Danijela Kuna[1]
Eric Brymer[2]
Keith Davids[3]
Dragan Marinkovic[4]

TASK CONSTRAINTS PATTERNS IN ACQUISITION OF THE BASIC TURN AS IMPLEMENTED BY INTERNATIONAL EXPERT SKI COACHES

VZORCI OMEJITEV NALOG PRI UČENJU OSNOVNEGA SMUČARSKEGA ZAVOJA, KOT GA IZVAJAJO MEDNARODNI STROKOVNI SMUČARSKI TRENERJI

ABSTRACT

The aim of this paper was to rank the most important didactic exercises for teaching the basic ski turn. Participants included 307 ski instructors and assistants teaching at different professional ski levels and coming from different countries. Participants were asked, via online survey, to rate the significance of exercises included in the formed model of the most important didactic exercises for teaching the basic ski turn. This model consisted of six different variables. The participants were divided in three groups based on their skiing ability level. In accordance with the study objectives, the rank-sum values (ΣR) of the most important didactic exercises for teaching the basic ski turn were calculated, as well as the appropriate empiric level of significance (p), which was calculated by using a non-parametric equivalent to post-hoc analysis, i.e. the Kruskal-Wallis test (H-test). Statistically significant differences were obtained between the values of ranking the most important didactic exercises for teaching the basic ski turn ($H=138,62$; $p<0,001$). The results of this study provide an accurate and scientifically-founded didactic setting for teaching the basic ski turn. This study sets foundations for the possible direction of future studies in terms of constructing measuring instruments. The practical application should provide better selection, as well as wider choice of modalities and training exercises in the process of training alpine skiers of various ages and different skiing ability levels.

Key words: hierarchical classification, skiing experts, basic ski turn.

[1]University of Split, Faculty of Kinesiology - Croatia
[2]Institute of Sport, Physical Activity and Leisure, Leeds Beckett University- UK
[3]The Centre for Sports Engineering Research Sheffield Hallam University - UK
[4]University of Novi Sad, Faculty of sport and physical education, Novi Sad, Serbia

Corresponding author:
Dragan Marinkovic
University of Novi Sad, Faculty of sport and physical education
Lovcenska 16, 21000 Novi Sad, Serbia
e-mail: marinkovic@uns.ac.rs

IZVLEČEK

Cilj tega prispevka je bil razvrstiti najpomembnejše didaktične vaje za poučevanje osnovnega smučarskega zavoja. Med udeleženci je bilo 307 učiteljev smučanja in njihovih pomočnikov, ki poučujejo na različnih profesionalnih ravneh, bili pa so iz različnih držav. Udeležence smo prosili, da preko spletne ankete ocenijo pomembnost vaj, vključenih v izoblikovani model najpomembnejših didaktičnih vaj za poučevanje osnovnega smučarskega zavoja. Model je obsegal šest različnih spremenljivk. Udeleženci so bili na podlagi znanja smučanja razdeljeni v tri skupine. V skladu s cilji raziskave smo izračunali vrednosti vsote rangov (ΣR) najpomembnejših didaktičnih vaj za poučevanje osnovnega smučarskega zavoja ter ustrezno empirično stopnjo značilnosti (p), ki je bila izračunana s pomočjo neparametričnega ekvivalenta post-hoc analize, t. j. Kruskal-Wallisov test (H-test). Statistično značilne razlike smo ugotovili med vrednostmi ocen najpomembnejših didaktičnih vaj za poučevanje osnovnega smučarskega zavoja ($H = 138,62$; $p < 0,001$). Rezultati te raziskave ponujajo natančno in znanstveno utemeljeno podlago za poučevanje osnovnega smučarskega zavoja. Raziskava postavlja temelje za usmeritev prihodnjih raziskav v oblikovanje merilnih instrumentov. Praktična uporabnost rezultatov je v zagotavljanju boljše selekcije ter širšega izbora modalnosti in vaj v treningih alpskih smučarjev različne starosti ter z različnim znanjem smučanja.

Ključne besede: hierarhična razvrstitev, smučarski strokovnjaki, osnovni smučarski zavoj

INTRODUCTION

Acquiring and mastering alpine skiing is influenced by task, environment and individual factors such as the evolution of skiing equipment, type of snow surface traversed, coaches' expertise levels, and individual factors such as motivation and physical preparation (Kipp, R. 2012). A successful performance in alpine skiing is based on learner's capacity for acquiring a functionally dynamic movement pattern which remains stable, yet somewhat adaptable, under various performance conditions (e.g. changing ambient temperatures, wind direction and strength, and snow properties) and types of skiing slopes (e.g. rate of inclination and its changes, tightness of bends and cambers) (Cigrovski, V. et al. 2014). Skilful skiers have a functional relationship with the performance environment successfully coordinating various elements characteristic for the process of skiing (such as coordination of movements of the upper and lower body parts), adapting them to different types of snowy terrain. Furthermore, when coordinating all the necessary actions, good skiers need less energy to transit across a slope compared to those with lower levels of skiing expertise (Bucher et al., 2014, Maleš et al., 2013).

Acquiring expertise in skiing and the ability to perform in more challenging environments depends on the degree to which a learner acquires and performs an important component of skiing, the basic ski turn (Kuna, 2012). This is because the basic ski turn is a foundation for the advanced skills system. Therefore, understanding how a learner acquires the skills involved in the basic ski turn and how to best facilitate learning of this turn is an important factor in learning to ski (Kuna, 2012; 2013).

Previous research has shown that expert coaches' experiential knowledge often provides a wealth of valuable information on designing effective learning environments in sport (Greenwood et al., 2012). Expert coaches' experiential knowledge can also be enhanced when guided by a principled theoretical framework (e.g. Chow et al., 2016). There are no studies on the role of experiential knowledge of ski coaches in facilitating skill learning in skiing or on the integration between theoretical frameworks and their experimental knowledge. The traditional method for learning to ski is through the ski school process. The ski school programme aims to enable and accelerate the acquisition of ski skills. In a ski school, the principle of progressivity means that learners develop from easy activities designed to ensure safety and progression to more advanced skills, for example, from the snow plough to the parallel ski. The snow plough has numerous functions including ensuring that a skier can stop and is relatively safe on the slopes. Through progression the skier moves into parallel skis and snow plough turns, and eventually into parallel turns. Experts from different skiing nations have previously attempted to represent the ski skill development process and define different concepts, specific classifications, and teaching models of skiing techniques in contemporary skiing schools programmes, often with dissimilar outcomes (e.g. Elling, 2003; Murovec, 2006; Anderson, 2007; Harald, 2010; Kipp, 2012; Puškarić, 2010; Lešnik & Žvan, 2010). For the most part these perspectives focus on a 'one size fits all' notion of learning to ski where techniques are the focus and learners adapt to the technique. However, the acquisition of a 'standard technique' is still the focus of all the traditional approaches. The problems arising from this approach in skiing are that skiers are often at different psychological stages, different developmental stages, have different morphological characteristics, might have different sporting history or injuries and so forth. One of the main preconditions for successful alpine skiers training is the formation of an expert model of didactic exercises (Lešnik et al., 2017).

In practice, ski coaches often combine different skiing techniques depending on the learner and the learning environment (Lešnik & Žvan, 2010).

The current focus on technique means that different countries and ski schools have adopted distinctive technique-based teaching programmes under the assumption that a specific technique developed is the most effective one. The first element taught at a ski school refers to the performance of parallel and snowplough techniques whilst applying a carving turn, is considered to be a basic turn. It includes a significant number of specific skiing skills which provide a possibility of successfully overcoming steeper ski slopes by connecting turns dynamically. Further progress in the acquisition of skiing skills depends on the quality of performance of the basic turn (Kuna, 2012), therefore it can be referred to as one of fundamental elements of a ski school. Based on the results of a study which established an expert model for the most significant ski elements in a programme of a basic ski school (Kuna, 2012) and developed an expert model for teaching the basic turn (Kuna, 2103), this study examines a hierarchical classification of the expert model in order to effectively facilitate learning. Accordingly, the purpose of the current study is to rank the most important didactic exercises for teaching the basic ski turn.

METHODS

Participants

Participants (n= 307) consisted of skiing instructors and assistants teaching at different professional ski levels and coming from different countries (aged 30±10), divided into two groups; advanced expert instructors and basic expert instructors.

Instruments / Data Collection Procedures

An online questionnaire was developed and uploaded on a specialized server used in global electronic data collection and analysis. In the first instance the questionnaire was completed by 20 top elite skiing experts who were selected based on their knowledge of skiing. This group recommended didactic exercises for teaching the basic ski turn that were used in this research. The participants voluntarily agreed to take part in this study. The most important didactic exercises for teaching the basic ski turn recommended by the top elite skiers were described and displayed via the Graphics Interchange Format (GIF). Participants were asked to rank, on a scale from 1 to 6, the displayed didactic exercises for teaching the basic ski turn. Based on the current ski literature that is used in didactics for teaching alpine skiers, six methodical exercises most frequently used for teaching the basic ski turn, were selected as follows: turn towards the hill with active skis (TTHAS), turn towards the hill and a take-off into the plough (TTHTP), ski poles on the neck (SPN), ski poles extended (SPE), basic turn with clapping (BTC), basic airplane turn (BAT).

Didactic exercises from the questionnaire:

1. Turn towards the hill with active skis (TTHAS) - skier practising the slope towards the hill with active ski guiding. The exercise is considered one of the main preconditions of the further acquisition of not only the basic turn, but of the all other exercises practices within the basic and advanced level taught at a ski school.

2. Turn towards the hill and a take-off into the plough (TTHTP) - skier performs the combination of open turns towards the hill and take-offs into the plough, by changing a direction of movement.

3. Ski poles on the neck (SPN) – the basic turn by holding the parallel ski poles on the shoulders and pushing the outer shoulder down the hill during the open turn towards the hill performance aiming to achieving better balance and load on the outside ski.

4. Ski poles extended (SPE) - the skier holds the parallel ski poles extended frontally. The main characteristic of this didactic exercise is to achieve better balance and weight centre on the skis which prevents the negative effect of body lingering behind the skis and skier leaning backwards as it is one of the most common errors during the basic turn performance.

5. Basic turn with clapping (BTC) - enables the skier to put the fists of both hands on knees, pushing them towards the turn in the phase of an open turn towards the hill facilitating circular, vertical and lateral knee movements, and more efficiently lowering the body mass centre. By ploughing the inside ski, the skier shifts from the lower to higher skiing position, simultaneously clapping with both hands in front of the body. Afterwards, the skier lowers the hands to the knees. This particular exercise teaches a skier to timely adopt different types of skiing movements, depending on the phase of a turn.

6. Basic airplane turn (BAT) - the skier performs the basic turn by imitating an aeroplane. During the parallel turn towards the hill, the skier lowers the outer arm towards the ski, while the inner arm is being lifted up. The high value of this didactic exercise is to achieve better achievement of balance and pressure on the outer ski during performance of the turn towards the hill, which facilitates obtaining the plough position and passing into the new turn.

Statistic analysis

With the aim of examining the ranking of the most important didactic exercises for teaching the basic ski turn, the statistical significance between the levels of classification of the difference and the most important didactic exercises were calculated with the non-parametric analogue post-hoc Kruskal-Wallis test (H) and corresponding empirical level of significance ($p<0,001$). The rank sum (ΣR) of the most important didactic exercises for the parallel ski turn teaching evaluation was calculated. The analysis was performed in person and it was used to achieve less lenient criteria with the data analysis software package Statistica Win. Ver.12.0.

RESULTS

The statistically significant difference between the values of ranking the most important didactic exercises for teaching the basic turn ($p<0.001$) was revealed through the results of the Kruskal-Wallis test (H-test) and corresponding empirical level of significance (p) which are shown in Table 1. Using the non-parametric analogue post-hoc analysis, a statistically significant difference between the rank sum of didactic exercises TTHAS, TTHTP, SPE, BTC and BAT was determined for $p=0.00$. Furthermore, the statistically significant difference was determined between the rank sum of TTHTP, SPN and SPE exercises, between the SPE, BTC and BAT exercises, and operators SPE and BTC for $p=0.00$.

According to the obtained difference significances in ranking the importance of applying certain didactic exercises in teaching the basic turn, and based on the rank sum value, the hierarchical classification was formed. Results suggest that the didactic exercise that was the most important in teaching the basic turn was the BAT. The BTC exercise was second position. The third most important didactic exercises were the SPE and TTHTP. The fourth TTHAS and SPN were the least important exercise.

Table 1.
Rank sum of the most important didactic exercises for teaching the basic turn

	TTHAS	TTHTP	SPN	SPE	BTC	ΣR
TTHAS						752
TTHTP	0,00					935
SPN	1,00	0,00				728
SPE	0,00	1,00	0,00			947
BTC	0,00	0,00	0,00	0,00		1132
BAT	0,00	0,30	0,00	0,61	0,36	1035
H=138,62; p<0,001						

DISCUSSION

Based on the objective set in this paper which was to rank the 6most important didactic exercises for teaching the basic ski turn, this study included 307 ski instructors and assistants teaching at different professional ski levels. Their task was to rank on a scale from 1 to 6 the displayed didactic exercises for teaching the basic ski turn via an online questionnaire.

As it is well known that the level of certain motor abilities correlates with success of alpine ski racing (Neumayr G. at al., 2003., Cigrovski V. et al. 2012., Lesnik et al. 2017) and that development of motor abilities plays a vital role in acquisition of the basic alpine ski technique (Mladenović et al 2014), the ski coaches have a special importance in the process of teaching alpine skiing. They must be able to recognize the capacity of a learner to acquire and perform a certain ski element which is, to some extent, determined by their level of motor abilities. Therefore, in addition to the aforementioned presumptions, performance is improved with an effective exercise and its quality is developed proportionally with the development of the overall skiing expertise. The learner who acquires a certain technique in alpine skiing focuses on different aspects of learning during different learning phases (Farrow et al., 2017). In turn this leads to different levels of error domination in their performance and to different focuses of attention on certain aspects of movement. Correspondingly, the coach must know how to apply adequate learning strategies and how to adapt them to the skills and abilities of the learner (Rosalie & Müller 2014). Selecting and applying the appropriate didactic exercise that will have the greatest positive impact on an individual learner's acquisition and performance of a specific ski element is an important part of this process. In other words, the selected expert learning activities model for teaching the basic turn does not necessarily have to be equally effective for all the ski school learners. Therefore, every coach should adjust the flow of the process of teaching to the learner and apply the learning activities that will, according to his expertise and experience, be most effective in the acquisition of a specific movement structure.

On the general review of the most important learning activities for basic turn teaching, results suggest that expert ski coach educators in this study rated most highly those learning activities that had multiple positive effects on the establishment of a proper skiing posture and ski-specific movements, but are also not complex with respect to the difficulty of their performance.

The integration of experiential knowledge of expert coaches with theoretically driven empirical knowledge represents a promising avenue to drive future applied science research and pedagogical practice (Greenwood et al., 2014) as confirmed by the results of this study. Despite the adoption of key aspects of representative design in practice (predominantly through striving for ecological validity), a principled theoretical analysis has yet to be articulated in detail to guide research and practice in sport psychology and sport science (Pinder et al., 2011). Related to the above said, this study highlights opportunities for further empirical investigation as potential constraints of alpine skiing didactic settings.

Since there are no papers on similar topic, this research is especially valuable, in the sense that it sets the basic structures of didactic settings that provide precise guidelines for the work of skiing experts teaching at all levels. This research is a good basis for the future research in which might include skiing experts worldwide, and additionally determine and perform the evaluation of an expert model for teaching the basic turn.

REFERENCES

Anderson, D. (2007). *Ski school.* United Kingdom, New Holland Publishers Ltd.

Bucher Sandbakk, S., Supej, M., Sandbakk, Ø., & Holmberg, H.C. (2014). Downhill turn techniques and associated physical characteristics in cross-country skiers. *Scandinavian journal of medicine & science in sports, 24*(4), 708-716.

Cigrovski, V., Radman, I., Matković, B., Gurmmet, S., Podnar, H. (2014). Effects of alpine ski course program on attitudes towards alpine skiing. *Kinesiology, 46(Supplement 1),* 46-51.

Rosalie, S.M. & Müller, S. (2014). Expertise facilitates the transfer of anticipation skill across domains. *Vol. 67 , Iss. 2, 319-334.*

Farrow D., Reid, M., Buszard T. & Kovalchik S. (2017, Februar). Charting the development of sport expertise: challenges and opportunities. *International Review of Sport and Exercise Psychology, 1-20.* Retrived Januar 25, 2017, from http://dx.doi.org/10.1080/1750984X.2017.1290817.

Elling, R.M. (2003). *The all-mountain skier: The way to expert skiing.* Camden, ME Ragged Mountain Press/McGraw-Hill

Greenwood, D., Davids, K., & Renshaw, I. (2012). How elite coaches' experiential knowledge might enhance empirical research on sport performance. *International Journal of Sports Science & Coaching, 7*(2), 411-422.

Greenwood, D., Davids, K., & Renshaw, I. (2014). Experiential knowledge of expert coaches can help identify informational constraints on performance of dynamic interceptive actions. *Journal of Sports Sciences, 32*(4), 328-335.

Harald, H. (2010). *Harald Harb's Essentials of Skiing.* Hatherleigh Press

Kipp, R. W. (2012). *Alpine skiing.* Contributor: Unated States of America

Kuna, D. (2012). Formiranje ekspertnog modela likova osnovne i napredne škole skijanja. [Expert model of the basic and advanced ski school technique]. In. Đ. Miletić et all (Eds.), *Proceedings Of The International*

Conference Contemporary Kinesiology (3rd ed., pp. 145-153). Split: Faculty Of Kinesiology University Of Split, Croatia.

Kuna, D. (2013). Metodički model za poduku osnovnog skijaškog zavoja [Methodical model for teaching basic ski turn]. *Sport Mont, 37,38,39,* 636-645

Lešnik, B., Sekulić D., Supej M., Esco M., & Žvan, M. (2017). Balance, Basic Anthropometrics and Performance in Young Alpine Skiers; Longitudinal Analysis of the Associations During Two Competitive Seasons. *Journal of Human Kinetics Volume 57;* 7–16.

Lešnik, B., Žvan, M. (2010). A turn to move on–Alpine skiing–Slovenian way. *Theory and methodology of alpine skiing. SZS–Združenje učiteljev in trenerjev smučanja. Ljubljana*.

Maleš, B., Franjko, I., & Kuna, D. (2013). Relations of biomotor structures and performance of technical elements of alpine skiing in Croatian ski instructors. *Collegium antropologicum, 37*(2), 77-82.

Matković, B., Ferenčak, S., & Žvan, M. (2004). *Skijajmo zajedno [Go skiing together].* Zagreb: Europapress holding i FERBOS inženjering.

Murovec, S. (2006). *The edge: OPS-learning by extending the ski*. Kranj, Format Kranj.

Nash, C., & Collins, D. (2006). Tacit knowledge in expert coaching: Science or art?. *Quest, 58*(4), 465-477.

Neumayr, G., Hoertnagl, H., Pfister, R., Koller, A., Eibl, G., Raas, E. (2003). Physical and physiological factors associated with success in professional alpine skiing. *International Journal of Sports Medicine, 24 (8),* 571-575.

Pinder, R.A., Davids, K., Renshaw, I., & Araújo, D. (2011). Representative learning design and functionality of research and practice in sport. *Journal of Sport and Exercise Psychology, 33*(1), 146-155.

Puškarić, D. (2010). *Istina o skijanju [The truth about skiing].* Ogulin: INFOSTUDIO d.o.o.