive success, i.e., readiness to achieve their best results at the most important competitions (*Vazny, 1978; Thies & Schnabel, 1987; Željaskov, 2004 in Milanović, 2013*).

SPORTS GAMES can be collective and individual, and they are characterized by competition between two teams or two individuals with the aim of winning and achieving the best result possible (*Findak & Prskalo, 2004*).

SPORTS LESSON refers to teaching the technique performance of some sport with the sole aim of mastering the technique without planning, programming, implementing and controlling a program of sports preparation or sports recreation.

SPORTS MEDICINE is part of primary healthcare of sports participants (athletes, coaches, judges, recreational athletes), which takes care of protection and improvement of health of sports participants, determination and assessment of their anthropometric and functional status with the aim of selection or monitoring the effects of training, and, independently or with other specialities if necessary, cares for treatment and rehabilitation of injured and ill athletes. Sports medicine includes health education of athletes and other sports participants, control of personal and environmental hygienic conditions, cooperation in athletes' nutrition, and fighting against the use of illegal substances and procedures (doping) (*Heimer & Jaklinović-Fressl, 2006*).

SPORTS PREPARATION refers to implementation of all types of training programs with athletes with the aim of developing anthropological characteristics, especially motor skills and abilities which are important for some sport or sports branch.

SPORTS TACTICS

- is defined as a deliberate, rational and economic way of governing a sports fight, i.e., competition (*Findak & Prskalo, 2004*).

- represent a way of action of individual athlete or a group of athletes during competition in relation to

the action of the opposing side – opponents, in the attempt to overcome, outsmart, outplay, i.e., disable their tactical attempts by conducting their own tactical activities (*Milanović, 2013*).

SPORTS TECHNIQUE

- is defined as rational and efficient performance of movement to solve certain motor task (*Findak & Prskalo, 2004*).

- specific way of performing movement in sports branches, i.e., disciplines. The course of application of movements by which a motor task is solved with relatively the highest efficiency. Technique is a specially constructed movement form, shaped in practice of physical education and sport, which occurs as the most efficient way of sports movement in some phase of their development, based on rational biomechanical principles of movement (*Sports lexicon, 1984*).

- refers to biomechanically correct and efficient performance of movement structures which make the motor contents of each sport. Rational technique enables an athlete to fully express personal functional and motor potentials. Basic characteristics of good sports technique are efficiency, economy and easiness of movement, and rhythmicity and harmoniousness of movement (*Milanović, 2013*).

- denotes coordinated efficient activity of handling aids (ball, javelin, bowling ball, oar, etc.) (*Heimer & Jaklinović-Fressl, 2006*).

SPORTS TRAINING

- is a complex transformation process consisting of ordered systems of training operators which are suitable for the determined athletes' states of physical fitness and the goals set by sports preparation in rounded cycles congruent with individual's giftness level, his or her level of self-activity and influence of environmental factors (*Milanović, 2013*).

- planned and programmed transformation process whose initial state, described by a set of indicators of physical fitness, is also changed into a new, desired state in accordance with the structure of success factors in each sport, individual characteristics of each athlete involved in the training process, periodization of training, competition calendar and acceptable recovery measures (*Milanović, 2013*).

SPORTS – RECREATIONAL MEDICINE is part of preventive and sports medicine which deals with health aspects

of regular sports-recreational activity and possibilities of application of sports-recreational activities in protection and improvement of health, functional and work abilities, prevention and complementary treatment of some health impairments and diseases, and improvement of quality of life (*Heimer & Jaklinović-Fressl, 2006*).

STABILIZATION is the state of initial reinforcement of motor skill (*Neljak, 2013*).

STATIC POWER – STRENGTH (STATIC FORCE)

- is the size of created movement force at isometric contraction of agonist muscles (*Heimer & Jaklinović-Fressl, 2006*).

- ability of maintaining excitation of muscle (motor) units, which finally enables maintenance of position which was assumed by activation of muscle (motor) units (*Sekulić, Metikoš, 2007*).

- is maximal force that can be manifested as a result of one maximal voluntary isometric contraction (*Prskalo, 2004*).

- ability of long-term isometric muscle work (*Neljak, 2013*).

STATISTICS studies methods and algorithms for analyzing data and testing hypotheses. This discipline includes functions of distribution, evaluation of parameters, correlation, regression and canonical analysis, analysis of variance and discriminant analysis, trend analysis and analysis of change, and methods for analyzing numerical data (*Findak & Prskalo, 2004*).

STIMULUS THRESHOLD represents the smallest amount of load that must be applied in a person to induce transformations in some dimension of anthropological status (*Sekulić, Metikoš, 2007*).

STRENGTH ENDURANCE is the ability of maximal isometric contraction of muscles, which enables maintenance of certain position in prolonged work conditions (bent arm hang) (*Prskalo, 2004*).

STRENGTH

- static or dynamic, is the greatest voluntary muscle force an athlete can perform in dynamic or static regime of muscle work, e.g., lifting heavy weights (1RM; dynamic strength) or trying to lift weights which an athlete cannot move (static strength) (*Milanović, 2013*).

- is the measure of one of the abilities of muscle contraction, and it is defined as maximal actual voluntary force of given movement (*Heimer & Jaklinović-Fressl, 2006*).

- is maximal voluntary actual force of movement, the greatest force of some movement which can be voluntarily manifested at a certain time (*Findak & Prskalo, 2004*).

- is an athlete's ability which is manifested in overcoming different resistances. It is developed and applied in different sports activities, because of which there are different types of action and topological manifestation of this motor ability (*Dick, 2007 in Milanović, 2013*).

STRUCTURAL ANALYSIS OF SPORTS ACTIVITY is a procedure for determining its typical structures, substructures and other constituent elements. It must answer the question on hierarchy and characteristics of technical and technical-tactical elements, i.e., their phases, subphases and structural units which make the motor contents of training or competitive activity typical for certain sports branch (*Milanović, 2013*).

SUBJECT OF RESEARCH OF KINESIOLOGY is determination of goals of some exercise process, determination of subject's state in relation to the goals and determination of principles and procedures of planning, programming and control of the exercise process (*Prskalo, 2004*).

SUBJECT'S STATE

- can be defined as a set of information of variables which describe quantitative and qualitative features of human characteristics and abilities, motor skills and health states (*Mraković, 1997*).

- is a set of information obtained by some measuring system. Subject's state is defined by the state of anthropological characteristics, state of motor skills, motor achievements, state of health and state of educational effects. Characteristic subject's state during transformation processes are initial state, transitive state and final state (*Findak & Prskalo, 2004*).

- targeted set of information obtained by testing and evaluating some subject before, during or at the end of the exercise process (*Neljak, 2013*).

SUBLIMINAL STIMULUS is such combination of kinesiological operators and energy which is below

certain threshold and does not induce adaptation processes but rather stagnation and decrease of a number of functions (*Findak & Prskalo, 2004*).

SUBMAXIMAL LOAD refers to those intensities or size of resistance that are part of aerobic capacity or part of movement strength (*Heimer & Jaklinović-Fressl, 2006*).

SUPERCOMPENSATION is a phenomenon of achieving a higher level of physical fitness than the initial, after the applied training and adequate recovery (*Sekulić, Metikoš, 2007*).

SUPRALIMINAL STIMULUS is such combination of kinesiological operators and energy which is above certain threshold and induces adaptation processes, but also inhibitory processes. This type of stimulus is necessary, not only in the process of individual's improvement in some kinesiological activity, but rather for every person in childhood and youth when positive change of the highest number of anthropological characteristics is possible (*Findak & Prskalo, 2004*).

SYNTHETIC METHOD OF TEACHING (LEARNING)

- in sport refers to learning a motor task as a whole. The essence of this method comes down to the following: an athlete, having perceived the motor task, realizes the task as a whole, concentrating the most on correct performance of the most difficult, i.e., the most important phase of the activity (*Milanović, 2013*).

- is applied in cases when motor skill is learned as a whole. This method is more appropriate for learning motor tasks of low complexity and simple movement structures (*Sekulić, Metikoš, 2007*).

- method of studying a subject in its wholeness, in unity and mutual relation of its parts (*Neljak, 2013*).

- is considered the most natural because movement is learned as a whole, i.e., the way it is seen and will be applied. The advantage of the synthetic learning method is in the fact that it allows students' individuality to come forth. This learning method is particularly suitable for working with children in lower grades of primary school. This is primarily due to the fact that students at this age observe all phenomena in their integral form, and secondly, because their abilities of analytic thinking are still modest. Besides, program contents for students

from first to fourth grade of primary school have quite simple structure so their learning as a whole, i.e., repetition with gradual correction of errors, is a great relief for the nervous system and it speeds up the automatization process (*Findak & Prskalo, 2004*).

SYSTEMATIC KINESIOLOGY

- includes general principles on the effect of kinesiological stimuli on human beings, general principles that regulate motor efficiency in people, as well as testing historical and social conditions in which in which development of physical education occurs (*Momirović, 1984*).
- studies general principles of the governed exercise process and consequences of those processes (*Mraković, 1997*).
- is general kinesiological discipline which studies general principles of the governed exercise process and consequences of those processes (*Findak & Prskalo, 2004*).
- branch of kinesiology which studies general principles of efficiency of motor movement and includes two disciplines, differential and genetic kinesiology. Differential kinesiology determines the differences in principles which are manifested in athletes and refer to gender and social economic affiliation. Genetic kinesiology studies principles of development of psychophysical abilities affected by movement (*Sports lexicon, 1984*).

T

TACTICAL PREPAREDNESS includes specific knowledge and skills for efficient performance of typical structures of situations in each sport. It refers to athletes' abilities which enable quick noticing of space-time relations "on the field", scanning motor memory and making quality tactical decisions for correct performance of tactical tasks with the aim of successful solving of situational problems (*Milanović, 2013*).

TEACHING METHODS are applied for acquiring motor information and their reinforcement through improvement and stabilization of motor programs related to athlete's technical-tactical action. After they have been acquired, they must be practiced, i.e., "honed" to the level of stable motor skill and habit.

Information processes underlie teaching methods. These processes include reception, transmission, processing, retention and use of motor information integrated into programs of motor activity in familiar and unfamiliar situations during training and competition (*Milanović, 2013*).

TEACHING PROCESS

- is a part of the educational process, but also is foundation. Teaching is the most planned, the most organized and the most purposeful part of the educational process (*Findak, 1999*).
- is teacher and students' joint work whose aim is for the students, with teacher's guidance, to realize anthropological and educational objectives of physical education (*Findak & Prskalo, 2004*).

TECHNICAL PREPAREDNESS Includes specific knowledge and skills necessary for correct performance of typical movement structures in each sport (*Milanović, 2013*).

THEORETICAL KNOWLEDGE Knowing the terms and principles and research strategies which are used to discover them. Theoretical knowledge in kinesiology is knowledge on physical activity, incorporated in subdisciplines (*Hoffman, 2008*).

THEORY OF TRAINING is applied kinesiological, scientific-teaching discipline which studies the sport system with consideration to historical, cultural, economic and political conditions of its structure and functioning at national, regional and local level, and theoretical and methodological bases of planning, programming and control of training, competition and recovery of selected athletes in all phases of long-term sports specialization for achieving maximal efficiency at all competition levels (*Milanović, 2013*).

THERAPEUTIC EXERCISE is a systematic and scientific application of exercise and movement for development or restoration of muscle power, endurance and flexibility, neuromuscular coordination, cardiovascular efficiency and other health-related factors of efficiency (*Hoffman, 2008*).

TOTAL LOAD-WORKVOLUME in training and competition is defined by two components. The first one is the energy component of load, which is underlain with energy flow and the level of nervous-

muscular activation, which is manifested mostly during conditional exercise. The second one is the information component of load, which is underlain with the exchange of information between coach and athlete and between athletes themselves, and it is manifested in motor teaching and learning. Athletes constantly, by perfecting their performance, and especially by solving tactical problems, overcome the information component of load (*Milanović, 2013*).

TRAINING EFFECT is adaptive response of an organism to long-term training (*Heimer & Jaklinović-Fressl, 2006*).

TRAINING LOCALITIES represent different spaces, both open and/or closed objects, at which training processes or various competitions are carried out (*Milanović, 2013*).

TRAINING OPERATORS are stimuli, incentives which produce changes in components of physical fitness and sports form (*Milanović, 2013*).

TRAINING

- is a complex sports-pedagogical process in which an athlete, through appropriate physical exercise, trains for higher achievements in sports branch of his choice. Training is a special process of physical education in which athlete's physical, psychological, moral-voluntary and character qualities are formed and perfected in certain sports branch. The term training includes conditional (or physical) preparation, technical, tactical, psychological and theoretical-expert preparation (*Sports lexicon, 1984*).

- conducting physical activity with the explicit aim of improving performance in athletic sense or some other type of event (*Hoffman, 2008*).

TRANSFORMATION OPERATORS represent the totality of kinesiological contents, methods and procedures by which a subject's state is changed (*Sekulić, Metikoš, 2007*).

TRANSFORMATION PROCESS

- includes planning, programming, implementation and control of the exercise process in order to achieve a predefined goal, and the goal of transformation processes is to achieve such changes in a subject which come closest to the ideal final state (*Findak & Prskalo, 2004*).

- process of changes caused by planned and programmed physical exercise in an attempt to achieve a predefined goal (*Neljak, 2013*).

TRANSITIVE OR CONTROL STATES

- are important for calculating the effect and correction of further exercise process. The number of transitive states depends upon numerous factors, such as the type of activity and subject's adaptability, but primarily upon frequency of supraliminal stimuli. Namely, as the frequency of exercises by which certain goals are achieved is increased, it is normal to assume that adaptation processes will be faster, so it is necessary to perform the control of those processes more often (*Mraković, 1997*).

- are states of parameters during a transformation process, which are generally numerous and represent the basis for monitoring and correcting work (*Findak & Prskalo, 2004*).

TRANSITIVE TESTING

- is carried out during school year to determine the degree to which the program has been realized at the moment of testing (*Findak & Prskalo, 2004*).

- refers to testing of anthropological dimensions during a transformation process with the aim of determining the current state of fitness of an individual or group.

U

UNCONVENTIONAL ACTIVITIES are those kinesiological activities whose contents are not limited by rules, and their primary function is the development of characteristics and abilities. These contents may also serve to develop skills if the contents from the structure of exercises are literally elements of technique of some kinesiological activity (*Findak & Prskalo, 2004*).

UPBRINGING

- is a constant and continuous process, and possibility of pedagogical influence in physical education teaching is great, work with students should be organized and implemented so that during classes and other organizational types of work, permanent pedagogic influence on students is ensured (*Findak, 1999*).

- from kinesiological point of view, upbringing is a permanent planned process of forming certain characteristics, abilities and skills which improve one's health and attitude towards environment, particularly work, nature, society and other people (*Findak & Prskalo, 2004*).

UTILITY is the size of effect on certain dimension of anthropological status (*Sekulić, Metikoš, 2007*).

V

VALIDITY indicates the level to which measuring in a research measure the precisely targeted characteristic (*Heimer & Jaklinović-Fressl, 2006*).

VALORIZATION OF EFFECTES OF THE EXERCISE PROCESS is the estimate of goal achievement, estimate of achievement of final state, set norms or criteria for each characteristic, ability and motor skill or their mutual relations, moreover, those that were the subject of kinesiological treatment (*Mraković, 1997*).

W

WARM UP/COOL DOWN Warm up is a part of individual training session or preparation for competition, increasing the level of organism's functions necessary for physical activity. Cool down is the opposite process in which an organism returns from the level of work functioning to the level at rest (*Heimer & Jaklinović-Fressl, 2006*).

WELLNESS is the system of measures and procedures for improvement of health and quality of life (*Heimer & Jaklinović-Fressl, 2006*).

WORK INTENSITY

- is work performed in a unit of time or the amount of released energy in a unit of time (energy tempo). Physical units are watts (W), kilopond meters per minute (kpm/min), calories per minute (Kal/min), oxygen uptake (VO_2 -L/min) (*Heimer & Jaklinović-Fressl, 2006*).

- represents the extent of performed work in a unit of time. Depending on the intensity of work are its duration, energy consumption, oxygen consumption, concentration of metabolism products in blood and tissues, pulmonary ventilation, cardiac minute

volume, concentration of blood sugar and finally adaptation of the organism and organ systems (*Findak & Prskalo, 2004*).

- a component of conducting physical exercise which describes the level of stimulus strength (*Neljak, 2013*).

- the extent of exertion during a unit of training or time unit. Activities in training can be performed by different intensity (maximal, submaximal, medium, low), of which the possible duration of the activity also depends, from a couple of seconds at maximal to several hours at low intensity, intensity of load is an important measuring category of physical work, i.e., training exertion (*Sports lexicon, 1984*).

WORK METHODS

- are modalities of work, and as they occur in every form and stage of the physical exercise process, they are also a part of work (*Findak & Prskalo, 2004*).

- connected sets of procedures used to prepare and conduct the process of physical exercise in all types of work in the area of physical education (*Neljak, 2013*).

WORK VOLUME OR WORK AMOUNT

- is defined by three independent components: intensity, intervals and duration of work. The principles on which these components are based arise from certain biotic laws of human organism functioning (*Mraković, 1997*).

- it can be defined as total amount of work performed per training unit (training session, PE class), or in certain time period (for example in a month or one competition season) (*Sekulić, Metikoš, 2007*).

- it is defined by intensity, intervals of work and rest and duration of work (*Findak & Prskalo, 2004*).

- exercise volume-determinant of exercise which describes its total amount (*Neljak, 2013*).

BASICS OF MEASURING IN KINESIOLOGY

4

DAMIR JURKO
DRAŽEN ČULAR
MARKO BADRIĆ
GORAN SPORIŠ

ETHICAL RESPONSIBILITIES AND PROTECTION OF RIGHTS OF RESEARCH SUBJECTS

The aim of ethical responsibilities of authors is to induce understanding and acceptance of basic principles of morally justified behavior and their application in the specific context of scientific research. Given that the area of ethics is relatively wider than the legal framework, the code of ethics attempts to assert and promote sensitivity to values which are specific for scientific work in the broadest sense, and which are not or have not yet been integrated into the existing legislation of each country. The starting premise implies that all presented research results are congruent with the conducted research studies, and data, results and ideas are not fabricated, falsified or plagiarized, not even to the smallest extent. Researchers and institutions at which the research studies are conducted, are required to comply with respective international and national laws and regulations on protection of human subjects. They must also guarantee voluntary participation and informedness of all subjects, confidentiality, privacy and anonymity of subjects' information, and favorable risk/benefit ratio for the subjects.

Examples of unethical acts:

- fabrication of data or results and their publishing;
- falsification – abuse of research materials, equipment or procedures, and change and subsequent manipulation of original data or their unfounded exclusion from analysis (e.g., to “embellish” the results);
- plagiarism – copying or taking credit for someone else's ideas, thoughts, words and results, presenting them as your own or new; regulations, i.e., specificities of each academic discipline regarding convention, style and expectations related to citation of published papers should also be taken into consideration;
- disabling future work of other researchers or research groups by deliberate damage to or destruction of materials, equipment or data;

- redundant, i.e., dual publication of the same original research result (unless it is otherwise officially regulated, with clear indication and approval from the primary publication);
- submitting the manuscript for revision or publication in more than one journal, unless it is otherwise regulated;
- authorship misuse: gift authorship (undeserved authorship), planted authorship (author named without his/her knowledge), individuals not named as authors but who contributed substantially to the work;
- deliberate inaccurate or biased citation of literature;
- distorted and false reporting on the status of one's own papers (e.g., “in print” or “Accepted for publishing” when this is not true);
- hiding the conflict of interest and bias.

MULTIPLE SUBMISSION

Submission and publishing of the same manuscript in two or more different journals at the same time is strictly forbidden.

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Using someone else's work and presenting it as one's own without permission from the author is illegal. To avoid awkward situations, most journals, before publishing the “accepted” materials, ask for written consent for their use from the original author, but also from the previous publisher, as it is often the case that authors transfer their rights to the publishers. Some publishers give permission for reproduction of materials with no fee, but there is a certain number of renowned publishers who charge certain fees for the use of materials published in their publications.

A SAMPLE LETTER REQUESTING PERMISSION TO REPRODUCE COPYRIGHTED MATERIAL

25th May 2016

*Assist.Prof. Damir Jurko, PhD
Faculty of Philosophy, University of Split
21000 Split*

Dear colleague,

*I am working on preparing the materials for publishing a university textbook titled: “How to prepare, write and publish a scientific paper – methodology of scientific-research work in kinesiology and sport”, and I would like to kindly request permission for reproduction of Figure 2. from your book:
Jurko D., Čular D, Sporiš G., Badrić, University textbook: Basics of Kinesiology, (2015)*

The note acknowledging the source of the reproduced figure will be written next to the figure, and full reference will be given in the reference list. If this way of acknowledging the source of the reproduced figure is not fitting, please inform me so I could write it in a way that is mutually satisfactory.

*Best regards,
Assist.Prof. Dražen Čular, PhD
Faculty of Kinesiology, University of Split
Teslina 6, 21000 Split
e-mail: dcular@kifst.hr*

Violation of ethical principles is unfortunately discovered after the manuscript has already been published. Development of information technology allows daily development of more sophisticated computer software for discovering plagiarism during submission of manuscripts to a journal. To preserve the quality of their journals, editors are using computer software for discovering plagiarism increasingly often.

AN EXAMPLE OF RESEARCH FORMS (ETHICAL AND PROFESSIONAL APPROACH)

INFORMED CONSENT - CHILD (A)

Statement by the Parent/Guardian giving consent

I have been asked to give consent for my daughter/son to participate in this research study which will involve him/her completing one psychophysical test, one questionnaire and some physical tests. I have read the information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily for my child to participate as a participant in this study with the title: Action anticipation in volleyball and relation with physical skills.

CHILD

FIRST NAME _____

SURNAME _____

PARENT OR GUARDIAN

FIRST NAME _____

SURNAME _____

SIGNATURE OF PARENT OF GUARDIAN _____

DATE (DAY/MONTH/YEAR) _____

STATEMENT BY THE RESEARCHER/PERSON TAKING CONSENT

I assisted to the read of the information by the Parent/Guardian or I have accurately read out the information sheet to the Parent/Guardian of the potential participant, and to the best of my ability made sure that the person understands that the following will be done:

- 1 Psychophysical test will be performed;*
- 2 Questionnaire will be administrated;*
- 3 Physical tests will be performed;*
- 4 Superficial electromyography will be recorded.*

I confirm that the Parent/Guardian was given an opportunity to ask questions about the study, and all the questions asked by him/her have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily. A copy of this Informed Consent Form has been provided to the parent or guardian of the participant.

PRINT NAME OF RESEARCHER/PERSON TAKING THE CONSENT

FIRST NAME _____

SURNAME _____

SIGNATURE _____

DATE (DAY/MONTH/YEAR) _____

INFORMED CONSENT - ADULT (B)

Statement by the Parent/Guardian giving consent

I have read the information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study with the title: Action anticipation in volleyball and relation with physical skills.

CHILD FIRST NAME

SURNAME

PARENT OR GUARDIAN FIRST NAME

SURNAME

SIGNATURE OF PARENT OF GUARDIAN _____

DATE (DAY/MONTH/YEAR) _____

STATEMENT BY THE RESEARCHER/PERSON TAKING CONSENT

I assisted to the read of the information by the participant or I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the person understands that the following will be done:

- 1 Psychophysical test will be performed;*
- 2 Questionnaire will be administrated;*
- 3 Physical tests will be performed;*
- 4 Superficial electromyography will be recorded.*

I confirm that the Participant was given an opportunity to ask questions about the study, and all the questions asked by him/her have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

PRINT NAME OF RESEARCHER/PERSON TAKING THE CONSENT FIRST NAME

SURNAME

SIGNATURE _____

DATE (DAY/MONTH/YEAR) _____

INFORMED ASSENT (C)

This informed assent form is for whom is invited to participate in research Action anticipation in volleyball and relation with age and physical skills.

Principal Investigator: Prof. Johnny Padulo, PhD

Organization: Faculty of kinesiology, University of Split

Sponsor:

Research Project: Action anticipation in volleyball and relation with age and physical skills

• **PART I: INFORMATION SHEET**

Introduction

My name is Johnny Padulo and my job is to research and test how the volleyball actions are recognized along the development and understand if this ability is influenced by some physical skills like strength and speed.

I am going to give you information and invite you to be part of a research study. You can choose whether or not you want to participate. We have discussed this research with your parent(s)/guardian and they know that we are also asking you for your agreement. If you are going to participate in the research, your parent(s)/guardian also have to agree. But if you do not wish to take part in the research, you do not have to, even if your parents have agreed.

You may discuss anything in this form with your parents or friends or anyone else you feel comfortable talking to. You can decide whether to participate or not after you have talked it over. You do not have to decide immediately.

There may be some words you do not understand or things that you want me to explain more about because you are interested or concerned. Please ask me to stop at any time and I will take time to explain.

PURPOSE: WHY ARE YOU DOING THIS RESEARCH?

You have to know that you are able to recognize the others' action even if you do not see the entire action and, during the game, you are able to recognize early that your opponent is serving toward you or toward your friend and hence you will react differently at the two conditions. This capacity increases with your experience and with training but it is not clear if you react early with your feet or with your arms. Based on this problem, we will ask you to answer both with your arm and with your feet at the test that we are going to explain you later. Finally, we think that your strength and speed can influence your ability to react to others' actions and to test this we will ask you to perform jump tests and a serving test. After that we will find any possible relation between the action recognizing ability and your physical skills.

CHOICE OF PARTICIPANTS: WHY ARE YOU ASKING ME?

We are testing the hypothesis that we reported above in a person like you because we know that you are a good volleyball player.

PARTICIPATION IS VOLUNTARY: DO I HAVE TO DO THIS?

You don't have to be in this research if you don't want to be. It is up to you. If you decide not to be in the research, it is okay and nothing changes. Even if you say "yes" now, you can change your mind later and it is still okay.

I have checked with the child and they understand that participation is voluntary

INITIAL _____

PROCEDURES: WHAT IS GOING TO HAPPEN TO ME?

If you decide to participate, you are going to do the following things:

- 1 You will fill out a demographic questionnaire and a questionnaire to assess your handedness.*
- 2 You will undergo the tests in a certain order that could be different from that of your friends*
 - a. We will put four white circular electrodes on your skin, two on the legs and two on the arms for recording the muscle activity and you will wear special glasses that allow us to detect what you are seeing.*
 - b. You will start doing the test and if you do not understand something do not hesitate to ask, and until you are not confident with the test, we will not start the experiment. During the test you will see a volleyball player during the action of serving. Half of the videos show only the first part of the action before the ball leaves the player's hand, whereas in the other half, you will see only the ball trajectory. Your task is to move your feet or hands in the direction you think that the player is serving. Remember, you have to be as accurate and fast as you can.*
 - c. You will perform three jump tests with maximal effort. First you will have to stand in the area of the test and when the experimenter tells you to jump, you will put your hands on the hips and you do not have to leave this position. Then, when you feel ready, you will bend your legs until your knees are at a 90-degree angle and immediately jump as high as you can.*
 - d. You will do 10 serves in one of the five areas that you see in the picture. Every area is marked with points between 1 and 7, and based on your ability, you can choose in which area to serve. Remember, if the ball lands outside the playground, you will get zero points.*

I have a picture here to show you what will happen. You can ask me to stop and explain again at any time and I will explain more about the process. All the measurements are non-invasive.

I have checked with the child and they understand that participation is voluntary

INITIAL

RISKS: IS THIS BAD OR DANGEROUS FOR ME? WILL IT HURT?

The tests that you are going to perform do not bear risks for your health and do not cause discomfort or hurt.

I have checked with the child and they understand that participation is voluntary

INITIAL

BENEFITS: IS THERE ANYTHING GOOD THAT HAPPENS TO ME?

Nothing really good can happen to you. But this research might help us to find how your brain works and will be a benefit for everyone.

I have checked with the child and they understand that participation is voluntary.

INITIAL

CONFIDENTIALITY: IS EVERYBODY GOING TO KNOW ABOUT THIS?

We will not tell other people that you are in this research and we will not share information about you with anyone who does not work in the research study.

Information about you that will be collected from the research will be put away and no-one except the researchers will be able to see it. Any information about you will have a number on it instead of your name. Only the researchers will know what your number is and we will lock up that information with a lock and key. It will not be shared with or given to anyone.

SHARING THE FINDINGS: WILL YOU TELL ME THE RESULTS?

When we are finished with the research, I will tell you what we learnt. I will also give you a paper with the results written down. Afterwards, we will be telling more people, scientists and others, about the research and what we found. We will do this by writing and sharing reports and by going to meetings with people who are interested in the work we do.

RIGHT TO REFUSE OR WITHDRAW: CAN I CHOOSE NOT TO BE IN THE RESEARCH? CAN I CHANGE MY MIND?

You do not have to be in this research. No one will be mad or disappointed with you if you say no. It is your choice. You can think about it and tell us later if you want. You can say “yes” now and change your mind later and it will still be okay.

WHO TO CONTACT: WHO CAN I TALK TO OR ASK QUESTIONS?

You can ask me questions now or later. I have written a number and address where you can reach us or, if you are nearby, you can come and see us. If you want to talk to someone else you know, like your teacher, or doctor, or aunt, that is okay too.

If you choose to be part of this research I will also give you a copy of this paper to keep for yourself. You can ask your parents to look after it if you want.

You can ask me any additional questions about any part of the research study, if you wish to. Do you have any questions?

• **PART 2: CERTIFICATE OF ASSENT**

I understand the research is about testing my ability to “read” a volleyball action; I understand that I have to be as fast as I can after I recognize the fate of the throw. Finally, I have to jump and serve to the best of my ability when this is asked of me.

MEASURING

Measuring has an extremely important role in science. By measuring, we obtain quantitative data that are then analyzed by statistical mathematical methods, in order to extract from the data that what is important for answering the hypothesis or hypotheses of research.

MEASURING INSTRUMENTS

Besides defining the scales which will be used to express the measured data, and in relation to this also the methods of data analysis, it is necessary to select the measuring instruments. Main types of measuring instruments are tests, questionnaires, rating scales, survey questionnaires. Test is a standardized procedure for testing abilities and skills. If there is no instrument for measuring a certain phenomenon, it will be constructed following a standardized procedure, which includes a pre-experiment to determine the metric characteristics and then standardization (procedure of determining the norms of an instrument obtained on randomly selected and representative samples of examinees who belong to the characteristics of the sample on which standardization had been done, and this information must be included in test instructions) and calibration of the instrument (the instrument is calibrated if there is a possibility of sorting brutto results on a certain scale of z-scale or t-scale or scale of deciles and centiles, and their purpose is to determine the distance of a result from the mean).

MEASURING INSTRUMENTS

It is understood that operations are performed on homogenous and representative subject samples for which the instrument was constructed. The operation of data collection can follow if, aside from the manner of measuring, metric characteristics of the test are also known (validity, reliability, objectivity, sensitivity and discriminant value, instrument calibration).

The procedure of data collection should be organized in such a manner that it maximally neutralizes the error that can be a part of the instrument or the measuring procedure. Data collection is the first fundamental scientific problem.

CHARACTERISTICS OF MEASURING INSTRUMENTS

MEASURING OR METRIC CHARACTERISTICS OF INSTRUMENTS have an important role in designing and selecting measuring instrument for needs of scientific research and needs of practice. Metric characteristics are certain preconditions and standards that a measuring instrument must fulfill in order to be used for measuring features, i.e., abilities and characteristics of subjects. Quality of the measuring procedure can be ensured only when the required standards are met.

If a measuring instrument which does not have good metric characteristics (because a better one is not available) is applied in a scientific research, this should be taken into consideration during interpretation of the results. However, in practice, measuring instruments that do not fully meet the standards regarding metric characteristics should not be used for the purposes of diagnostics and selection of candidates. The reason is clear, diagnostics is extremely important for selection of adequate intervention or treatment, and this also goes for the selection of candidates for activities that are extremely important in people's lives, e.g., admission to college and obtaining a job position.

FOUR METRIC OR MEASURING CHARACTERISTICS:

1. validity
2. reliability
3. sensitivity
4. objectivity.

In order for a measuring instrument to be used in practice, aside from satisfying the aforementioned four preconditions, a fifth one should also be fulfilled, and that is calibration. Calibration denotes determination of norms or standards for evaluation of results that subjects achieve on the measuring instrument. Some consider it to be a fifth metric characteristic.

A measuring instrument is valid if it measures that what we think it measures. Reliability refers to different aspects of stability and consistency of results obtained by measuring instruments. In the broadest sense of the word, reliability denotes the range in which individual differences in results obtained by the measuring instrument can be assigned to actual differences in some characteristic which was the subject of measurement and the range in which they can be assigned to error. In other words, what portion of the total variance belongs to true variance, and what portion belongs to error variance. **RELIABILITY** is a metric characteristic related to the precision of measuring.

It is defined in two ways:

- A measuring instrument is reliable if basically the same results are obtained in repeated measuring.
- A measuring instrument is reliable if all its parts are consistent in measuring the same construct.

A measuring instrument is sensitive if it allows detection of even the smallest differences between subjects in the characteristic that is the subject of measurement. If several subjects have the same result, there is a higher possibility that the instrument is not sensitive. **OBJECTIVITY** of measurement implies that such measuring conditions have been secured in which subjects' performance would depend only upon the development of the characteristic which is being measured in the subjects, and not on other circumstances in which the measurement is taking place and subjects' performance is being evaluated. Therefore, a measuring instrument is considered to be objective if the obtained results depend solely on the subjects, i.e., the development level of the characteristic which is being measured, and not on the circumstances in which the measuring was carried out or the examiner's influence. The results must be compared with certain standards and reference values in order to be interpretable. **CALIBRATION** is the testing of accuracy of a measuring instrument. The norms should be periodically checked.

REASON FOR TESTING

There are many reasons why testing (diagnostics of physical fitness) is of vital importance for scientists, coaches and examinees.

Some of these reasons are:

1. **DETECTING WEAKNESSES** – one of the main reasons for testing is to define “strengths” and “weaknesses” of subjects. This includes detecting principal components of functional-motor abilities in a sport and to define tests that can assess the state of physical fitness of those components, i.e., abilities. Training programs should be defined only after the testing is done and state of preparedness of functional-motor abilities is defined.
2. **MONITORING DEVELOPMENT/PROGRESS** – by repeating appropriate tests in appropriate time intervals, coaches can monitor efficiency and effectiveness of distinct (defined) training programs of young athletes. Performing only one testing (diagnostics) per year provides very little useful information, both for coach and for subjects, and this type of diagnostics is not recommended.
3. **GETTING FEEDBACK** – feedback on the results in specific tests often encourage the subjects to improve individual abilities, especially if they know that the testing will be repeated after a certain time period. The possibility of a team and individual to periodically compare their abilities with objective and relevant tests makes suitable motivation for desire for improvement and perfection.

4. **EDUCATION OF COACHES AND EXAMINEES** – the program of testing provides coaches and examinees with better understanding of the necessary levels of functional-motor abilities required by certain task in order to be successful. This also points out the necessity of systematic planning of individual training program.
5. **PREDICTION OF SUCCESS** – to define, plan and control progress and predict success, it is necessary to have the knowledge of the state and the changes of morphological particularities and functional-motor abilities and capacity.

Specificities of psychophysical development of examinees and demands of individual phases of fitness preparation determine the contents and modalities of training, and thus also the diagnostics procedures, which can ensure the achievement of the set goals with the highest level of certainty. Some abilities, as a priority, are developed in early, and some in later phases of conditional preparation. They are mutually dependent and development of one ability is a precondition for development of another ability. The development of one ability may last for a longer period of time, whereas the development of another ability may be intense and last only for a short period of time.

SELECTION AND COMPILATION OF A BATTERY OF TESTS

Knowing the most important characteristics of tests allows teachers, coaches, scientists or experts in the domain of diagnostics of athletes' physical fitness to select and compile efficient, precise, reliable, valid tests and optimally large batteries of tests for assessing the level of subjects' physical fitness. Whilst selecting the tests that will be used in a specific case, it is important also to take account of other accompanying elements which are essential for successful testing, such as selection of measuring equipment and materials, preparation of materials and equipment, preparation of administrative aids, selection of the date of measuring and organization of subjects' time of arrival and departure (especially important when testing larger groups of subjects on the same day), definition of the order in which the tests will be applied and the length of the pause between the tests, method of analysis and interpretation of results after the testing, etc. All these "steps" in organization must be carried out in time and professionally because if any of them is missing, reliability, validity, and result interpretability on the one hand, and on the other hand efficiency, effectiveness, and certainty that the measuring will be carried out become questionable. Therefore, in selecting and compiling a battery of tests and testing the state of preparedness of subjects' anthropological status, one must have the knowledge of kinesiological analysis of sports activity to be able to define the importance, specificity, practicality, validity and precision of the selected tests for a specific sport.

The results obtained by testing can be used for:

- programming and prognosis of the final state of one or several subjects, which is achieved by desired changes of abilities and skills, which allow the subject to have a high level of fitness ability;
- programming training procedures which are supposed to ensure safe and economic transition from the determined initial state to the desired final state;

- selection of candidates for participation in specific actions or activities;
- comparison of obtained values with model parameters, i.e., model characteristics of athletes;
- comparison with average values for the age, sex and level of physical fitness and/or order of individuals, and minimum and maximum result;
- comparison with previously achieved individual results, i.e., previous measurements;
- comparison with values within the group/team to which the subject belongs;
- prediction of results in criterion;
- differences of the same group at two independent time points;
- differences between two or more groups in one or more tests;
- correlation between tests, dimensions and one or more criteria (possibility of prediction).

Anthropological characteristics are organized systems of all characteristics, abilities and motor information and their mutual relations.

ANTHROPOLOGICAL CHARACTERISTICS include: anthropometric characteristics, motor, functional and cognitive abilities, conative personality traits or characteristics, and social status. Each characteristic is further divided into its subcomponents which determine them.

Basic groups of **DIAGNOSTICS PROCEDURES** are procedures for assessing:

1. health status,
2. morphological characteristics,
3. motor abilities and skills,
4. functional abilities.

ANALYSIS OF HEALTH STATUS

Health status is the basic precondition for athletic physical fitness and engagement in sport in general. Improvement and maintenance of optimal health status is largely contributed by preventive and rehabilitation fitness programs whose aim is to reduce the number and severity of injuries, i.e., quick and quality recovery after sports injuries.

HEALTH STATUS

Health is a state of man determined by physical, social and mental dimensions. *World health organization* (WHO) describes health as a positive phenomenon with emphasis on potential for full life of an individual and society. Health is the source of everyday life, and not the goal of life in itself. Therefore, health is a continuum of states expressed not only by absence of disease, but equally important, by ability to meet the challenges of everyday life and possibility for full achievement of one's life potentials. In this sense, health includes functional capacities necessary for a satisfying and full life.

HEALTH

Health fitness (fitness related to health) can be viewed as a set of characteristics and abilities that contribute to good health in the broadest sense. Characteristics are generally genetically determined. Abilities primarily refer to individual's possibility to perform a given muscle action. Both characteristics and abilities are important in the sense of health fitness. Whereas characteristics are only somewhat adaptable to the level of kinesiological activity, abilities are much more sensitive regarding adaptation to changes in physical activity. Thus, every ability is important in the evaluation of health fitness. Having insight into previous and current physical activity and exercise contributes to evaluation of test results, which also means to prescription and consulting in terms of exercise. Information about unhealthy living style complement the information about exercise and allow integral counseling about the general lifestyle and health maintenance. Survey questionnaire for assessing health status and medical history contribute to gathering additional information for application of appropriate tests, interpretation of results and planned execution of kinesiological activity. The procedure for the assessment of health status should be a part of all testing programs.

HEALTH FITNESS

ANALYSIS OF MORPHOLOGICAL CHARACTERISTICS

MORPHOLOGICAL CHARACTERISTICS (anthropometric characteristics) are part of anthropological characteristics and are defined as the characteristic responsible for the dynamic of growth and development and for characteristics of build of morphological characteristics which include the following: longitudinal and transverse bone growth, muscle mass and subcutaneous fat tissue.

Morphological (anthropometric) characteristics describe subject's body build and are the result of interaction of biological heredity and adaptation of subject's body to various influences of different factors, especially training process (characteristic for every activity) and nutrition. Every activity, i.e., task or action has its own specific internal structure, specific demands regarding structural, biomechanical and energy components. Knowing subjects' morphological characteristics is one of the bases for planning the training process. Adequate anthropometric characteristics are also necessary for success in certain tasks, even though experts' opinion differ regarding this issue. Besides anthropometric measures, analysis of body composition is also performed as standard, with the aim of improvement and optimization of the training process, i.e., the final aim of result improvement.

Body composition in general population is calculated by skinfold method (*Jackson et al., 1985*), i.e., by inserting values of different skinfold combinations into the equation for calculating body density, and the value of body density is inserted into the equation for calculating the body fat percentage:

$$\% \text{ BODY FAT} = (495/G) - 450 \text{ (Siri, 1956).}$$

However, when these equations are used in assessing athletes' body composition, and given the fact there are no adequate and verified equations for every sport in practice, the percentage of fat tissue is being estimated higher by a few percentage values. There are several reasons for this, and the one that is among more important ones is certainly the different status of hydration of non-fat tissue of athletes in comparison to non-athletes, just as there is a difference in hydration between children and adults. That is why it is desirable to apply athlete-specific equations when measuring athletes, which take into consideration the aforementioned differences. However, such formulas have still not been sufficiently validated, so in everyday practice formulas for general population are used (*Jackson et al., 1985*), and these can deviate from real values to a smaller or greater extent. In children, unfortunately, there is no equation specific to children athletes either, rather Slaughter's equations are used to determine the fat percentage in children. These are very simple because they require measurements of only two skinfolds. These can be triceps and calf skinfolds, or triceps and subscapular skinfold (*Slaughter et al., 1988*). Even though year after year a variety of new methods appear for determining the fat tissue proportion in total body mass, it seems that the skinfold method is still the method of choice in everyday field conditions (*Vučetić et al., 2007*).

The *Heath-Carter method* is applied to determine somatotype characteristics, based on *Sheldon's somatotype classification*.

In this method, somatotype is defined by three numbers which express the value of the following three components:

1. endomorphic, which defines higher values of subcutaneous fat tissue, and it is calculated from the values of three measured skinfolds; ENDOMORPHIC COMPONENT
2. mesomorphic, which represents prominent development of the muscle-skeletal system, and it is calculated from the values of body height and limb circumferences (upper arm and calf), modified for skinfold values and elbow and knee diameter; MESOMORPHIC COMPONENT
3. ectomorphic, which represents longitudinality of the body, according to the body height and body mass ratio. ECTOMORPHIC COMPONENT

Morphological characteristics (variables) which can be applied in the testing process should be congruent with the model of structure of morphological status (*Momirović et al., 1969*).

Variability and covariability of morphological variables depend on four latent morphological dimensions: LATENT MORPHOLOGICAL DIMENSIONS

- longitudinal dimensionality of the skeleton (LDS),
- transverse dimensionality of the skeleton (TDS),
- body volume and mass (BVM), and
- subcutaneous fat tissue (SFT).

ANALYSIS OF MOTOR ABILITIES AND SKILLS

According to *Milanović (1997)*, **MOTOR ABILITIES** are included in realization of all types of movement. They are underlain with efficiency of organ systems, especially nervous and muscular systems, which are responsible for the duration, intensity and regulation of movement. Motor abilities determine subjects' motor capacity (e.g., explosive power, coordination, flexibility, agility, etc.). Motor abilities are developed by different methods and modalities of training, and are determined by tests of motor abilities (e.g., standing long jump, sit-ups, obstacle course, ball slalom, etc.).

For the purposes of fitness training, **MOTOR SKILLS** can be determined as skills necessary for improvement of fitness (motor and functional) abilities, morphological characteristics and health status of athletes. Motor skills imply mastering different motor activities specific for the technique of some activity, sport or sports discipline (e.g., push kick shot in soccer, underhand serve in volleyball, mae-geri kick in karate, hand technique in breaststroke technique in swimming, etc.). Motor skills are learned, practiced and perfected by different methods and modalities of training, and are tested by technical performance of each element.

In the training process, the state of motor skills and abilities must be monitored constantly in order to detect, in time, possible negative deviations from the desired state.

Given that athletes' success is determined by the level and structure of a large number of motor abilities and that the relation of these abilities among athletes from different sports is sometimes very different, it is necessary to carefully define a battery of tests which could be used to objectively and reliably diagnose those abilities which determine success in some sports discipline to the greatest extent. For this purpose, various tests for assessing basic and specific motor abilities are used in sports practice, which can be applied in laboratory and field conditions.

REVIEW OF BASIC MOTOR ABILITIES AND SOME TESTS THAT ASSES THEM

When testing athletes, depending on their age, years of sports engagement, sports discipline, phase of competitive season and level of physical fitness, those tests of motor abilities that are, at a given moment, applicable and necessary for analysis of the state of physical fitness are selected from the overall base of motor tests. It is important to emphasize that some basic motor abilities are tested in all athletes regardless of the sports activity they are engaged in and regardless of their age and years of sports engagement (there are only differences in the length or load of the motor test), such as repetitive and static relative strength, flexibility, etc., whereas other motor procedures are applied depending on the needs and possibilities. Motor abilities that are most frequently assessed in sports diagnostics are coordination, agility (speed of movement direction change), balance, explosive power (speed, throwing, jumping, hitting and lifting), strength (repetitive or static, absolute or relative), flexibility and movement frequency. This group of tests often includes also the 300 yard test (or the new version of the test – 300 meters), which is applied to assess anaerobic capacity (speed endurance), which is basically a functional motor ability.

ANALYSIS OF FUNCTIONAL ABILITIES

FUNCTIONAL ABILITIES represent efficiency of energy processes in the body, and refer to the efficiency of aerobic and anaerobic functional mechanisms (Jukić, 2003), i.e., fundamental energy processes. Fundamental energy processes are defined as aerobic and anaerobic, which take part in activities in different proportion. Unquestionably, in cyclic sports activities of endurance type, aerobic capacity, i.e., maximal oxygen uptake as a measure of subject's aerobic abilities, has the leading role. In sports activities of relatively short duration and high intensity, the largest amount of energy is secured from anaerobic reserves. This group includes sports games as activities of high tempo and maximum intensity, and combat sports as activities dominated by the glycolytic anaerobic energy process. Based on functional analysis we can establish the state of individual's functional abilities.

AEROBIC CAPACITY (aerobic endurance, cardiorespiratory endurance or aerobic fitness) is defined as the ability to perform an action over a longer period of time in conditions of aerobic metabolism.

Generally accepted parameters for assessing aerobic capacity, i.e., long-term endurance, are:

- maximal oxygen uptake, $VO_2\text{max}$, which represents the amount of oxygen an organism can consume during a one minute period;
- aerobic threshold, which represents the maximum intensity of work load at which the accumulation and decomposition of lactic acid are balanced.

MAXIMAL OXYGEN UPTAKE ($VO_2\text{max}$) is defined as that level of oxygen uptake per minute at which further increase of work load does not lead to further increase of oxygen uptake. $VO_2\text{max}$ is also defined as maximal amount of oxygen a body can consume in one minute during intensive physical activity.

STORING ORIGINAL DATA

When you are finished with a research, writing and submitting a scientific paper for publishing in some journal, given that reviewers or editors, i.e., other authors could ask to see the results or materials that were used during the process of writing the paper, all materials should be stored for a period of 5 to 10 years.

**METHODOLOGY FOR WRITING
A SCIENTIFIC PAPER**

5

SCIENTIFIC LANGUAGE USAGE

Writing a scientific paper requires reasoning and use of certain rules, creating a language which is colloquially referred to as “scientific language”, characterized by: logic, clarity and accuracy. It is the author’s task to convince the reader of the correctness of what is written. A scientific paper represents means of persuasion based on arguments and evidence. To illustrate the challenge the authors meet, we will present the problem of defining the title of a scientific paper. It is not easy to choose the title and write it in “scientific language” as it should

represent a “condensed version of the abstract”, which is often composed of an “irreducible set of notions” used to describe the paper’s contents as precisely as possible. There are two types of titles: **INDICATIVE**, which does not speak of the result, but rather of the problem or area, and **INFORMATIVE**, which conveys the message of the paper. When writing a scientific paper, it is recommended to use clear and precise sentences which can draw readers’ attention, and also to avoid unnecessary wordiness and repetitions, as follows:

WORDINESS

Bad example: *Today we have a method developed by (1973), which is used to analyze the effect of motor abilities on result efficiency in karate.*

Good example: *Perić (1973) developed a method for analyzing the effect of motor abilities on result efficiency in karate.*

REPETITION

Bad example: *In Perić’s study from 1977, the effects of body height and weight were not taken into consideration (Perić, 1977).*

Good example: *Smith (1972) did not take the body height and weight into consideration.*

When writing a paper, we follow an unwritten rule that a scientific paper is written in the first person plural. Different tenses are used in different parts of the scientific paper: past tense when talking about our own results (*Abstract, Material and methods, Results*), and present tense when discussing the results of other authors (*Introduction, Discussion*). The acceptance of paper for publishing often depends on the message it conveys, but the style of writing can be one of the crucial factors based on which reviewers decide on the paper's fate (publication or rejection). Authors should make an effort to write the text of their paper in such a way that it is characterized by:

- *Eloquence* – Fluency and unbroken line of thoughts (sentences) accompanied by coherence of paragraphs;
- *Clarity* – Clear structure and flow of the paper;
- *Accuracy* – Usage of words and sentences in the right context and applied accuracy of the presented data;
- *Moderation* – «Economic» usage of words to provide readers with the most comprehensive information possible by using as little words as possible;
- *Consistency* – consistent application of the previous four criteria in all chapters of the paper.

SCIENTIFIC PAPER CHAPTERS

According to *Day (1979)*, a scientific paper is a written and published report describing original research results (*in Silobrčić, 2008*). Moreover, *Silobrčić (2008)* defined scientific paper as "the first publishing of original results (observations) in publication, which is easily available to international scientific community, and is written in that way, that the research could be repeated and conclusions checked". Scientific paper is comprised from the following sections (*Mejovšek, 2013*):

TITLE – the smallest amount of terms needed for the contents of the paper to be described (*Marušić et al., 2008*). There are two types of titles: indicative, which does not tell the answer that the paper offers, but only about the area the paper covers, and informative, which gives and directs on results of the research.

ABSTRACT – they are written as informative types of text, and are usually divided in several paragraphs: aim, methods, main results and conclusions.

INTRODUCTION – the writing style is deductive (from general to specific information), and authors of the study mention and elaborate why the study was carried out and introduce the main questions of the study (*Marušić et al., 2008*).

METHODS – consists of several subgroups: participants (descriptive characteristics such as height, weight, body-mass index, age), variables (which tests were performed in the study and detailed description of each test), testing protocol and data analysis (statistical procedures used in the study).

RESULTS – shows new information about the research. It is necessary to mention that results must be shown in only one way, with tables, graphs or text.

DISCUSSION – it is written in an inductive way (from our results to general information about our topic).

REFERENCES – there are three ways of writing the references, depending on journal requirements in the text:

- *Harvard style* (last name and year),
- *Vancouver style* (citing from the order of reference in the text)
- *alphabet-numeric style* (the combination of Vancouver and Harvard style).

Aside from the aforementioned sections, in publication of scientific papers in the area of social sciences, a certain number of scientific journals allow authors to include the *Conclusion* and *Acknowledgements* sections.

CONCLUSION is not a mandatory section in all journals and it is sometimes left to the author to decide whether or not to present his/her conclusions in a separate chapter. The main conclusions of the paper are often presented in the *Discussions* section, so there is no need for a separate *Conclusion* chapter. *Conclusions* are often found in short papers in which the *Results* and *Discussion* are merged into one chapter, or in very large papers with long and complex *Discussion*, so there is a justifiable need to summarize and repeat the main conclusions. In any case, this is usually a very short chapter in which main conclusions of the paper are concisely presented as a list (sometimes even numbered).

ACKNOWLEDGEMENTS, which is also not a mandatory section, is usually written between the *Discussion* (or *Conclusion* if it exists) and *References*. In this chapter, the authors thank every person who helped them in any way during their research, or during their writing of the paper. Science ethics dictates that no one should be mentioned in the Acknowledgements if they had not been previously consulted and had given permission to do so.

THE ORDER OF CHAPTERS IN A SCIENTIFIC PAPER

The order of writing chapters in a paper is an individual decision of each author, and it depends on the problem, type of paper, etc. However, most authors usually start writing with the chapter that seems “the easiest”.

Many authors start with the *Methods chapter*, whereas others prefer to start with the *Results chapter*. The *Methods* are surely a logical choice for the easiest start because it is the section in which the subject matter presented has already been analyzed in the phase of planning the scientific research described in the paper. This is actually a report on the conducted research and the obtained results.

The next step in writing a paper can be the presentation of the research results in the *Results chapter*. *Discussion*, as the most creative section of the scientific paper and the overall report on the scientific research is structured after the aforementioned chapters are finished, because here the obtained results are put in context of scientific findings of the respective scientific discipline or interdisciplinary scientific area, which creates the basis for definition of scientific contribution specified in the *Conclusion*.

Conclusion as a chapter is often found in short papers in which the *Results* and *Discussion* are merged into one chapter, or in very large papers with long and complex discussion, so there is a justifiable need to summarize and emphasize the main conclusions. In any case, this is usually a very short chapter in which main conclusions of the paper are concisely presented as a list, and sometimes even numbered.

Abstract, key words and the title are usually written after all other chapters, and the *References* list is edited in parallel with writing other chapters (when a reference is included in the text, it is added to the list, which is usually a separate document).

PRESENTATION OF STATISTICAL DATA (PREPARATION OF TABLES AND GRAPHS)

Data collected by research can be presented in a table, or pictorially as a chart, diagram or graph. The same data set is never presented both in a table and graphically, thus, it is up to the author to choose the most appropriate presentation depending on the character of the data and the aim of the paper.

Moreover, depending on the publication and the character of the paper in which the table or graph is presented, they are formatted in accordance with the prescribed rules. For example, the results are presented in a certain way in graduate and Master's theses, whereas different scientific journals have defined rules for drawing tables and graphs that should be followed.

TABLES

There are many ways to present the results of scientific research. **TABLES AND GRAPHICS** are basic type of presenting the data. Tables are sums of rows and columns, which serve to present numerical or graphical data.

Recommendations for table defining are:

- think about the title,
- study the shape of the table in the journal,
- set up rows and columns must in an orderly manner,
- chose the appropriate shape of the table,
- correctly write the titles of tables and columns with subtitles,
- correctly present statistical data (present the type of statistical test, number of observations, arithmetic mean and standard deviation and p value) (Marušić et al. 2008).

Table 1. Descriptive statistics (Means and Standard Deviations - SD); ANOVA statistic significance with demographic, anthropometric and competitive efficacy variables between medalists and non-medalists in male and female competitors.

Variables	Medalists (males) mean ± SD	Others (males) AS ± SD	F- test	Medalists (females) AS ± SD	Others (females) AS ± SD	F- test
AGE	25.44 ± 3.67	25.19 ± 4.29	0.04	23.00 ± 2.63	23.19 ± 4.62	0.02
HEIGHT	182.73 ± 8.99	179.74 ± 8.50	1.44	169.41 ± 7.86	171.72 ± 6.18	1.45
WEIGHT	73.99 ± 13.88	72.78 ± 12.10	0.11	60.81 ± 9.17	62.13 ± 8.16	0.30
BMI	21.99 ± 2.47	22.39 ± 2.25	0.36	21.10 ± 2.22	21.00 ± 1.93	0.03
KJP	1.09 ± 0.48	1.02 ± 0.81	0.11	1.24 ± 0.61	0.80 ± 1.02	2.68
GJP	0.23 ± 0.23	0.29 ± 0.36	0.37	0.36 ± 0.29	0.13 ± 0.30	7.13 ^b
OK1P	1.16 ± 0.92	0.83 ± 1.10	1.16	1.17 ± 0.51	0.55 ± 0.58	1.79 ^b
OK2P	0.19 ± 0.25	0.10 ± 0.34	0.89	0.14 ± 0.27	0.03 ± 0.11	4.95 ^a
DK1P	1.76 ± 0.82	0.90 ± 1.06	8.56 ^b	1.54 ± 0.84	0.77 ± 0.78	11.32 ^b
DK2P	0.05 ± 0.10	0.01 ± 0.07	2.49	0.08 ± 0.15	0.03 ± 0.12	1.67
POPP	3.07 ± 1.01	1.71 ± 1.80	8.13 ^b	2.90 ± 0.91	1.38 ± 1.01	20.95 ^b
PRIPP	1.78 ± 0.91	3.00 ± 2.09	5.09 ^a	1.41 ± 0.73	2.66 ± 1.21	9.61 ^b

* F – test – univariate test results; ^a P < 0.05; ^b P < 0.01

Abbreviations used: (AGE) age, (HEIGHT) body height, (WEIGHT) body weight, (BMI) Body mass index, (KJP) warnings, (GJP) penalty points, (OK1P) offensive kicks to the trunk, (OK2P) offensive kicks to the head, (DK1P) defensive kicks to the trunk, (DK2P) defensive kicks to the head, (POPP) given points, (PRIP) points received

GRAPHICAL REPRESENTATION

Besides tables, pictorial presentations, i.e., graphs are also used to clearly present important data related to the conducted research. Graphs are a form of pictorial presentation that also allows clear and complete presentation of relations between different numerical data. Graphical representations are useful for understanding the results obtained by research, but they are also useful for “evaluation” of values that have not been directly determined by measuring, by using the interpolation and extrapolation methods. The use of graphs can help discover the unexpected characteristics of the results, which makes the comparison of different values, trends and relations between the results easier. The recommendations related to graphical representation of data are identical to those related to tables: the obtained results should be presented as clearly and simply as possible.

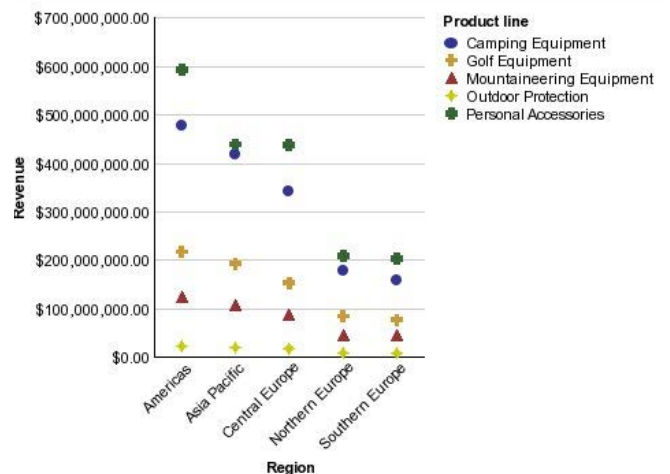
To do so, we should follow these basic principles:

- Every pictorial/graphical representation should be numbered and have its unique title. The graphs should be named: “Figure No.,” followed by the title which should be as short and clear as possible.
- The number and the title of the pictorial representation, i.e., graph, are placed below the graph. The text “Figure No.” is written in Italics (with a full stop after the number), and the title is written in normal text. The font and spacing in the figure title should be somewhat smaller than the font in the main text. Graphs should be centered on the page.
- A legend is often added to the graphical representation, which contains explanations necessary to understand the representation. A reader should be able to understand the contents of the representation without reading the text of the paper, i.e., based on the title, legend and the graphical representation itself.
- Graphical representation should be clear and readable, which is achieved, among other things, by the selection of color, font, legibility, etc.

As it was previously stated, there are different types of graphical representations the selection of which depends on the type of the collected data and the aim of their representation. Histograms and frequency polygons are most commonly used in scientific papers, primarily to represent the distribution of data within different variables.

Aside from these, there are also other types of graphical representations and we will mention only the basic ones:

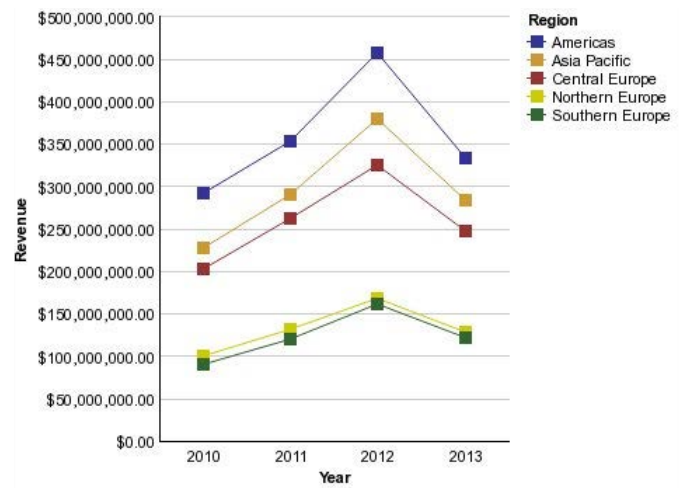
DOT CHART is usually used for two variables which are thought to be somehow connected, in a way that the dependent variable is put on the y axis and the independent (the one that affects the dependent variable) on the x axis.



Retrieved from:
http://www.ibm.com/support/knowledgecenter/hr/SSEP7J_11.0.0/com.ibm.swg.ba.cognos.ug_cr_rptstd.doc/c_ti_charts_point.html

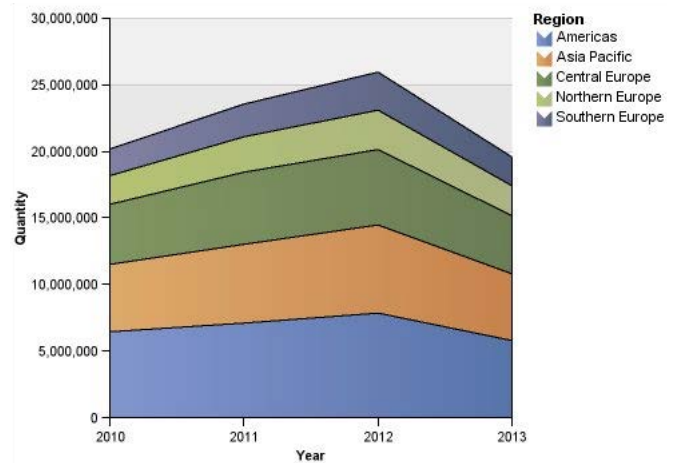
LINE CHART is similar to the dot chart, but the measured times are connected with lines. The advantage of this chart is that two dependent variables could be presented (one on the y axis, and one on the right side of the chart), to see mutual dependence between the variables.

Retrieved from:
http://www.ibm.com/support/knowledgecenter/hr/SSEP7J_11.0.0/com.ibm.swg.ba.cognos.ug_cr_rptstd.doc/c_ti_charts_line.html



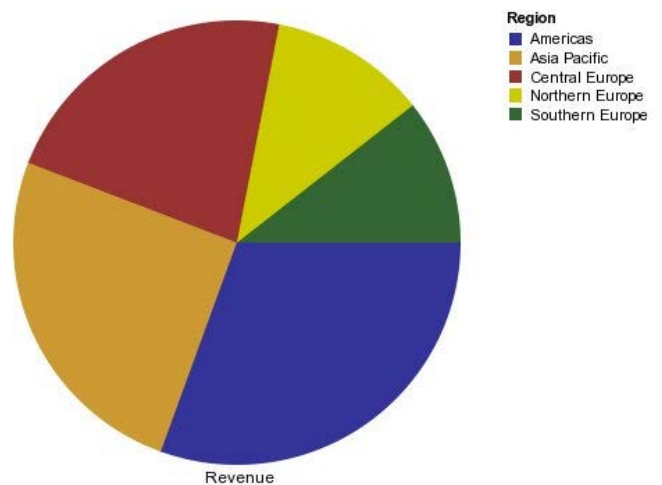
AREA CHART is often used in cases when we have one independent and several dependent variables, where dependent variables have a constant sum (Marušić et al., 2008).

Retrieved from:
http://www.ibm.com/support/knowledgecenter/hr/SSEP7J_11.0.0/com.ibm.swg.ba.cognos.ug_cr_rptstd.doc/c_ti_charts_area.html



PIE CHART best presents percentages in the model. It must be used in cases where the sum of all variables is constant.

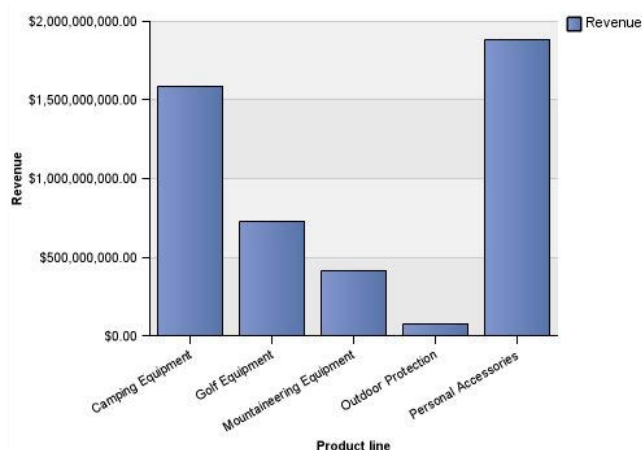
Retrieved from:
http://www.ibm.com/support/knowledgecenter/hr/SSEP7J_11.0.0/com.ibm.swg.ba.cognos.ug_cr_rptstd.doc/c_ti_charts_pie.html



BAR GRAPH is used when the variables are nominal or ordinal (frequencies or ranks). Special type of those graphs, histograms, show the value on x axis in interval of ratio interval scale (for example, number of students in the classroom).

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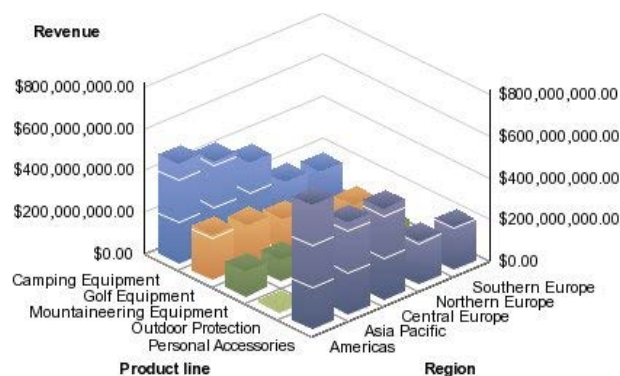
http://www.ibm.com/support/knowledgecenter/hr/SSEP7J_11.0.0/com.ibm.swg.ba.cognos.ug_cr_rptstd.doc/c_ti_charts_column.html



THREE-DIMENSIONAL GRAPH is used to present three complex variables, which are mutually related, in a way that two independent variables are shown on X and Z axes, and the dependent variable on the y axis (Marušić et al., 2008).

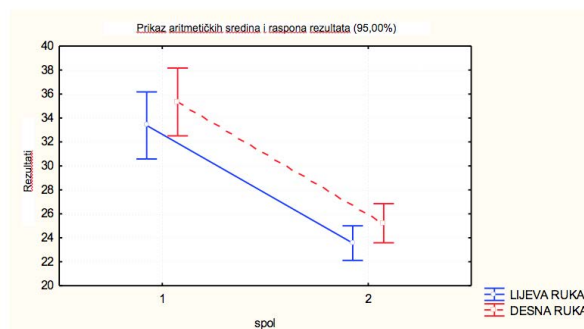
Retrieved from:

http://www.ibm.com/support/knowledgecenter/hr/SSEP7J_10.2.2/com.ibm.swg.ba.cognos.ug_rptstd_fin.10.2.2.doc/c_ti_chart_3d_config.html



BOX & WHISKER PLOT GRAPHS are used for presentation and identification of extreme results or differences of data within a sample or subsample.

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To create and format graphical representations, we use computer programmes, the most common of which is *Microsoft Excel* and programmes for statistical data analysis. These programmes offer many features that are often more than enough to

properly present the results. In the text, we have shown only basic information about the graphical representation of results, whereas more detailed instructions on this subject can be found in the computer applications.

RULES OF CITING THE LITERATURE

VANCOUVER STYLE OF CITING THE LITERATURE

Milanović Z, Pantelić S, Sporiš G, Mohr M, Krustrup P. Health-related physical fitness in healthy untrained men: effects on VO2max, jump performance and flexibility of soccer and moderate-Intensity continuous running. Plos One. 2015; 10: e0135319

HARVARD STYLE OF CITING THE LITERATURE

Milanović, Z., Pantelić, S., Sporiš, G., Mohr, M., & Krustrup, P. (2015). Health-related physical fitness in healthy untrained men: effects on VO2max, jump performance and flexibility of soccer and moderate-Intensity continuous running. Plos One, 10(8), e0135319.

**PUBLISHING A
SCIENTIFIC PAPER**

6

CHOOSING THE TITLE, KEY WORDS, WRITING THE ABSTRACT AND ACKNOWLEDGEMENTS

CHOOSING THE TITLE

The title is one of the most important parts of a scientific paper, much more important than it might seem at first. The title should capture the essence of the paper, suggest its contents, and sometimes even point to the discovery or scientific contribution the paper will bring. The title of a scientific paper should be specific in a way that it describes the whole paper. The title should be unique in a way that there is no other paper with the same title. The right words should be chosen for the title so it is not too long (maximum of two lines). The title is also important because numerous services which are used to find scientific information use the title for their search. The title should be designed based on key words. All unnecessary words whose meaning is not specific to the paper should be avoided in the title. Abbreviations should also be avoided in the title.

KEY WORDS

In a number of scientific journals, authors are required to highlight several most important words related to the paper (key words) which are written after the abstract. Key words are included in different citation indices and literature browsers and make the search for needed literature easier. When choosing the order in which the key words will be written, one must start with the broadest concepts and finish with the narrowest. The selection of key words requires great experience of the scientist. The selection and order in which the key words are written shows the extent to which the author can “predict” the key word search and thus ensure wide availability of their paper. The author chooses the maximum of 5 key words, avoiding the words and terms already used in the title.

ABSTRACT

Abstract is a short text (chapter) at the beginning of the paper. Most journals limit the word count of the abstract to 250 words. The abstract should, in a concise manner, outline what was investigated and present the main results. The abstract sums up the main elements of the paper:

- the purpose of the research
- the methods that were used
- the main results obtained
- conclusions derived from the results.

A good approach to writing an abstract is to extract all the important characteristics of each chapter and write them down on a piece of paper. An abstract can be composed of the sentences extracted in this way. The abstract should not contain: information that are not given in the full paper, references, abbreviations and references to Figures and Tables from the full paper. It is best to write the abstract in the end when the paper is completely finished. The abstract is well-written if it is an independent unit which is understandable to the reader without an insight into the full paper. The abstract is as important as the title of the paper because, in addition to the title and key words, it is the first thing that researchers look when they review the literature necessary to prepare new research. The abstract can be conventional and structured. The structured abstract differs from the conventional one in the fact that the title of each chapter is given (e.g., Introduction, Methods, Results, Conclusion). If the journal requires a structured abstract, the guidelines for authors prescribe what titles can be used in such an abstract.

AN EXAMPLE OF A STRUCTURED ABSTRACT

Aim

The purpose of this study was to examine the effect of intensive practice in table-tennis on perceptual, decision-making and motor-systems. Groups of elite (HL=11), intermediate (LL=6) and control (CC=11) performed tasks of different levels.

Methods

All subjects underwent a reaction-time-test and a response-time-test consisting of a pointing task to targets placed at distinct distances (15 and 25 cm) on the right and left sides. The ball speed test in forehand and backhand condition was applied just for HL and LL group.

Results

In CC group reaction time was higher compared to HL ($P < 0.05$) group. In the response-time-test, there was a significant main effect of distance ($P < 0.0001$) and the tennis-table expertise ($P = 0.011$). In the ball speed test the HL were constantly faster compared to the LL in both forehand stroke ($P < 0.0001$) and backhand stroke ($P < 0.0001$). Overall, the forehand stroke was significantly faster than the backhand stroke.

Conclusion

We can conclude that table-tennis-players have shorter response-times than non-athletes and the tasks of reaction-time and response-time are incapable to distinguish the performance of well-trained table tennis players of the intermediate player, but the ball speed test seems to be able to do it.

Key words: Expertise; Motor control; Reaction time; Response time; Complex Task.

ACKNOWLEDGEMENTS

When an article is written as part of some project, the name and the number of the project, i.e., project ID, are stated in the acknowledgements, unless otherwise noted by the journal. People who contributed to the paper in any way and who are not given credit as authors should also be mentioned in the acknowledgements. Authors must obtain permission to include the names of all individuals included in the Acknowledgements section.

An example of Acknowledgements: *This paper was funded by the Croatian science foundation within the project Anaerobic Capacities in kicking combat sports (No: 6524). The authors further wish to thank the members of the organizing committee of the Croatian taekwondo federation for their help in defining the sample for the research which resulted in publication of this paper.*

CONDITIONS FOR AUTHORSHIP CREDIT

A scientific paper should include the names of all individuals who made their scientific contribution in the research process and writing of the paper. Contribution of each author should be clearly defined, and the order in which the authors are listed usually reflects the level of their contribution to the paper. If there is a person who made a “non-scientific” contribution to the paper, which is insufficient for authorship credit, this person can be mentioned in the acknowledgements. For an individual to be credited as author of a scientific paper, they should participate actively in the process of planning, conduction of research, writing or review procedure in publishing the paper.

CHOOSING A JOURNAL FOR PUBLICATION OF THE PAPER

The choice of journal to which you will submit your paper for publication depends on different characteristics which describe it as follows: target audience (readers), scientific area/field covered by the journal, quality of the editorial board, visibility of the journal, *Open Access*, citation, time required for the peer review process, acceptance rates, *Impact factor*, etc. It is very important to choose a journal at the very beginning because the formal appearance of the text (paragraph distribution, literature citation, the length of text, the type and number of appendices) depends on the requirements of the specific journal.

Journals in printed and/or digital form give precise guidelines to authors. The purpose and the aim of the journal, as well as the audience for which it is intended, are also described in those guidelines. As it is not easy to choose a journal, it is recommended to make a list of journals to which the paper could be submitted and then choose the most suitable one.

The questions we need to ask ourselves and actions we have to take when choosing a journal to publish a paper:

QUESTION 1: Which journals publish papers from the area investigated in the paper?

You should perform a subject search of databases relevant for the specific scientific area in order to find journals that publish papers from your area of interest. For the area of sports science relevant databases are: *Current Contents* (CC), *Web of Science* (WOS) and *Scopus*.

CURRENT CONTENTS (CC) is a multidisciplinary bibliographic database which includes about 9500 journals* (12 Croatian), all journals indexed in CC should also be indexed in WoS, i.e., its citation indices (SCI-EXP, SSCI AND A&HCI). This database is available to Croatian academic community in its electronic form through *Thomson Reuters' platform Web of Knowledge* (since 1998).

WEB OF SCIENCE (WOS) is a multidisciplinary bibliographic and citation database which includes three citation indices: *Science Citation Index Expanded* (SCI-EXP), *Social Science Citation Index* (SSCI), *Arts & Humanities Citation Index* (A&HCI); since 1955 it has been indexing journals and tracking citations of papers, and it indexes about 12000 journals, 60 of which are Croatian.

SCOPUS is a multidisciplinary bibliographic and citation database which was presented to the general public in 2004. It indexes journals, book series, trade journals and conference proceedings from all scientific areas. It includes sources from all over the world – more than half of its contents come from Europe, South America and Asia. It has retrogradely indexed journals and there are some records that go back as far as 1823. It has been tracking citations since 1996. It has indexed over 19500 current publications, over 18500 of which are journals and more than 100 of them are Croatian).

QUESTION 2: Are the journals that I have chosen visible and influential in my subject area?

Visibility is checked through the aforementioned relevant databases. The influence within a certain area is evaluated by reviewing the following: the structure/quality of the editorial board, time required for peer review process/publication, acceptance rates, journal index in relevant databases and bibliometric indicators of the journal (*Impact Factor* (IF), *5-year Impact Factor* (5-YEAR IF), *Eigenfactor Score* (EF), *Article Influence Score* (AI), *SCImago Journal Rank* (SJR), *Source Normalized Impact per Paper* (SNIP), *h-index*). The most common way of evaluating the rank, i.e., quality of scientific journals within a certain area (e.g., *sports science*), is expressed in the number called the *Impact Factor*. It denotes the ration of the number of citations from the article published in certain scientific journal in a year and the total number of articles published in that journal in the last two years (or some other given period) in the same journal. A higher impact factor should imply higher reputation and quality of the journal.

Information on journal ranking in a certain area is published annually by the *Institute for Scientific Information* in its *Journal Citation Report*. Journals are categorized according to subject matter into separate WoS subject areas (243 subject areas). A journal can be categorized in several WoS subject areas at the same time, and within a certain area, according to their IF, journals are classified into 4 – quartiles (Q1, Q2, Q3, Q4).

BIBLIOMETRIC INDICATORS OF THE JOURNAL	IF	5-YEAR IF	EF	AI	SJR	SNIP	H-INDEX
TIME PERIOD (YEAR)	2	5	5	5	3	3	N
SELF-CITATIONS	YES	YES	NO	NO	33%	YES	YES/NO
CITATIONS THAT ARE CONSIDERED	ALL	ALL	ALL	ALL	A, R, CP	A, R, CP	OPTIONAL
TYPES OF PAPERS THAT COUNT AS THE NUMBER OF PUBLISHED PAPERS	A, R, CP	A, R, CP	A, R, CP	A, R, CP	A, R, CP	A, R, CP	OPTIONAL
POSSIBILITY OF COMPARING JOURNALS FROM DIFFERENT SCIENTIFIC AREAS	NO	NO	YES	YES-	YES-	YES	NO

LEGEND: A- SCIENTIFIC, ARTICLE, R- REVIEW ARTICLE, CP- CONFERENCE PAPER

Table 4. Different models of metric evaluation of scientific journals and authors

QUESTION 3: *Is the journal suitable for my paper?*

To answer this question, several potential journals should be compared according to different indicators (index in relevant databases, bibliometrics, etc.). In order to be able to compare journals, several different metric indicators should be used and their correct interpretation should be learned to gain the most realistic picture possible of the analyzed journals. Even though separate metric indicators are promoted by stating they enable comparison of journals from different scientific areas, the presented results should be considered with caution and reservations.

QUESTION 4: *Should I submit my paper to a high impact journal and risk being rejected or should I submit it to a low impact journal and increase my chances of being published „more quickly“?*

It is not good to underestimate or overestimate your own paper, try to evaluate the quality of your paper realistically and choose an optimal journal accordingly. If you believe your paper is of high quality, submit it to journal with a higher impact factor first, and if it gets rejected, you can later submit it to a journal with a lower impact factor.

COMMUNICATION

In communication with editors and reviewers, regardless of the possible difference of opinion or attitudes and the outcome of publication of the submitted paper, you should always mind your manners and maintain communication at academic level. In most cases, reviewers and editors are respected scientists who do their job without compensation. If you think the reviewers have misunderstood or misinterpreted certain parts of your manuscript, you can try, in a polite manner and with valid arguments, to explain your opinion. In communication with reviewers keep in mind that they should have access to all data and papers mentioned throughout your paper, thus it would be advised, in addition to the paper itself, to also provide papers that are at a certain level of submission or publication process.

CORRECTIONS BASED ON RECOMMENDATIONS FROM REVIEWERS

All changes made to the manuscript based on instructions or suggestions from the reviewers must be elaborated and precisely clarified in the written response. As an example, we offer a response to reviewers' suggestions asking for abridgement of the manuscript forwarded to the publishing procedure:

Dear Reviewer, following your recommendations, we have abridged the manuscript for approximately 30%, and you can see the comparison of the previously submitted manuscript and the revised, i.e., „abridged“ version through chapters in the following Table.

ACCEPTANCE OR REJECTION OF PAPER

- If the reviewers or editors assess that a paper has scientific value for certain journal, they will inform you with a short note

Dear Doctor,

Your manuscript has been accepted for publication and forwarded to the publisher. You will receive official confirmation shortly.

- If the reviewers or editors assess that your manuscript does not have scientific value or does not belong to the area covered by the journal to which you submitted your manuscript, they will inform you with a note.

Dear Dražen,

We hereby inform you that due to the large number of papers submitted and publication space limitations, unfortunately we are not able to accept your manuscript for publication at the moment. We hope you are not disappointed with our response and hereby express our sincere wish that you will continue with submission of manuscripts in the future and allow our readers to become familiar with your research results.

- Whether the response is positive or negative, it is polite to thank the reviewers and editors of the journal for their time.

Dear Editor/Reviewers,

Thank you for your valuable time and good suggestions which will surely help us in improving the quality of the manuscript in the publishing process in some other journal. We have another manuscript in preparation that will be submitted to you when finished.

LITERATURE, BIBLIOGRAPHY AND REFERENCING

When writing scientific and expert papers correct referencing and citations are very important. This mainly refers to decreasing the chance of some paper or part of paper being classified as plagiarism. In the process of writing scientific and expert papers plagiarism refers to unauthorized copying of someone else's ideas, thoughts, findings, research results, different images (tables, figures, illustrations, etc.) without explicitly stating the original their source or passing off someone else's work as your own.

PLAGIARISM

There are different reasons for emphasizing papers from other authors that are important for current research for any reason, whether they represent theoretical or practical bases, to allow insight into the given area of research and enable others to study them in detail (which authors have dealt with the same or related subject matter, the development course of research on given problem, the latest achievements in a given area, are there other areas which deal with research that are important for the primary area of research, etc.), that the current research relies on their results or conclusions or carries on their work, etc.

Apart from the aforementioned, citation and referencing often point to the fact that the author, i.e., authors are not alone in their statements, attitudes and findings, and sometimes serve to refer to some eminent authority in a given area. According to *Garfield (1986)*, there are more than 250 different ways of referencing scientific literature. Editors of prestige biomedical journals met in Vancouver, Canada, in 1978 to agree upon a uniformed style of referencing scientific papers. One of their suggestions was for the authors to number the references in the order in which they appear in the text (*International Committee of Medical Journal Editors 1997*).

There are several generally accepted citation systems in practice today: Numerical, Alphabetical, Alphabetical-numerical, Vancouver. Each of these systems implies a defined set of precise rules for citing the sources in the paper and the way in which they are referenced in the reference list/bibliography. The simplest referencing model is called the Harvard system. Regardless of the referencing style we choose, it is important to emphasize what parts of the text belong to the author, and which are taken from other sources or other authors. The common way of separating the author's own thoughts, results, statements, etc. from those belonging to other authors is to use quotation marks or write in Italic font style. It is important that the use of quotation marks or Italics enables the reader to see where the citation starts and where it ends, and that the same model is applied throughout the paper – (either quotation marks or Italics, never use both in the same paper).

CITATION SYSTEMS

HARVARD SYSTEM

According to *Belak (2005)*, References include a list of references that are directly cited in the text, i.e., all citations in the text must be listed in the References (a list at the end of the paper), and vice versa, all citations from the list must be cited in the text. Bibliography contains a list of references cited in the text, but also all other sources that were used during the process of writing a scientific paper, and which were not cited in the text. Bibliography presents the fact that authors study and review much more sources than those cited when they conduct their research and write the paper. Secondary referencing is citation of a paper that has not been read by the author for any given reason, but its reference has been found in some other author's paper, which is emphasized in the text as follows: *Čular (2011)*, as cited in *Sporiš (2015)*.

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(CARL SAGAN)

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Dražen Čular, PhD, was born on 10th May 1970, married, father of three children, Croat, Croatian citizen, Croatian defender-volunteer awarded the Commemorative Medal of the Homeland War. He was physical education teacher at High school Jure Kaštelan in Omiš from 2000 to 2007. He was adjunct professor and course leader of Kinesiological recreation and kinesiological education at the Faculty of philosophy, University of Split from 2006 to 2009. Senior lecturer at the Faculty of philosophy in Split from 2009 to 2011. He defended his doctoral dissertation *Factors of success in taekwondo – attitudes of elite coaches* at the Faculty of kinesiology, University of Split, on 11th October 2011. By the decision of Scientific Committee for the Social Sciences, field of educational sciences the from 19th December 2011, he was named research associate in the scientific area of humanities, field of kinesiology. He is currently employee of the Faculty of Kinesiology, University of Split, as assistant professor for the area of Social sciences, field of Kinesiology, branches Kinesiological recreation and Sports kinesiology. He is the course leader of Basics of kinesiological recreation and fitness, Individual programmes in recreation and fitness, Diagnostics in recreation and fitness 2, Sports systems, Sport climbing, Outdoor sports on wheels, Taekwondo, and Systematic kinesiology 2. He is the course leader of Methodology of scientific research in kinesiological recreation and fitness at the post-graduate doctoral study of kinesiology at the Faculty of Kinesiology, University of Split. He is actively involved in realization of classes for foreign students in English as part of the ERASMUS programme. He has published more than 60 scientific papers, 15 of which have been published in the *Web of Science (WoS)* database. He has participated as invited lectures and presenter at a number of international scientific conferences. He is the author and leader of 12 expert projects/programmes, Leader and principal investigator at competitive four-year scientific-research project of the Croatian Science Foundation: *Anaerobic capacities in kicking combat sports (2014–2018)*. He is the author and editor of several university handbooks, expert and strategic studies. Roller-skating instructor of the Croatian Roller-Skating Federation, ski teacher of the Croatian Snow Sport Instructors and Trainers Association. International taekwondo instructor, holder of 5th dan black belt, licenced coach and examiner for the ranks of the Croatian Taekwondo Federation. Former head of the Croatian junior national team in sport climbing and selector of para-taekwondo and Croatian student national taekwondo team. Member of the Croatian Olympic Committee Assembly and Executive board of Sports Association of Split. Since 2014 he has been the advisor of the Croatian taekwondo federation for testing and monitoring fitness level of members of all age selections of the Croatian national taekwondo team. Head of Professional studies (2012-2013), Advisor to the Dean for development and implementation of modern technologies (2013-2014), and Vice-Dean for business politics and finances and Head of the Institute for Kinesiology at the Faculty of Kinesiology in Split since 2014.



Krešimir Šamija, PhD, was born on 11th October 1979 in Zagreb, married, Croat, Croatian citizen. He went to elementary school Davorin Trstenjak in Zagreb, which he finished in 1994. He then enrolled the II Gymnasium in Zagreb, which he finished in 1998. That same year, he enrolled the Faculty of kinesiology at the University of Zagreb and graduated on 31st March 2004. In 2006, he enrolled the postgraduate doctoral study in social sciences, the field of educational sciences, branch of Kinesiology, modul sport. He defended his doctoral dissertation titled „*The effects of specific speed and agility training (SAQ) on morphological, motor and functional characteristics of soccer players*“ on 4th May 2011 at the Faculty of Kinesiology, University of Zagreb. He was made adjunct professor at the Skiing course of the university study of kinesiology and undergraduate studies at the Study Centre for Coach Education and Training on 9th January 2006. As a ski instructor with international professional licence (ISIA), in the last ten years he has been involved in classes and teaching skiing to both students and citizens of all ages. He has diplomas of soccer (A – licence) and fitness coach. On 7th November 2011, he was made adjunct professor at the courses of Systematic kinesiology, Methodology of kinesiological research and Orientation and selection in kinesiology at the integrated undergraduate and graduate university study of kinesiology, and the Basics of kinesiology course at the Study Centre for Coach Education and Training at the Faculty of kinesiology, University of Zagreb. On 24th February 2016, at the Faculty of Kinesiology in Split he was made lecturer at the Sports system course. In the period from 2002 to 2009 he worked as coach of younger age categories at NK Sava, NK Lokomotiva and NK Hrvatski dragovoljac. From 2004 to 2007 he was physical education teacher at Vladimir Prelog Science School in Zagreb. He passed his state qualifying exam for physical education teacher on 9 November, 2005. He has been employed at the Department for Sports at the Ministry of science, education and sports since 24 May, 2007, as expert associate, expert advisor, senior expert advisor, head of the Department for physical education, sport and sports recreation, and currently as the head of the Sector for elite and recreational sport and sport in education. He has published one CC paper, 6 scientific papers in other journals, and 3 scientific papers and 6 expert papers in conference proceedings. During his employment at the Ministry of science, education and sports he represented Croatia in several expert bodies of the European Council, and he is currently a member of the Expert group „*Human resource development in sport*“ of European Commission for the period of 2014-2017, which deals with expert qualifications in sport, dual career, employability and volunteering in sport.



Goran Sporiš, PhD, was born on 6th September 1979, in Zagreb. He attended elementary school Šestine in Zagreb, which he finished in 1994. That same year he enrolled the II Gymnasium in Zagreb, which he finished in 1998. He enrolled the Faculty of Kinesiology in Zagreb in 1998, and graduated on 30th January 2003. On 20th January 2004, he enrolled the post-graduate doctoral study in social sciences, the field of educational sciences, branch of Kinesiology, modul sport. He defended his doctoral dissertation under the title *“Effects of situational, polystructural complex training on morphological, motor and situation-related motor and functional abilities”* at the Faculty of Kinesiology, University of Zagreb on 24th September 2007. On 1st January 2005, he was employed as assistant on the subject Systematic Kinesiology and Research Methodology of Kinesiology of the university graduate study of kinesiology at the Faculty of Kinesiology in Zagreb. By the decision of the Scientific Committee for the Social Sciences, field of educational sciences, dated 13th March 2012, Goran Sporiš gained the scientific title of senior scientific associate in the scientific field of social sciences –kinesiology. On 23rd May 2012, he was appointed the position of associate professor in the field of social sciences, kinesiology – branch Systematic kinesiology at the Faculty of Kinesiology, University of Zagreb. He was advisor on 34 graduation papers and 2 doctoral dissertations. He currently holds the position of Department of General and Applied Kinesiology vice-head, International Relations Office head at the Faculty of Kinesiology University of Zagreb. He teaches classes in Research Methodology in English for foreign students within the framework of ERASMUS+ programme. He is a reviewer to 18 international journals. He is a member of editorial board at two international journals. He has published 2 authored books, 4 edited books, 7 book chapters, 2 handbooks, 17 scientific papers in CC journals, 68 scientific papers in other journals, 10 plenary lectures at conferences, 20 scientific papers in conference proceedings with international peer review, and 26 abstracts in conference proceedings.



