EXPERTS MODEL OF EXERCISES FOR THE CORRECTION OF CHARACTERISTIC MISTAKES MADE DURING THE EXECUTION OF DYNAMIC PARALLEL SKI TURN

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Original scientific paper

Abstract

The purpose of the present study was to investigate the formation of an expert model of the most important methodical exercises for correction the mistake Slipping, manifested through execution of dynamic parallel ski turn, and the hierarchical classification of the expert model a two-stage research was conducted. In the first phase of the research with the aim of forming an expert model of the most important methodical exercises for correction the mistake Slipping manifested through execution of dynamic parallel ski turn participated of 20 skiing experts aged 25 to 45. By means of email and coordinated by the paper author, the experts first defined a model of 13 methodical exercises and then, on a scale from 1 to 5, selected the five most important exercises. In accordance with the objective set by the study a nonparametric chi - square test ($\chi 2$) was used. Based on the obtained values of testing difference between the experts in the evaluation of the five most important methodical exercises was not established ($\chi 2$=14,22; p=0,22). The expert model of most important methodical exercises for correction of the Slipping mistake consisting of: *Hands on knees, External arm on side and other on internal knee, Hands on hips, Sticks with hands on sides* and *Pushing the external shoulder in turn*. In the second phase of the research with the aim of forming the hierarchical classification of the expert model of the most important methodical exercises for correction of the Slipping mistake correctional correction exercises manifested through execution of dynamic parallel ski turn, 307 ski experts various levels of ski knowledge participated. Respondents' mission was to rank the exercises based on their opinions of how important they are. Total amounts of rank sums (ΣR) were calculated, as well as the Kruskal-Wallis test (H-test), and belonging levels of significance (p) with the purpose of comparing the significance of diversity between rank sums and expert model. The statistically significant difference was found between the sum of the sum of the sum of the rank (ΣR) of the most effective exercises for the correction of the characteristic mistake Slipping (H=210,37, p <0,001). The results of the two phases investigate of this research provide valuable information on the methodological settings of dynamic parallel ski turn. In future research it is necessary to evaluate the formed expert model of the most important methodical exercises, as well as its hierarchical classification, in different groups of respondents.

Key words*: Expert evaluation, alpine skiing, methodical exercises, dynamic parallel ski turn*

Introduction

Cigrovski and Matković (2008) said that Alpine skiing, as a sports and recreational activity, which is executed in specific mountain conditions, has positive influence on human body, both in health and sociological terms. Skiing is a motor activity in which an athlete needs to use a wide spectrum of skiing techniques in order to execute turns with the purpose of overcoming snow slopes. Lately, Alpine skiing has become an incredibly popular sports and recreational activity which attracts an increasing number of enthusiasts. The popularity of Alpine skiing stems from its benefits for the health of people who engage in it, but also from the excitement it provides. Downhill skiing, especially when performed on a regular basis, may contribute to healthy aging due to its association with a healthier life style including higher levels of physical activity (Butscher et al. 2019). Alpine skiing, for example, requires a variety of qualities. Besides material factors (skis and equipment) a variety of human skills consisting of sport-specific (ski technique) and sport unspecific features (e.g. the athlete's physical, physiological and psychological profile) is responsible for success in competition (Franjko, 2007, Neumayr et al. 2003). The skiing sports and disciplines involve a complex integration of many different physiological systems, none of which may be more important than the other for overall performance (Turnbull, 2009). All cited aspects of ski performance require an excellent technique of an athlete. In purpose of making Alpine skiing more successful, a number of skiing schools are opened. In those schools the ski experts and instructors teach the students the right ski techniques. Carefully designed programs of ski schools facilitate learning and reduce the time required for mastering specific techniques. Fédération Internationale de Ski (FIS) is the world's biggest governing body. Numerous national ski

federations exist and operate under the supervision of FIS who takes it on itself to organise skiing schools and the instructions. However, there is a certain difference in ski school programs among national federations. Current programs which exist in the territory of ex-Yugoslavia are Slovenian, Croatian and Bosnian and Herzegovinian ski school programs (Kuna, 2013).

Level of expertise and high quality of the instructions given by the skiing teachers and experts is an essential factor in process of adopting and upgrading the motor skills related to skiing techniques. Ski teachers or coaches need to have a wide range of learned motor skills and skiing techniques, methodical and didactical knowledge of learning principles, and the basics of psychological approach when working with people. Due to the fact that the process is aimed on people, there are significant differences between the potential learners, the level of their development and ratio between their anthropometrical specifications, skills and performances. In addition, ski instructors need to understand the dynamics of methodical processes in service of quality learning of ski techniques. Following historical adaptations of ski techniques, carving technique has been profiled as the most popular technique in 21st century. Carving technique is defined as a way of skiing in which skis are positioned in parallel stance in regard to turns. For example, when the movements of Alberto Tomba (the dominant skier in technical disciplines during the late 1980s and 1990s, who has won gold medals in slalom and giant slalom at the World Championships and Olympic Games) were analysed on the basis of slow-motion video recordings and images, coaches realized that he placed more pressure on the tails of the skis after the fall line, enabling "carving" (i.e., cutting into the snow, so that the skis bend into an arc and then turn). The translocation of pressure from the forefoot (at the beginning of the turn) towards the heel (at the end of the turn) is still a feature of alpine ski racing (Supej, 2019, Falda-Buscaiot et al., 2017). Today's carving techniques also rest on these settings, but with accentuation of deflection of body in the opposite side of the hill, and routing knees to the hill. It is important to accentuate the importance of having adequate skis. Carving skis are special because of its lateral curvatures, which makes them easier to control. Typical carving skis have a side cut radius of the order of 16m at a chord length of 170 cm. However, parameters used in various models may be adapted to the intended application (Jentschura, 2003). In previous researches (Kuna, 2013), expert model for teaching dynamic parallel turns is defined, the same as the characteristic mistakes made in the process, and the most important exercises for their correction. Aimed researches seek for further detailed elaboration of methodical settings in teaching parallel dynamic turns with the purpose of improving the quality of the learning process.

Since one of characteristic mistakes in execution of dynamic parallel turns is *Slipping,* this research had two objectives: a) Forming an expert model of the most important methodical exercises for correction the *Slipping* mistake, manifested through execution of dynamic parallel ski turn, b) Forming the hierarchical classification of expert models for most important exercises for correcting the *Slipping* mistake through execution of dynamic parallel ski turn.

Methods

Participants and procedure of measurements

Data was collected in order to form an expert model of most important correction exercises for a mistake called *Slipping,* a mistake which most often occurs during the execution of dynamic parallel ski turn. The sample of respondents is formed from twenty state demonstrators. There are eight demonstrators from Croatia team, six demonstrators from Slovenia team and six from Bosnia and Herzegovina team. Following the request of authors of this research, and with the approval of president and members of the executive council of HZUTS Croatia, ZUTS Slovenia and ATUS Bosnia and Herzegovina, the state demonstrators agreed to take part in forming the methodical settings for forming the expert model for correction of the *Slipping* mistake, the one that occurs during the execution of dynamic parallel ski turn. Requests in Microsoft Word form were sent to the respondents via mail, along with the descriptions of each of the elements and their role in research. Through the two-way communication with the author, the experts formed model of the most important methodical exercises for correction the *Slipping* mistake. They had to choose between thirteen correction exercises which are: *Hands on knees – HOK, Hands on hips - HOH, Internal hand on side and external hand on internal knee – IHSEHIK, External arm in front, Internal arm in the extension - EAFIAE, Inner ar min the front – IAIF, Hands on knees with clap during the turn - HOKWC, Internal arm on side and other on hip IASOH, Elevation of internal ski during the turn EISDT, Pushing the external shoulder in turn PESIT, Sticks with arms in front SWAIF, Pull the inner ski back in the turn – PISBIT, Internal stick behind the neck, External stick draws on snow – ISBNESDS, Sticks with arms in the extension - SSWAIE.*
After forming the expert model, they asked the respondents to select/highlight the five most important correction exercises. In order to make the process more transparent, all of the exercises were filmed and put in „gif" format so the respondents can know exactly which element is which. After that, an online poll was formed and sent to all respondents from the second stage of research. A sample of respondents is made by four hundred and sixty ski teachers with various levels of expertise from Croatia, Slovenia and Bosnia and Herzegovina. They were supposed to fill the whole poll and send their personal data and IP addresses. After filtrating of results, three hundred and seven results were used in further data processing. The final sample of respondents was made by one hundred and eighteen Croatian, one hundred and nine Slovenian

and sixty Bosnian ski teachers, aged between twenty five and forty five.

Sample of variables and statistical analysis

A sample of variables is defined in the first stage of research, with the expert model of most important correction exercises for correction of the *Slipping* mistake consisting of: *Hands on knees, External arm on side and other on internal knee, Hands on hips, Sticks with hands on sides and Pushing the external shoulder in turn.* Respondents' mission was to rank the exercises based on their opinions of how important they are. Data processing was executed with „Statistica Windows 12.0" program, and significance level is set on p<0,001. Total amounts of rank sums were calculated, as well as the Kruskal-Wallis test (H-test), and belonging levels of significance with the purpose of comparing the significance of diversity between rank sums and expert model. In order to achieve harmony between the experts, Kendall Tau (τ) coefficient was calculated.

Results and discussion

Table 1 shows total values of the most important methodical correction exercises ranking. Based on the results, it can be said that there is no statistically significant difference in the evaluation of five most important methodical correction exercises for the *Slipping* mistake between expert choices. A reason for that is probably the fact that experts defined too wide a spectrum of methodical exercises which have specific values and contributions in correction of the *Slipping* mistake, so distribution of their values was dispersed.

Table 1. Expert evaluation of the most important correction exercises for the *Slipping* mistake made during execution of the dynamic parallel ski turn. Observed (OF) and expected (EF) frequencies of expert evaluation for correction exercises, value of Chi-square test ($\chi 2$) and level of significance (p).

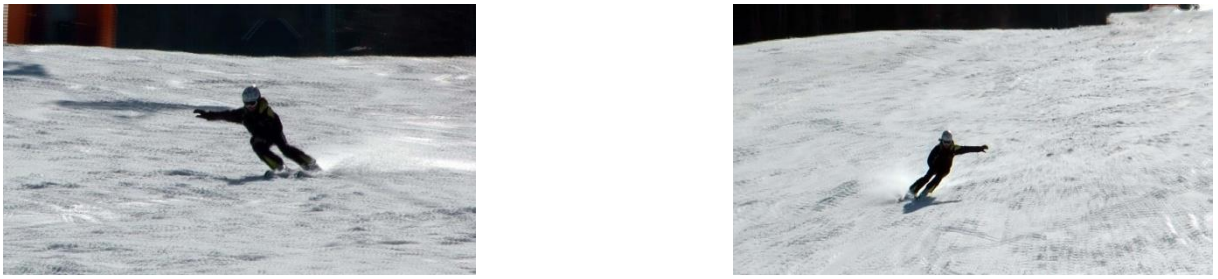
The most important correction exercises for the *Slipping* mistake	**OF**	**EF**
HOK	9	4,61
HOH	7	4,61
IHSEHIK	8	4,61
EAFIAE	3	4,61
IAIF	1	4,61
HOKWC	4	4,61
IASOH	4	4,61
EISDT	2	4,61
PESIT	7	4,61
SWAIF	3	4,61
PISBIT	2	4,61
ISBNESDS	4	4,61
SSWAIE	6	4,61
	$\chi 2$=14,22 p = 0,22	

After analysing five most important methodical correction exercises for the *Slipping* mistake it is clear that the exercise with the biggest value is the one called *Hands on knees*.

Picture 1. *Hands on knees*

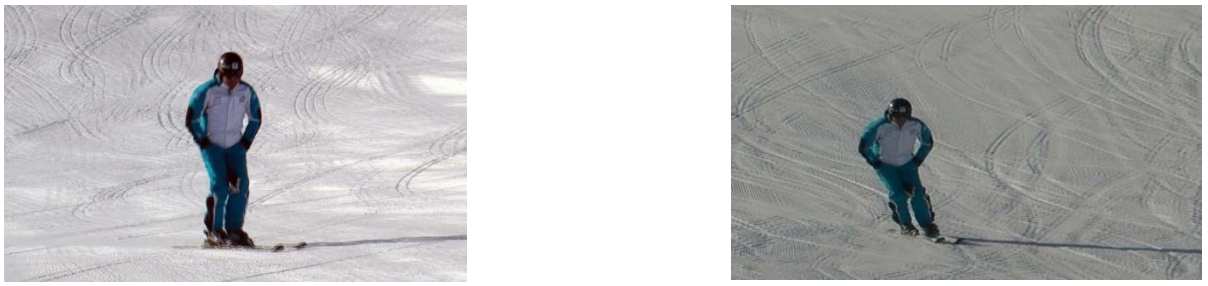
The goal of the students while executing the exercise called *Hands on knees* during the dynamic parallel ski turn is to push their knees in the way of motion and thus place their skis on their edges.

Picture 2. *Internal hand on side and external hand on internal knee*



The second exercise is called *Internal hand on side and external hand on internal knee*. When performing it, the student needs to push the internal knee on the external edges while simultaneously pulling the internal knee with external hand in order to increase the side bend of the trunk which means getting into the best position for carving on the internal ski edges. Next exercises are *Pushing the external shoulder in turn* and *Hands on hips* which have the same value of expert evaluation.

Picture 3. *Hands on hips*



When holding the hands on hips, the student is focused on attaining the right centre of gravity on skis and placing the skis on their internal edges in order to perform the turn. This methodical correction exercise is especially valuable because, during the dynamic parallel ski turn with hands on hips, the student is getting a feel, a notion of what the right position of skis is, which depends on the steepness of the hill and hip width.

Picture 4. *Pushing the external shoulder in turn*

Pushing the external shoulder in turn is an exercise in which student, during the dynamic parallel ski turn, has sticks positioned parallel with the hill all the while pushing his external shoulder on external side and simultaneously pushing his knees and hips in the centre of turn, which enables a good side bend of trunk and dominant pressure on the external ski.

Picture 5. *Sticks with arms in the extension*

The last methodical correction exercise in expert evaluation results is called *Sticks with arms in the extension* in which the students hold their sticks in extension of arms on sides while executing dynamic parallel ski turn. During the execution of the turn the student pushes his internal hand holding the stick on side in parallel position with hill while his external hand with stick pushes down in parallel position with hill, and the angle depends on the steepness of the hill and on the movement of the body. This exercise is valuable and useful because it demands the trunk to be bent during the turn.

Table 2. Sum rank of evaluation of the most efficient methodical correction exercises for the *Slipping* mistake made during the execution of dynamic parallel ski turn, Kruskal-Wallis test (H-test) and level of significance (p).

The most efficient correction exercises for the *Slipping* mistake					
	HOK	**HOH**	**IHSEHIK**	**PESIT**	**ΣR**
HOK					838
HOH	0,00				692
IHSEHIK	0,00	0,00			980
PESIT	0,00	1,00	0,00		662
SSWAIE	0,00	1,00	0,00	1,00	664
H=125,06; **p**<0,001					

The analysis of received rank sum values for most efficient methodical correction exercises, gathered from ski teachers with different level of education (N=307), from H-test and p values, shows that there exist statistically significant differences (Table 2).

With the use of non-parametric post-hoc analysis, it has been found that there is significant difference (p=0.000) between sum rank results of methodical correction exercises *Hands on knees*, *Hands on hips*, *Internal hand on side and external hand on internal knee*, *Sticks with arms in the extension* and *Pushing the external shoulder in turn.* Also, there is statistically significant difference (p=0,000) between variables *Hands on hips* and *Internal hand on side and external hand on internal knee*, as well as between variables *Internal hand on side and external hand on internal knee*, *Pushing the external shoulder in turn* and *Sticks with arms in the extension*, *Internal hand on side and external hand on internal knee* and *Sticks with arms in the extension.*

According to received differences between sum ranks of methodical correction exercises, a hierarchical classification of selected exercises was constructed. The correction exercise with the highest value in efficiency of correcting the *Slipping* mistake is the one *called Internal hand on side and external hand on internal knee*. Exercise called *Hands on knees* is in the second place. Third place belongs to exercises *Hands on hips, Sticks with hands on side* and *Pushing the external shoulder in turn.*

Exercise called *Internal hand on side and external hand on internal knee* is a high quality exercise in which students need to stimulate their kinaesthetic organs and their proprioception. These dimensions are as important in the process of learning ski techniques as they are in the manifestation of dynamic parallel ski turn. Continuous active cognition of the stance of the body in regards to the hill is an essential element of a high-quality ski technique and skiing itself. Second exercise, according to the sum rank results, is an often practised exercise in ski schools because it directs the students' focus on the movement of knees, which is often the reason for making mistakes during the dynamic parallel ski turn. Because knee is one of the biggest joints in human body, it has many proprioceptors that need to be activated in order to be strengthened and improved, and to get the right position of the body during the execution of the turn. Students often put too little effort into lateral pushing of the knees „to the hill" and forward because they are afraid, and this exercise can help overcome that fear. The exercises in the third place are used for getting the right body position and body control, too. The exercise *Hands on hips* is used for accentuation of movement in the hips. If we consider importance of hip movement during the execution of dynamic parallel ski turn, this exercise is quite important. In comparison to the exercise called *Hands on hips*, this exercise is positioned on lower place in hierarchical classification probably because of getting the hips into the correct position as a precondition for getting the correct position of knees during the execution of dynamic parallel ski turn. According to expert evaluation, exercise called *Sticks with hands on side* is, in hierarchical classification, at the same level of importance as is the exercise *Pushing the external shoulder in turn*. Aimed exercises are helpful because they demand active posture, and the lateral trunk bends downhill. Precondition for a quality execution of those exercises is a good coordination of the students, and an adequate amount of pressure on external ski during the turn. That can be really challenging because students need to control all the key elements and determinants of dynamic parallel ski turn.

Conclusion

After the presentation and analysis of received results, in relation with selected objectives, important information about methodical correction exercises for the *Slipping* mistake are collected. The construction of expert models of important methodical correction exercises and the selection of the five most important exercises, we got transparent, effective and precise correction settings for correction of the *Slipping* mistake which often occurs during the execution of dynamic parallel ski turn. With formation of hierarchical classification of expert model for most important methodical correction exercises, given from ski teachers and experts with different levels of education and expertise, strict and precise information about correction exercises in the process of ski studying are mentioned and emphasized. Special value of this new-composed expert model of correction exercises for characteristic *Slipping* mistake, and the hierarchical classification of those exercises, is observed through their application in advanced and competitive ski schools. With the practical application of the presented results, especially with ski students who have problems with executing the correct dynamic parallel ski turn, this newly composed expert model can be of large help. That means that it has a constructive value in real life and it can improve the efficiency of ski schools.

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Received: 17.09.2019.
Accepted: 10.01.2020. .
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