vantage of video and web-based technologies that have been developed at Edinburgh University (UE) and CAPDM, specialists in development of on-line educational products. The necessary practical components of the current programme will be retained and revamped to synthesise with the on-line components. UI will set up, manage, and implement the teaching qualification of the SSI to its specifications. The on-line components of the courses will be delivered through the international e-learning delivery and coach information website CoachesInfo.com to participating coaches and teachers. METHODS: Educational units for swimming teachers and coaches will be upgraded to 'on-line' delivery for the SSI with a view to implementation throughout Europe. The refinement of the units will benefit from involvement and complementary expertise of the three university partners. Progressive surveys and pilots are used to 'fine-tune' the content, delivery and assessment mechanisms, and to achieve appropriate synthesis of on-line and practical course components. RESULTS: The primary beneficiaries are the coaches in Iceland. Improvements in instructional effectiveness of the swimming teachers will have a significant 'knock on' effect to increase swimming ability of all swimmers, whether recreational or competitive. Feedback from swimming coaches has been generally very positive. and ensured that material is optimally effective and at levels suited to the requirements and abilities of the participants. DISCUSSION: This project is successfully adopting the latest technology to develop effective learning material for swimming coaches and teachers for global use in a cost effective manner. This will have a beneficial impact at three levels – the SSI; the Nordic Swimmer Education Network; and coaches and teachers throughout Europe. The project is a good example of cooperative endeavour to transfer complementary knowledge and experience, possessed through academic, business, and coaching activity, to practicing educators.

O-067

Using a Scalogram to Identify an Appropriate Instructional Order for Swimming Items

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Scalogram, first proposed by Guttman (1950), is a descriptive ordering technique used in the social sciences to investigate how heterogeneous behavioral items may temporally relate to one another. In the present study, we explored whether there was a predictable temporal order of acquisition among selected swim skill items used in the instruction of swimming to identify whether the preferred order suggested preferences for the order in which to teach the same swim skills. A convenience sample of thirty-one college students enrolled in University instructional swimming classes performed each of the items in random order while each performance was videotaped by the investigators. After establishing acceptable inter-observer objectivity exceeding $P \geq 0.80$, the investigators observed each of the video trials and scored each item for each participant as pass-fail using pre-established criteria based on the American Red Cross Swimming and Water Safety learn-to-swim program (2004). The Red Cross order for teaching the tested skills was confirmed as the best order identified by the scalogram for young adult participants with a coefficient of reproducibility of CR = 0.93. Limitations in the procedures and results suggested the need for several future studies to identify whether the order could be applied to other ages and ability levels as well as to how susceptible the scalogram technique is to idiosyncratic instructional experiences of participants.

O-068

Learning and Improving a Swimming Technique within an Inter-Disciplinary and Experience Based Teaching Approach with two 7th Grade School Classes

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INTRODUCTION: The aim of the study is to investigate in how far the school subjects swimming and physics can benefit from each other when teaching them together in an inter-disciplinary and experience based context. It was expected that a comprehensive background knowledge about the biomechanics of swimming help improving a swimming technique. On the other hand, teaching physics in the context swimming was supposed to be an advantage regarding improving interest in physics as school subject. Gained experiences in the context of swimming should make it easier for the students to deal theoretically with the respective topics as well. METHODS: Two parallel school classes (7th grade) of a German Gymnasium were taught separately over six weeks. In the experimental group (N=25), physics and swimming were taught as a unit in the context of "moving efficiently through the water". In the control group (N=26), physics and swimming were taught separately. Besides the different arrangement and teaching method, it was tried to keep the aims and contents similar in both groups. Standardized tests were conducted in order to evaluate different factors such as knowledge, interest in physics, and swimming technique (Noethlichs and Schulz 2007). RESULTS: Results showed that both groups improved their breast stroke technique significantly but with an advantage for the experimental group. The knowledge test indicated a significant increase of the experimental group in comparison to the control group. DISCUSSION: Within the experimental group, learning the physics of swimming were directly linked to personal experiences and experiments in the water. The students experienced for instance different forces in the water with their own body and they tried to investigate how they could take advantage of those forces regarding an efficient movement through the water. Subsequent theoretical reflections gained an experience-based background knowledge, which seemed to enable improving their breast stroke technique autonomously. The control group students depended more on the teacher's instructions and feedback. In addition, the experience-based method supported the understanding of the physics of swimming significantly which can reasonably be related to the specific teaching design. REFERENCES: Noethlichs, M. & Schulz, A. (2007). Physik und Schwimmen gleichzeitig. Ein Beispiel für eine fächerverbindende Unterrichtsreihe, Praxis der Naturwissenschaften (56), 8, 35-43.

O-069

Stability and Prediction of 100-m Breaststroke Performance During Elite Swimmers Career

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INTRODUCTION: Longitudinal performance assessment is important to help coaches defining realistic goals and training methods. The purpose of this study was to analyze the 100-m Breaststroke performance stability throughout the elite swimmer's career, from children to adult age. METHODS: An overall of 35 Portuguese male swimmers and 905 race times were analyzed for seven consecutive seasons between 12 and 18 years old. Portuguese male top-50 ranking in the 100-m

Breaststroke event, in the 2007-2008 season was used to identify the swimmers included in it. Best performances were collected from ranking tables provided by the Portuguese National Swimming Federation, and when appropriate were also collected from a public swimming database (www.swimrankings.net). Performance progression was analyzed based on two approaches: (i) mean stability; (ii) normative stability. For mean stability assessment, descriptive statistics and ANOVA repeated measures for each season and event followed by a post-hoc test were computed. Normative stability was analyzed with the Pearson Correlation (Malina, 2001) and the Cohen's Kappa tracking index (Landis and Koch, 1977). RESULTS: ANOVA repeated measures revealed significant variations in the 100-m Breaststroke swimming performance [F (1,34) = 353.57; P < 0.01]. Bonferroni post-hoc tests verified significant differences (P < 0.01) between all seasons analyzed. The only exception was for the pair wise comparison between the sixth and the seventh seasons which was not significant. The K value, expressing the stability throughout the overall swimmer's career, was low (K = 0.38 ± 0.05). Self-correlations were significant in all situations (P < 0.05), except between the 16 and 17 years. Stability becomes high (r = 0.644) from 14 until 18 years old. DISCUSSION: There was an obvious 100-m Breaststroke performance enhancement from children to adult age. Stability and prediction of swimmer's performance based on overall career is low. When more strict time frames are used, swimming performance stability and prediction increases starting at the age of 14. The change from 13 to 14 years can be a milestone, where the ability to predict the final swimmer's performance level strongly increases. REFERENCES: 1. Landis JR, Koch GG. The measurement of observer agreement for categorical data. Biometrics 1977; 37:439-446 2. Malina RM. Adherence to physical activity from childhood to adulthood: a perspective forma tracking studies. Quest 2001; 53:346-355

0-070

Performance Decrease Following Summer Break in Youth Swimmers

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INTRODUCTION: Children in Germany have 6 weeks of school break. During this time usually no swim training is performed leading to a decrease in performance which was built up before the school break. The aim of the study was to evaluate the amount of performance loss following 6 weeks of summer break in youth swimmers. METHODS: 26 competitive swimmers between 9 and 11 years (MW 11.5 ± 1.4 yrs) participated in the study. Seven weeks before the summer break the kids performed a 100m all-out swim and a 2000m all-out swim. After five weeks of training the two tests were performed again. After the second test day the summer break occurred (6 weeks) without any swim specific training. Two and eight weeks after the summer break the tests were repeated again. RESULTS: The swimmers achieved a time of 35:31.2 ± 5:14.5min (2000m) and 1:25.4 ± 0:10.8 min (100m) during the first tests. After five weeks of training the times decreased without statistical significance (2000m 34:52.8 ± 4:35.0 min; 100m 1:24.3 ± 0:10.4min). Two weeks after the summer break the performance level in both tests decreased significantly (2000m 36:11.6 ± 5:01.4 min; 100m 1:26.7 ± 0:09.7min). After a short period of training, the performance increased significantly and the swimmers nearly reached their level of the time before the summer break (2000m 35:10.7 ± 4:34.4 min; 100m 1:24.3 ± 0:10.3min). DISCUSSION: We could show that junior swimmers between 9 and 11 years of age are able to rebuild their performance level in six weeks of training. Therefore the summer break of six weeks is very important in competitive junior swimming. From a physiological and psychological point of view, young athletes need a break from daily training to regenerate and motivate again for the next season.

0-071

Talent Prognosis in Young Swimmers

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INTRODUCTION: Neural networks are able to predict the future success of talents by revealing distinct patterns in the individual set-up of the sport specific disposition (Philippaerts, Coutts & Vaeyans, 2008). The purpose of this paper is to compare linear and nonlinear talent prognoses in the crawl sprint. METHODS: The Magdeburg Talent Study on Elite Sport Schools (MATASS) is a six year longitudinal study. The data were collected from 1997 to 2001 from a total of 729 male (age: M = 171.2 months, SD = 42.5) and female swimmers (age: M = 159.3 months, SD = 39.0). The final competition performance data were recorded in 2006 for all male (n = 130) and female swimmers (n = 113). RESULTS: 33 performance prerequisites were measured at three different time points, and reduced by factor analyses: (1) body stature, (2) maximum and explosive strength, (3) general and (4) sport specific speed strength, (5) technique and coordination, and (6) elementary speed. In a second step, the factor values of the six juvenile talent criteria, together with the (7) speed of performance development, (8) utilization of performance prerequisites, and (9) psychological stress stability were used to predict three final talent groups at adult age. For the cross-validated prognosis two methods were used: a linear discriminant analysis (DA), and a nonlinear operating Self-organizing Kohonen Feature Map (SOFM). The comparison of the real adult performance groups with the modeled outcome led to far better predictions in the SOFM. The percentages of correctly predicted cases (females = 87.9 percent; males = 68.3 percent) are much higher than those delivered by the DA (females = 69.0 percent; males = 50.0 percent). DISCUSSION: The quality of the predictions of the linear DA was comparably lower than that of the nonlinear SOFM. Thus, the results of the study show that neural networks are excellent tools to model and to predict future competitive performances on the basis of juvenile talent makeup. Besides that, the better results of the neural network modeling support the interpretation that the development of talented young athletes is a nonlinear complex problem that should be addressed by a dynamic systems approach. REFERENCES: Philippaerts, RM, Coutts, A, Vaeyens, R (2008). Physiological Perspectives on the Identification and Development of Talented Performers in Sport. In Fisher, R, Bailey, R (eds.). Talent Identification and Development. The Search for Sporting Excellence. Berlin: ICSSPE: 49-67.

0-072

Reproducibility of Pacing Strategies in High Level Junior Swimmers

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INTRODUCTION: Recently, the analysis of pacing strategies has gained importance in sports medicine research. Up to now, there is little data available in swimming. Three different ways of pacing have been described in swimmers: even, fast-slow and slow-fast pacing (Maglischo, 2003). This classification was mainly developed from observations in races at Olympic Games or World Championships. The aim of this study was to determine the reproducibility of pacing strategies in high level junior swimmers during 200, 400 and 800 m tests. METHODS: 16 competitive front crawl swimmers (7 ♀, 9 ♂, age: 16.9±2.2 years, training history: 6±1.8 years) performed 200, 400 and 800 m tests, each dis-