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The structure of ladies' figure skating short program in 2010 Olympic Games

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Abstract

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The purpose of this work was to examine senior ladies short program element structure which was skated at the Winter Olympic Games in Vancouver 2010. The study covers all 30 skaters that were qualified for the Games.

Theory part scratches the surface of demands to become a top athlete and continues with the demands of the program in rule wise and represents the new judging system of figure skating and how it has brought new demands to the sport. The research part is defining structure of ladies short program focusing on tactical side; is there any common laws among top skaters to build programs and are there any structural differences between the champion and the number 30 or are there any differences in timing/placing the elements that succeeded or didn't were couple of ultimate questions when starting to do this study.

Skaters 1-15 had a quite the same program structure with only minor differences on elements. They mainly tried to perform the hardest jump elements on a first two elements and then have a small "breathing break" before double axel, the last two spins and step sequence which is quite physical to perform with the new judging system. Most of the mistakes happened among the hardest and most valuable jumps.

Skaters 16-30 mainly opened with easier jump and then did all the jumps in a row. They did mistakes through the program and also with spins which should be "the easy ones" from element list to perform with good quality. Also the program structure differed quite a lot compared to best 15 skaters.

The higher ranked skaters were able not just to perform with good quality harder and more valuable elements, they also planned to do totally different caliber elements than e.g. skaters ranked 20-30. On many element, skaters lost too much points considering the base value and it is reasonable to present the hypothesis to plan the program according to skill level of the skaters' normal, everyday skill level, not according to what it might take to qualify for free skating at the certain event. By doing this, the chances to qualify for free skating increases because of higher grade of execution (GOE) values that seem to be the key factor to earn highest score from the performance in today's figure skating.

Key words
Figure skating, women, short program analysis, tactics, program structure, 2010 Olympic Games

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1 Introduction

Figure skating has faced a lot of changes in 21st century. All started from 2002 judging controversy which forced International Skating Union (ISU) to create the system which wouldn't leave space for speculations or malpractice when it comes to the judging or competition results. The outcome was "the new judging system" as it is still known after six years of practice. The formal name of it is the ISU judging system. (Stutzman, 2010)

Johnny Heater once stated that figure skater "must have balance of a tightrope walker, the endurance of a marathon runner, the aggressiveness of a football player, the agility of a wrestler, the nerves of a golfer, the flexibility of a gymnast and the grace of a ballet dancer" (Provost-Craig & Pitsos, 1997, 1.) Mr. Heater brings out the fact how figure skater must be multitalented to be able to do this sport. Unfortunately, often people tend to forget the characteristics of a good coach, like being able to plan programs in a way that enables the perfect performance for the athlete. Considering modern skating and effects that the new system has brought, it is justified to say that tactics is very important part of figure skating: the only goal is to score more points than the other competitors. Now, when there are predefined number of elements and only one opportunity to perform those it is crucial to maximize the possibility to succeed.

Because of a changed situation and different aspect of counting points, it is important for the coach to understand how the new system works. It is not all about rotating in the air or waving hands every now and then any more. Now everything matters –and especially that what skater doesn't do.

Sports that are based on scoring points against the opponent have created sophisticated systems to analyze their sport and scoring chances. With those statistics they have been able to develop their own sport and to find new, better ways of training. Figure skating doesn't have that kind of statistics. It is important to take model from those sports that have taken tactical view much further than it has never existed in figure skating world and start to create our own system to develop our sport. This is the main reason for creating this research -starting kick of a new era.

My personal interest lies on developing sport and coaching habits. It is crucial to know and understand how program structure works and how it affects to performance. Taking this fac-

tor into a consideration coaches are one step closer to optimizing program performances by avoiding bad element combinations or to pick better timing for the elements at the planning phase of program. This research will increase the knowhow of coaches in this matter based on scientific approach.

When reading this research, one must keep in mind that this research includes only one short program competition from one competition. To ensure all the results and assumptions made by those, it is needed to make more studies concerning the subject to increase the data. Also validity of results is based purely on cold numbers to ensure only tactical point of view for the research. It is obvious that there are several factors that are effecting into a performance but closing all but tactical out of question is impossible –larger database will do that in time. After all, it is guidelines that these kinds of studies are all about, exceptions complete the rules and there are always those present.

This work represents some of the demands to becoming a top athlete and the main points of the ISU judging system and focuses on senior ladies short program analyze. The goal is to find similar patterns with the athletes who succeeded or didn't succeed at short program competition in 2010 Olympic Games and through those results define in future more optimal program structure for ladies' short program.

2 The way to the top

There was a time when one of my teachers asked me skeptically something at the gymnastic class. I can't recall specific question but I do remember my answer: Everything is possible. That is the sentences that every athlete trying to the top has to keep in mind. That is the starting point for the development and success in sports and probably in other areas of life too.

Still just believe is not enough when talked about sports in high or in top level. There are some qualities that define the limitations of human body's capability in sports and the main frames of those qualities form the next chapters. Nevertheless, going over the own limits needs faith. It is a matter of "Do you believe?" which was one of the slogans of 2010 Olympic Games.

2.1 Qualities of top athlete

What are the qualities of top athlete is a question with endless answer list. The list of qualities changes depending of sport and the view of a person who is answering to the question. Although the answers are different, there are four main categories which comprehend all possible answers to this question. The foundation of any sport is created by technical-, tactical-, physiological- and psychological factors. If a person is gifted with these areas in a suitable manner defined by a sport, there is a chance to become a top athlete.

2.1.1 Anthropometrics

"Small size is advantage in figure skating because the amount of proportion of strength becomes larger. Figure skaters are, according to anthropometric studies, small sizes, thin and muscular athletes," (Jacobson, K. 15.9.2010). Fat percentage is quite low compared to normal, non-athlete persons, with males 5,8% and with females 12,5% (Ziegler, Nelson & Jonnalagadda 1999, 348.). Though, there are several studies that report higher percentages with fat cells among female figure skaters, like Honkanen (1998, in Nieminen 2000, 12.) presents value of 23%. Pies, Provost-Graig, Neeves & Richards (1998, in Nieminen 2000, 12.) reports value of 18,6% and Hämäläinen (2001, in Nieminen 2000, 12.) states fat percentage of 20% value from Finland's ladies' national team. What it comes to maturation, it seems like competitive figure skaters reach menarche later than non-athletes in average and it appears that later maturation

is a significant feature of more elite, specialized skaters. Though, it doesn't guarantee success at higher competitive level. (Vadocz, Siegel & Malina 2001, 98.)

2.1.2 Physiological factors

"There's no doubt that in some athletic circles, figure skaters have a dubious reputation. Yes, most agree they are artists, but some people still cling to the notion that skaters aren't athletic. An outdated and untrue speculation? Of course." (Seng 2001, 20.)

Our whole life is based on aerobic energy production. Without that it is impossible to walk, train or even live. In sports and training, this factor is known as stamina. To be able to do work for a longer periods of time.

"Stamina becomes relevant in sports where performance takes longer than two minutes or when performance recurs several times with high power in a short time" (Mero, Nummela, Keskinen & Häkkinen 2004, 333.). Considering the nature of figure skating competition programs, those fill both definitions.

Figure skaters' competition performance varies between 2 minutes and 50 seconds to 4 minutes and 40 seconds. Taking into account that program has been build more or less into the interval type of body it makes competition performance an anaerobic execution with lactic fermentation. (Jacobson, K. 15.9.2010)

Endurance capability (stamina) is based on good aerobic energy production (VO_{2max} –value), to long-run aerobic endurance, to good efficiency and to muscle-nerve strength production capability (Mero et al. 2004, 333; Kantola & Rusko 1984, 17.). "Endurance is a factor that defines the limitations of training power and quantity" (Gerich & Kyröläinen 1988, 61.).

Usually endurance capability is identified with VO_{2max} –value. Figure skaters reported values with women are close to 50 ml/kg/min. Kriemler, Stuessi, Buehlmann & Frey (1997, in Niestates Desgardin, Sesboue, Robert & Lac measured 45-52,3 ml/kg/min values from athletes. Considering these values, it is understandable that Volgusev (1990, in Nieminen 2000, 16.) recommends having VO_{2max} –value with women skaters between 50-60 ml/kg/min.

Like previously stated stamina and so forth aerobic energy production becomes relevant after 2 minutes in sport performance. For sure, it is important before 2 minutes but not the main stream of energy. Good stamina also enables filtrations of lactic acid from the muscles during "the pauses" or during the periods when is needed less power to skating. This means that it is wise to base (partially) program structure according to physiological laws so that the most demanding elements are performed before accumulation of lactic acid starts to effect to performance. This means that skaters should perform those elements through alactic anaerobic energy production which gives out the biggest power from humans' energy production. It is meant to small, quick dashes like figure skating jumps.

Alactic anaerobic energy production means usage of ATP and CP storages. CP storages lasts on maximal continues work approximately 30 seconds (Mero et al. 2004, 97.). Considering interval type of body of figure skating program this means that it is possible to perform the first two or even three elements with alactic energy production system before anaerobic glycolysis with fermentation of lactic acid starts to be the main stream of energy and so forth makes muscle work harder than with alactic system.

Studies show that skaters' heart rates arises after 30 seconds to 80% from maximal heart beat and it stays high throughout the program (Honkanen 1998 in Nieminen 2000, 16-17; Provost-Craig & Pitsos 1997, 68-69.). This result supports the hypothesis that it is preferable to perform the hardest elements before heart rate arises and accumulation of lactic acid starts to disturb muscle work.

Increasing strength levels of an athlete has lifted reached results to the new level almost in every sport in a past 20 years. Considering coaching, the question lies how to acquire more strength so that it would be possible to use it in optimal way inside one's sport. (Mero et al. 2004, 251.)

Figure skater needs a lot of fast twitch muscle fibers which are needed to produce fast and forceful muscle contractions for performing triple or quadruple jumps. Kantola & Rusko (1984, 26.) have defined fast twitch muscle fibers' function to fast movements or to muscle work with great power.

Considering demands of triple or quadruple jumps, two most important fields of strength are neural strength and explosive strength. Explosiveness is needed at the take-off phase of the

jumps and with neural strength it is possible to reach needed height for the jumps without muscle mass which would be gained with hypertrofic strength training which would be incongruity with figure skaters optimal anthropometrics. (Jacobson, K. 15.9.2010)

At Salt Lake City Winter Olympic Games there was made a study concentrating on a characteristics of triple and quadruple toe-loops. The result states that every skater that were able to perform a quadruple jump stayed in the air longer than 0,685 seconds which means on average of 55 cm peak height during the flight. (King, D., Smith, S., Higginson, B., Muncasy, B. & Scheirman, G. 2002, 119.)

In a study that was presented in 1994, King, Arnold and Smith presents jump heights even up to 81 cm with triple axel. (King, D., Arnold, A. & Smith, L. 1994, 58.)

"Speed is known to be very highly hereditary quality when considered muscle-nerve system" (Mero et al. 2004, 294). It is possible to improve to certain limits with training like any other factor but only inside certain limits.

Needed rotation velocity measured at the Olympic Games 2002 to perform quadruple jump was 4,8 rotations per second (King et al. 2002, 119.). Eight years earlier King measured rotational speed of 5,4 revolutions per second with triple axel jumps (King et al. 1994, 57.).

Figure skating is aesthetic sport where difficult movements are needed to look easy and effortless. Also performing some of the glides and variations of different elements need flexible muscles and joints. Though, this is not the only reason to pursue to good ranges in motion with athletes.

Mobility is one of the key elements in any sport. Ranges in motion are needed to be so wide that it won't limit the execution of different elements among specific sport at hand. With decent mobility athlete is able to perform those faster, easier and more efficiently (Gerich et al. 1988, 66, 69.).

Flexibility directly effects to physical factors like speed, endurance, generation of power or relaxedness. It also reduces potential for muscle injuries. This means that it should be one of the routine procedures in athlete's training methods. (Mero et al. 2004, 364, 369.).

2.1.3 Psychological skill factors

Psychology is very interesting area. Even at these days there are people who believe that it is only a waste of time but is it? I claim that origin of every movement and action of human body lies at thoughts. As far as I understand anything about sports, the main focus of any sport is performance done by a human. If origin is a thought but athlete is unable to hold his thoughts, it will effect to performance. After many miserable competitions unfortunate athlete states how the focus just wasn't there even though the body felt great. Training athletes' minds systematically is routine procedure on a way to the top. The real questions are what kind of mindset winner has and how to train athlete into that?

Anderson states that every athlete needs psychological preparation (1990, 10.). The problem is that there are not any right ways to do it. There are only common patterns that are known to help most of the athletes' performance. Those are needed to blend into athlete's training and day rhythm and to find out which routines are improving the performance level. All puzzles are needed to be connected to each other which together creates working pattern. (Vasarainen & Hara 2005, 51.)

The idea behind psychological training is to help athlete to develop himself as an athlete and a person, to find balanced life where sport presents only one field. All this is done by broadening the perspective of athlete, by increasing self-guidance and self-knowledge. In other words, the goal is to increase athletes' inner freedom and through that to improve their performance. (Närhi & Frantsi 1998, 15-16; Vasarainen et al. 2005, 52..).

It is important that intent psychological training doesn't start openly too soon with youngster. Athletes' self-image has to be developed enough before starting these kinds of sessions. It is needed to have some experience from competing and hard training before starting mental training. (Vasarainen et al. 2005, 51.).

Though this doesn't mean that athlete's mind cannot train into winning before this, conversely it is preferable.

Johnsson and Swindley (1996, 93-95.) believe that it is possible to improve one's performance as much at one's mind as with physical training. They emphasize the importance of ideas and

thoughts in performance. "Unless you don't control your thoughts, those control you. If you want to reach the set results you must think right thoughts."

Anderson (1990, 28.) defines concentration as a state of mind where athlete is able to close everything less important information out from his mind. In a way surrounding doesn't exist. When done so, there are left only present moment with task to do. This skill is one of the most important mental skills of an athlete.

Characteristics of personality define what kind of person everyone is and how any activity is done. Our personality will change in time because we are living and experiencing new. Our goals, learned things, attitudes or thinking patterns are all the time developing our personality. It is a process that never ends. In elite sports, there are particularly present need of achievement, aggressiveness, dominance, self-confidence, self-emergence and independence. Some of the complementary factors are anxiety, organized behavior, need of others nursing oneself and sensitivity (Forsman & Lampinen 2008, 190.).

Finnish Olympic Committee continues the characteristics with will to win, being disciplined and ambition, positive attitude towards the coach and fellow competitors and realistic point of view towards a subject at hand (Suomen Olympiakomitea 1988, 129-130, 134.).

Most of the qualities listed above are usually seen as positive factors in a person but it is needed to remember that any exaggeration over the limits are, and will be, over the limits. Perhaps that is the reasons why some sources have stated qualities like unbalanced and anxiety among athletes (Finnish Olympic Committee 1988, 129-130; Forsman et al. 2008, 190.). It might be that the demands to become part of a small elite group are so high and specific that when coaches and athletes are pursuing to the new, higher level they end up harming themselves. Very good example is eating disorders that are related commonly into figure skating.

The need of achievement is seen with athletes as a motive to train towards the long term goals. "Successful person wants to experience positive feelings from the work he has done but is able to wait the results even though it would take for a while" (Poutanen 1999, 13). Poutanen (1999, 9.) states top ten rank from needed qualities to become elite athlete, many of them already said. All of these qualities can be summarized into one word: desire. Desire to become someone; desire to win is the foundation for something bigger. "It means will to win so much that one will do anything that is legal to reach the goal" (Jonhsson et al. 1996, 20).

The work needed to be done to reach the top level and to stay there is not always fun. There are involved many things that others would qualify into masochism or self-torture. Others into finding own limits and having extremely huge pleasure through adrenalin spurts.

To be able to train over own limits again and again means that athlete must have clear vision/motivation behind those acts. Otherwise, training becomes useless in time. (Johnsson et al 1996, 20; Vasarainen et al 2005, 52)

Our mind is a great weapon either against our opponents or ourselves.

2.1.4 Technical skill factors

"Technical skills and ability to use those are the most important parts of sport performance" (Mero et al. 2004, 241.). Skills in sports means ability to learn new movement patterns, to use those to learn more sophisticated new moving patterns, to develop the optimal performance technique to specific movements and to apply all learned patterns in different situations which might be either in stable or non-stable situations (Suomen Olympiakomitea 1989, 286.).

To skill, to ability to do or learn something is usually referred with a name of coordination. Any skill is always related into other physical features and by training coordinative thrills at the right time in human's lifecycle, it has a huge impact to athlete's later ability to adapt new movement patterns and so forth defining athlete's potential in sports (Gerich et al. 1988, 23-24; Weineck 1982, 161.). This correspond better technique with elements and so forth more difficult and valuable elements in figure skating.

Coordination has commonly been divided into several different factors/skills. Some divides it into a 8 parts (Miettinen 1999, 58; Suomen Olympiakomitea 1989, 289): Ability to react, ability to orientate, ability to keep balance, ability to sense and make difference with same kinds of movements, sense of rhythm, ability to combine movements, ability to adjust muscle tension and as a last factor ability to adjust oneself to different conditions and situations. Others divide it into 11 different factors by adding skills such as ability to be agile, ability to be specific and consistent with movements and ability to anticipate, with other words said magnitude of movement patterns and usage of those (Forsman, Nieminen & Lampinen, 78.).

One could say that every action that athlete does is based on coordination. Higher ability on listed skills means ability to perform more difficult movement patterns with good consistence. This comes very much relevant in a closed skill sports such as gymnastics or figure skating where performance is entirely based on ability to perform different movements with own body.

Technically better skaters need less effort and power to perform difficult elements than skaters that haven't been able to standardize their technique. Figure skating is a sport where happens more failures than in most sports e.g. with triple jump element. There can be thousands of tries behind the first successfully landed one. In order to reach stabilization it is needed to train same element with a same pattern again and again. (Jacobson, K. 15.9.2010)

Jacobson's (2010) statement refers directly into skill base of an athlete. If an athlete isn't able to repeat an element with a same pattern again and again, stabilization of a technique cannot happen and skating instructor has impossible task to improve one's technique since it randomly changes on every try. Skill factors are regulating and controlling sport performances (Karvinen, Hiltunen & Jääskeläinen 1991, 57.). That is the reason why it is important to pay attention to coordination at the right time of athlete's development.

2.1.5 Other factors

It is not enough to have all the necessary inner factors as a human being to becoming a top athlete. There are plenty of puzzles which need to find a right place before success. Justice and equality are "fashion" words at the modern world but the real life is something totally different. Everybody doesn't get equal chances to climb to the top. Most of these other factors are solvable with money. For sure there are other means too to get over the obstacles than money but at the end it is quite commonly one of the cornerstones.

Everything starts from the decent equipments. Good, supporting boots and right blades with good sharpening effects to the performance greatly. Next step is to find training facilities and time for using those. For example in Finland, ice time is rather expensive and there are many clubs/teams fighting over the same practice times.

Every parent among competitive sport and older athlete understands the importance of a good coach who is willing to spend time to make an effort to improve athletes' performance

in a consistent manner. Without her it is very difficult to make a difference that would lead into a success.

Inner motivation is a key factor in sports and training company is a very important part to find a drive to go over the athlete's personal physical and psychological limits. To find right coach and training company, promising athletes are quite often "forced" to change the home club further away from home. If they are lucky enough, they don't have to move but sometimes it is necessary in order to have suitable facilities and persons to help their journey to the top.

Persons behind athletes are quite invisible factor but one of the most important ones. Parents and backers are the ones who give a ride to the rink, supports when needed, arranges competition dresses or training clothes, pays everything etc. Only rare athlete could reach their potential without support of these people.

2.2 Tactics

Tactics is very crucial factor in sports. How big part it plays depends from the sport. When considered single events which take only a short time in a "field of battle," like figure skating, the meaning of tactics is smaller than in sports that take longer time, like in marathon. Nevertheless, it still presents important upholder.

The need of tactics is related into many things. If an athlete is clearly better or worse in every part of the sport than other competitors, tactics are useless. Athlete in a class by itself compared to others can be expected to win without really paid attention to tactics. At the reversible situation with less talented athlete, it is unlikely to reach success even with the best possible tactics. (Suomen Olympiakomitea 1989, 315.)

Like Hughes has described: "The winning strategy is not a substitution to good skills" (Hughes 1990, 9.).

Tactics can be seen in many ways. There are tactics for training athletes and tactics for competing. In some way it is even possible to claim coaching being a big chess game where tactics are the ground-up which usually is referred as a coaching philosophy. For example some psychological aspects can be seen also as a part of winning strategy or growing-up an athlete to become victorious.

As an example it is important that athlete doesn't drift into a swamp at the edge of loss or failure. At the moment like these it is needed to analyze the situation and carry on with right and needed manners (Johnsson et al. 1996, 88-89.). Like Eero Välivuori (2003, in Vasarainen et al. 2005, 50.) has stated: "Athlete has to concentrate to the solutions of the problem, not to the problem itself."

If so happens that athlete loses his temper, it more likely gives more self-confidence to the opponents which, like stated earlier, is one of the key features with successful athletes. With other words, tactically it is a bad decision to show frustration to other competitors. Psychologically they will benefit from that.

The puzzles to create winning formula into competition with single athlete sports are usually found from the comparison of athlete's basic qualities, from the energetic demands and from the sport analyze. Strengths and weaknesses are commonly tried to find from: size, strength, speed, stamina, skills, mental state and from athlete's knowledge and understanding of one's sport. (Finnish Olympic Committee 1989, 315.)

The winning strategy is based on analyze of top level competitions. It is needed to know what the demands of the sport are and how the top level is executing their perspective from the sport. When right attitude is connected to good physical shape and skills, the right method will lead into a success. (Hughes 1990, 9-10.)

This means that it is crucial to study modern skating in order to find right and working patterns to push the sport forwards. Someone has to be the one who leads the way to the future.

The development of training methods have always based on two principles: mirroring others and walking own path - trying to find something new by exploring and trying. There has to be an image of something inside trainers mind –blurry goal which either works or not once he gets there. It is a matter of trying, effecting into a systems and getting something done. Not just excepting the present state. (Kantola 2007, 320, 346.)

Athletes must be trained into competition situations and prepare them to face possible unpleasant surprises so that no matter what happens, it won't affect to up-coming performance.

At the end, athlete and only athlete himself is responsible from his actions at performance. He is the only one who is performing. (Finnish Olympic Committee 1989, 327-328.)

When preparing to performance and performing there are several external factors which can be transmitted to help athlete, to create extra pressure for the opponents or even affect to the judges' evaluation. These means usually effect to the psyche of the subject. All of this can be done with manners of good sportsmanship. (Finnish Olympic Committee 1989, 327-328.)

What it comes to tactics in training there are a few things that should be considered by a coach. Athletes are putting in so many hours to training that in a sense of motivation, they need to see progress in themselves. If they don't, it affects to self-confidence and will start a snowball effect which will influence their whole performance in training and in competitions. Athlete is needed to believe in himself, to training and to the backers behind him. It is important that those things where athlete's believe lies will happen. This can be done through tests done by consistent manners and competitions. Coach needs to see one step forward and understand how to bring the important information to athlete's knowledge. (Forsman et al. 2008, 189.)

3 Evaluation in figure skating

The scoring in figure skating has always based on the evaluation of performed by judges. As a sport figure skating has grown from the total evaluation sport into a scoring-evaluation sport. There are related such skills that are so important part of the performance that cannot be graded non-other way but evaluating. This means that "talk" at the audience considering the stands of competition will always be related to this sport. At the next chapters, there are explained how figure skating has made a major turn towards the scoring sports and how it has effect to the everyday training among skaters and coaches.

3.1 Background for the development of ISU system

The old judging system is called 6.0 -system and it is still in use at smaller competitions all over the world. The basic principle of it is so called "majority system" which is quite unique among sports. Panel of judges in competitions are comprised from odd number of judges. The winner of competition is a skater which is placed highest by a majority of judges. Unlike at the new judging system, all judges' scores are used in calculating the results. (US figure skating 2010a).

The old system's two gravid principles are (Elo et al. 1993, 31-33.):

1. There are two separate results from both programs even though those two programs form one whole competition. The scores of one isolated judge won't be summed up from those programs.
2. Inside each program competition, the scores of each judge will be processed separately. Judges are using scores only to define rank for the competitors from their point of view.

In single skating, all judges are giving two marks for skaters: one for technical merit (in short program for technical requirements) and one for presentation. Technical mark stands for the quality of required elements performed in short program. In free skating, it reflects the difficulty, variety, cleanness and speed of the elements chosen. For example with jumps judges note the height and distance of jumps and with spins the quality of spinning positions, including arched back, pointed toes etc. The presentation mark represents a judge's assessments of the program as a whole: of its composition, choreography, posture and carriage, speed and

flow, originality, skater's style and expression of chosen music. In other words: the artistic view of program. (Tashman, Schallehn & Schallehn 2000, 167-168.)

Each judge will award marks ranging from 0.0 to 6.0, based upon the following scale (US figure skating 2010b):

0 - not skated
1 - Very poor
2 - Poor
3 - Mediocre
4 - good
5 - Very good
6 - Perfect & faultless

One of the most important things to notice is that the judging scale is not stable from competition to competition. Peter Krick, ISU event coordinator has described it quite well: "But you got one mark, say a 5.3, which at a world championship is a good mark, but not so good at somewhere else. You had no idea what it was that got you to a 5.3, and a 5.3 was always different in each competition" (Wilner 2010). Even though what Mr. Krick said is perfectly true, the whole range of scale was not in use at every competition. Mark 6.0 was extremely rare even at the world championships as well as marks that begun with number 3.

3.1.1 Assigning ordinals to each skater

Ordinals in skating means the placement/ranking which is assigned for each skater according to judges' marks by mean of total marks of the two marks awarded. At the table 2 is presented usual result sheet from 6.0 -system. On a top row there are judges which always were public information, who is behind the number. On next three rows there are three different skaters' marks: First technical merit, then presentation marks and on third line total marks. The last line shows on which rank said judge placed skater. (US Figure Skating 2010c)

Like said before, the one who judges have placed more on the first place, like skater A at the table, will win the competition. If so happens that same judge has given exactly the same marks for two different skaters follow happens: On short program, the one who has highest technical merit will win when at the free skating, the one with the higher presentation marks will be at the stronger position. Compare skaters A and B's scores from judge 6. (US Figure Skating 2010d)

Table 1. Example for 6.0 –system (US Figure Skating 2010e)

Judges		1	2	3	4	5	6	7
Skater A Ordinal	Tech Pres Total	5.9 5.9 11.8 ***1***	5.8 5.9 11.7 ***1***	5.8 5.8 11.6 ***2***	5.8 5.7 11.5 ***2***	5.9 5.9 11.8 ***1***	5.7 5.8 11.5* ***1***	5.9 5.7 11.6 1
Skater b Ordinal	Tech Pres Total	5.7 5.8 11.5 ***2***	5.7 5.7 11.4 ***3***	5.9 5.8 11.7 ***1***	5.8 5.8 11.6 ***1***	5.8 5.7 11.5 ***2***	5.8 5.7 11.5* ***2***	5.7 5.8 11.5* ***2***
Skater c Ordinal	Tech Pres Total	5.7 5.6 11.3 ***3***	5.7 5.8 11.5 ***2***	5.6 5.8 11.4 ***3***	5.6 5.7 11.3 ***3***	5.6 5.7 11.3 ***3***	5.6 5.6 11.2 ***3***	5.7 5.8 11.5* ***2***

Final placement happens after free skating when both programs have been skated. The placement that skater has earned at each part is multiplied by factor based on the percentage of the whole represented by that part of the event. In singles this means that short program's factor is 0, 5 and for the free skating 1, 0. After multiplying the placement of each skater by the factor for each event, the skater with the lowest total score will be the winner. If two skaters are tied at this point, the winner is the skater who places higher in the free skating.
(US figure skating 2010f)

3.1.2 The incident leading to the new judging system

Eight years ago at Salt Lake City Winter Olympic Games happened judging controversy that forced International Skating Union (ISU) to change judging system rapidly for the next Games

to Torino. The whole chain of events started with pair skating and continued after investigations to ice dance too.

When Russians Jelena Berezhnaja and Anton Siharulidzen won gold medal questionably before Canadians Jamie Sale' and David Pelletier, scandal got the starting kick. Turned out that at least French judge agreed to favor Russian pair skating couple before competition in a change of Russian judge to favor French couple in ice dance. The French judge ended up having several years' suspension from judging (Helsingin Sanomat 2002). ISU decided to share two gold medals from pair skating because of judging controversy (Markkula 2002a)

3.2 The ISU judging system

The ISU judging system was drafted by Ottavio Cinquanta, the president of ISU. The first hints from it were given away already during Salt Lake City Winter Olympic Games (Markkula 2002b) when Cinquanta presented "point earning system" and it was voted into use in June 2004 (Helsingin Sanomat 2004). It is probably the biggest change in figure skating since patches were eliminated from the sport at the early 1990's.

What it comes to reducing potential for bloc judging system, Skate Canada's proposal from unidentified judges selected randomly by computer from enlarged panel of judges was voted by ISU to test (Hines 2006, 306.). This proposal became part of ISU judging system.

The new judging system is based on different sections that are evaluated separately. Those sections are Elements and Program Components. Basically these are the same as at the 6.0 system's technical merit and presentation, but those are classified a lot more specifically and there are predefined values at each element. At top of this, also judges' job description has changed a lot.

3.2.1 Competition Officials

a) Technical panel

   Technical panel is consisting 3 ISU Members, namely the Technical Controller, the Technical Specialist and the Assistant Technical Specialist. These persons are identifying what skater performed on the ice during competition. This means calling difficulty level of elements and identifying illegal, additional or innovative elements which all ei-

ther leads to deductions or granting more points. As a help, they have Data Operator for video recording all elements for use to identifying difficulty levels for the elements. Technical Specialists are the first source of identifying levels for spins, jumps, and spiral- or step sequences. Technical Controller is authorizing or corrects the deletion of elements. He is superior for Specialists and Data Operator. If so happens that Specialists disagree from difficulty level of an element, Controller's vote is winning vote. In case that Technical Controller corrects mutual decision of Specialists', their decision holds. (International Skating Union 2010a)

b) Judges

Judges duty is to evaluate only two things: The quality of performed element –not what has been performed which belongs to technical panel, and the quality of program components. Their evaluation is based on specific quality criteria for each element and section. Also they have the same video from elements in use that technical panel does to ensure the rightful decision according to facts not guesses what and how skater just performed the elements.

Panel of judges are consisting 9 judges from where 7 of them are secretly and randomly drawn to giving scores, even though all 9 of them are evaluating the whole competition. Even the judges themselves won't know if their scores were counted in. From those seven scores is ignored highest and lowest value at each element and the average will be taken from the remainder, generating the trimmed mean value.
(International Skating Union 2010a)

3.2.2 Technical score

Technical element score is composed from step sequences, spins, jumps and spiral sequences –from so-called elements. Each element has a Base Value (see table 4) that defines the difficulty of the element (part of Technical Panel's job), e.g. triple axel is more challenging to perform than double axel and therefore has higher Base Value, also spins, step- and spiral sequences have four different levels of difficulty in a same way as a single, double, triple or quadruple jumps. The Base Value of an element is a starting point for the final points for the element of performed. Like said, judges' job is to evaluate the quality which defines the final score of an element. The chart of quality is: -3, -2, -1, 0, +1, +2 and +3, zero is the Base Value. Minus

scale obviously lowers the score where positive quality increases it. This chart is called Grade of Execution (GOE). The final score (the panel's score) from the element will be the sum of Base Value and GOE. Technical element score would the sum from all elements. "These element Base Values and levels of difficulty ensure that skaters receive the appropriate and consistent credit for every element performed."
(International Skating Union 2010a)

Jumps differ from rest of the elements in a way that after the first half of the program, all the panel scores from every jump will be multiplied with special factor 1.1 in order to give credit for even distribution of difficulties in the program (Go Figure Skating 2007). This rule gives space for tactics.

3.2.3 Program Components

The second component that judges are evaluating is called program components and it is divided into a five categories which all together covers the artistic view and overall presentation of program as well as general skills of figure skating. Program component explanations with definitions by ISU (2004a, 1-5.) are:

- *Skating skills*
  Definition: "Over all skating quality: edge control and flow over the ice surface demonstrated by a command of the skating vocabulary (edges, steps, turns, etc.), the clarity of technique, and the use of effortless power to accelerate and vary speed." In all this means to look very confident on the ice by performing the whole variation of steps and turns with good technique by using knees and ankles.
- *Transitions, linking footwork and movement*
  Definition: "The varied and/or intricate footwork, positions, movements that link all elements. This also includes the entrance and exits of technical elements." This concerns everything that happens between the elements. How well skater is able to tie everything together so that it forms a program.
- *Performance/execution*
  Definition: "Is the involvement of the skater physically, emotionally, and intellectually as they translate the intent of music and choreography."
  Execution: Is the quality of movement and precision in delivery.

This stands for the passion. How much skater is able to give from herself to the judges and audience? This is one of the reasons why figure skating is many times compared to art.

- *Choreography/composition*

  Definition: "An intentional, developed, and/or original arrangement of all movements according to the principles of proportion, unity, space, pattern, structure, and phrasing."

- *Interpretation of the music*

  Definition: "The personal and creative translation of the music to movement on ice. To reward the skater who through movement creates a personal and creative translation of the music. As the tempo binds all notes in time, the ability to use the tempos and rhythms of the music in a variety of ways, along with the subtle use of finesse to reflect the nuances of all the fundamentals of music: melody, rhythm, harmony, color, texture, and form create a mastery of interpretation."

The score is given at the scale from 0.25 to 10.00 with increments of 0.25 points. Judges' panel score from program components is multiplied always with set factor which is in ladies' short program 0.8 and at the free skating 1.6. (International Skating Union 2008a, 20.)

3.2.4 Final Score

The final score for the skater is calculated by adding technical element score and program component score together. If there are any deductions, like minus 1 point from fall or from time/music violations, it will be deducted. (International Skating Union 2010a)

3.2.5 Critiques and counterarguments

The ISU judging system has divided people among sport into a two separate groups. The ones against it complain that the artistic view has diminished from the sport when getting points is based on mathematics. Johnny Weir has estimated on the interview that there are 10 seconds during the free skating when he can truly show his original artistry. At the same column, Frank Deford states that the audience doesn't understand the results anymore since understanding scoring means knowing the rule book thoroughly and to remember to count every rotation

from every spin's each position and quite developed mathematic skills to sum everything together. (Deford 2010.)

Sandra Loosemore has brought to the table some facts considering element value list and the system how score is comprised with some elements: "The base values assigned to some of the elements in the code of points appear to be extremely arbitrary and don't always correspond to common perceptions about the relative difficulty of various elements." Loosemore continues criticizing the system concentrating into a jumps and jump combinations. With jump combinations she believes to be injustice when the score is only been summed up by elements' base value list when the second jump is a lot harder to perform than the first one. Loosemore gives an example: "…double toe/triple toe combination is much more difficult than a triple toe/double toe." She also questions the correctness of the absolute values of the elements: "…who decided that double axel is 1.74 times as difficult as a double lutz, but triple axel is only 1.23 times as difficult as a triple lutz?" (Loosemore 2003.)

The opposite faction believes that figure skating is going to the right direction. Their biggest reasoning for it is that it is very difficult to effect to results from outside the panel since judges are drawn into a panel only 45minutes before the first warm-up group and not even judges themselves know if their scores count (NBC 2009.). On top of this, there are the trimmed mean value system in use and the base value-system where every element has a determinate base value which is the same for all competitors (International Skating Union 2010a.). These kinds of rules do not leave much of room for speculations in a sense of malpractice and scoring.

ISU reasons that the new judging system is improving the sport by separating the responsibility of evaluation: "Judges no longer have to remember and try to compare all aspects of every skater. Their energy and focus can remain on the individual evaluation of each aspect of each skater." International Skating Union is also trying to push tactical aspect into minds of coaches, skaters and spectators: "A well-balanced program provides an even playing field for the athletes. Strategy of how and when the skater displays their skills now becomes an important and strategic aspect of the sport." (International Skating Union 2004b.)

Victor Kraatz's, gold medalist of 2003 World Championships, comment from the old system states quite clearly the unofficial hierarchy of figure skating: "It's not a question of whether it's fair. It's the way it is. You have to wait your turn, to take over from someone who's been

there longer, who's more mature. And once you're there, you get to stand your ground." (Milton 1996, 37.)

2006 Olympic silver medalist Sasha Cohen believes that the ISU judging system will definitely push sport forwards and to the right direction. "Even if it meant not getting a 6.0, the new scoring would also be more exact and a fairer arrangement for the skaters." (Cohen & Maciel 2006, 171.)

4 Competition rules of figure skating

The International Skating Union (ISU) is the governing body for international competitions in figure skating, including the European Championships, World Championships, Four Continents and the figure skating events at the Winter Olympic Games.

4.1 Qualification for Olympic Games

Competing spots for figure skating events at the Olympic Games are always qualified. Entries are in all cases awarded to NOCs/Members, country which is a member of ISU, and not individual/named skaters. The qualification happens at two competitions. The first 24 spots are qualified at last year's World Championships according to results. For the last six spots is held individual qualification competition during the autumn before the Games. Those spots are given to countries in a rank order that don't yet have position at Olympic Games even though they wouldn't qualified into a top 6 at results. Countries are not obligated to fill all the spots that they have earned. The Georgian Skating Federation announced that they will send only one lady to the Winter Olympic Games. Therefore Israel was entitled to one entry for the Ladies' event. This incident increased the number of countries presented at the Games from the normal 21 to 22 countries. (International Skating Union 2010b, 1-2.)

After receiving competing spot for the country starts new competition from being selected to present home country at the Games. Qualification happens bit differently in different countries but main policy is that sport associations qualify athletes according to different norms and presents those athletes for said country's Olympic committee which nominates athletes for Olympic Games. Even though country would have earned Olympic spot it doesn't mean that they are obligated to fill that spot. For example, Georgian Skating Federation filled only one spot from two spots and so forth Israel was able to take part with one competitor to Ladies figure skating events at Vancouver 2010. (Finnish Olympic Committee 2005)

Table 2. Countries and number of entries present at the senior ladies (International Skating Union 2010b)

Country	Number of entries	Country	Number of entries	Country	Number of entries
Korea	2	Georgia	1[1)]	Turkey	1
Canada	2	Italy	1	**China**	**1**
Japan	3	Slovakia	1	**Hungary**	**1**
USA	2	Estonia	1	**Slovenia**	**1**
Finland	2	German	1	**Austria**	**1**
Russian	2	Poland	1	**Spain**	**1**
Switzerland	2	Great Britain	1	**Belgium**	**1**
				Israel	**1**

4.2 Ladies' competition

Single skating consists Short Program and Free Skating (International Skating Union 2008a, 89-90.).

4.2.1 Short program

Skating time is two minutes and fifty seconds but may be less. Program consists of eight required elements, though the sequence of elements is optional. The required elements for senior ladies according to ISU rulebook (2008a, 93.) are:

- double Axel Paulsen;
- one triple jump immediately preceded by connecting steps and/or other comparable Free Skating movements;
- one jump combination consisting of a double jump and triple jump or two triple jumps;
- flying spin;
- layback or sideways leaning spin;
- spin combination with all three basic positions (sit, camel, upright or any variation thereof) and with only one of change of foot;
- spiral sequence;
- step sequence (straight line, circular or serpentine).

If used maximum skating time, new element would start/would be performed every 21, 25 seconds.

During the competitions and evaluation on them, the elements are abbreviated from their formal full name (see appendix 1.). When element has been evaluated, its' difficulty level has been defined. Difficulty levels are from 1 to 4, four being the highest. This means that number after abbreviations states the difficulty level and so forth effects to element's score.

5 The meaning of research and the questions to answer

The meaning of research is to analyze ladies short program performance from 2010 Vancouver Olympic Games. The aspect of research is purely tactics since it is quite impossible to define all competitors' physical-, mental- or technical skill capacity.

1. Is there any common program structure at this level and are there any differences between the best ones and the latter part of competitors?
   Hypothesis: Solo jump and jump combination are performed before reaching 60 seconds. Top skaters have saved at least one "highlight"/jump at the way to the end of program. Lower ranked skaters perform those with cluster at the early program. Spins, step- and spiral sequence are filling the latter part of the program with all skaters.

2. What kind of timing skaters use at the program with jumps and how it is affecting to succeeding rates and quality with jumps?
   Hypothesis: The top five skaters are able to perform as they have planned beforehand with good quality. After the best half of the skaters, the amount of quality decreases and the amount of mistakes increase lowering scores dramatically. (See also hypothesis for the first research question.)

6 Method

6.1 Subjects

The subjects were all senior ladies (30) who were qualified for the 2010 winter Olympic Games. The Games were held in Vancouver, Canada and competition day was 23rd of February. 23 Countries were present. All programs were analyzed from short program.

6.2 Instruments, policy and the source of videos

Timing of overall time of programs and defining the starting moment of every element was done through Television Company CTV's website (ctvolympic.ca) where all the programs were broadcasted and recorded. Timing was done with Citizen stopwatch, model L1200-8W080. All performances were hand timed twice with one stopwatch and then calculated the average time from received times. Timing was done by one person and every program was timed twice in a row to ensure the same starting point of element and the same procedure on all programs. Times were rounded to the closest full second.

Competitors were divided into a six groups according their rank after short program, five at each group, and then calculated the average times for the groups from the length of programs and for each element included. Those mean times are in use on upcoming tables unless otherwise stated.

6.3 Timing elements

Timing happened as a one action when a clock was started at the beginning of program and stopped at the end of. Elements were timed by using "lap time" –function which wouldn't stop counting of overall time. Idea of this policy was to get the very same starting point, start of a program, for every element and in that way to keep as right spots in time wise for elements as possible.

Overall times were timed with a same pattern as the ISU has ruled to be timed. This procedure is to start the clock when skater makes the first move from standing still after music has started to play. Competition performance reaches the end when skater stops gliding/moving on the ice with music. (International Skating Union 2008a, 89)

Jumps were calculated to begin at the moment when skater reaches the first edge that can be said to lead into a take-off edge –meaning when there is clear purpose to proceed into a jump (International Skating Union 2010c, 15). Spins and spiral sequences were timed from the step on the edge even though gliding/spinning position wasn't ready. This procedure was chosen because of clear start of the element and the fact that the other foot wouldn't touch on the ice and therefore couldn't help skater to create more speed or to balance posture.

Step sequences were counted to start from the moment of first step or turn.

At the tables are used two colors: black and red. Black indicates successful, non-mistake element or positive value. Red stands for mistake or negative value.

6.4 Calculating scores

Results and scores were published at the ISU web page (isuresults.com). Through reports, there is possibility to see detailed "judges scores" which includes individual marks from every judge comprising all elements, base value of those and scores of panel which states the final score of every element. Those reported executed elements and the values were used in this study to define the order of elements and earned points.

Elements' base value (see appendix 2.) was decided to express successful element. If the scores of panel were smaller than base value, at the research, element was considered to include a mistake.

What it comes to defining invisible failures at the programs, were used following protocol: At the official web site of the Games (2010 The Vancouver Organizing Committee for the 2010 Olympic and Paralympic Winter Games) has been published planned element structure unlike usual policy of organizer. Those element lists were compared to executed element lists and as a result found out the real amount of errors that audience wouldn't know. This procedure was only able to do with jumps since there wasn't any way to find out for sure which level of spins, step sequences or spiral sequences skaters were trying. The levels weren't showed at the table.

Even though planned element structure-form is not binding skater to stick to it with short program there are demanded elements and generally only easement that can happen without deduction is changing triple-triple combination to triple-double combination.

If so happened that skater missed jump element which was planned to be a combination but executed jump combination later on at the program, it wasn't counted among errors since according to rules it is allowed to change planned program structure. This action is possible even on short program since ladies don't have predestinated solo jump and if also jump combination is done from preceding steps, turns or from other acknowledged connecting moves, skater is capable to gain more points by changing solo jump into a combination and through that get points from two jumps instead of only one jump.

6.5 Stating results of research

Most of the results that are stated in this research are stated in six groups consisting five skaters each. Groups were divided according to direct rank/results of short program competition. This approach was chosen because it is vital to be able to compare skaters to each other as a part of larger view so that there can be seen differences between top skaters, the ones that are just behind them and the last ones that were disqualified from free skating.

Six groups are enabling moderate way to present the results, process those and finally comprehending the meaning of research.

7 Results and discussion of program structure

Skating time throughout all competitors was quite the same. Generally skaters were trying to use the maximum time that is allowed. This enables a little slower rhythm for performing elements and concentration to each of them. This kind of behavior potentially enables better scoring on program components when there is more time, for example, for transitions and executing choreography.

The first element was a jump element with 29 out of 30 skaters. Only 17 skaters survived with positive GOE value from the element. The highest ranked skaters performed the element sooner than the others with significantly higher scores. This refers to better consistence and quality with the first element compared to other competitors. Seems like that the first five skaters had clearly higher planned base value for the element and it started to lower gradually all the way to the group 6 which only reached half of the value that the best five skaters had. *This suggests that skaters ranked 16-30 wanted to start the program with easier elements when skaters 1-15 went straight to the most valuable and therefore to the most difficult element of the program.* There were 21 jump combinations and 5 solo jumps. 12 of the combinations were done by skaters ranked 1-15.

28 competitors did a jump as a second element too. Interesting is that skaters ranked 1-5 had planned base value not more than 4th highest from all groups but they ended up receiving more points than any other group. This is explained by moving on to a solo jump which was executed very well. *Good execution implies that top skaters moved relatively to easier elements than other groups, after the first element.* There were 18 solo jumps and 10 combinations. 12 of the solo jumps were from the skaters ranked 1-15.

At the third element there can be seen two clear divisions when it comes to element structure. *The latter part* (considering results of short program) *continues jumping when the first half takes step back to the spins and spiral sequences.* The planned base value structure is totally upside down compared to ranking because of this fact. *40 percent from jumps didn't succeeded and all of those were so-called big misses that effect largely to base value and therefore to final score.*

On fourth element with groups 4-6 the elements have spread all over so that there isn't any common main element to perform. With top skaters, most of them did spiral sequence well. Fourth element is at the half way when considered elements but when considered time, the average performance time is a

lot sooner than the half of the program. It is explained with more time consuming elements to come, like step sequence, combination spin or spiral sequence.

On fifth element, competitors 1-15 are performing mainly axel type of jump when the other part is doing spiral sequence. Group 1 gets a lot higher GOE values than other groups and gathers again the highest score even though they are starting from the second lowest planned base value position. This tells from excellent quality compared to other groups.

The sixth element is obvious position for the spin, though it has been separated into many spins. All groups were able to get positive GOE value average.

As clearly as the previous element was a spin for most of the skaters, *the seventh element is a spot for step sequence.* Considering GOE value, the first three groups were able to raise base value clearly when the last three had a trouble to reach zero level.

By overwhelmingly combination spin *was the most used element for the last element spot* and mainly it was well done.

Table 3. The most used program structure of top 15 skaters and latter 15

Element spot	Skaters ranked 1-15	Skaters ranked 16-30
1st element	Jump combination (12)	Jump combination (8)
2nd element	Solo jump (12)	Jump combination (7) or solo jump (6)
3rd element	Spin (10)	Solo jump or axel (10)
4th element	Spiral sequence (8)	Spin (8)
5th element	Axel (8)	Spiral sequence (8)
6th element	Spin (12)	Spin (10)
7th element	Step sequence (14)	Step sequence (9)
8th element	Combination spin (11), the number of all spins at this element spot is 15	Combination Spin (9), the number of all spins at this element spot is 14

From table 3 can be seen two different program structures. From the left column can be identified the running number of an element spot. At the middle column is stated the most popu-

lar element from top 15 skaters. At the right column there are presented the most popular element performed by skaters ranked 16 to 30. The number of each performed element is in brackets after the named element on a middle column and on right side column.

Taking into a consideration that number in brackets can be at its largest 15, can be stated that top skaters were quite unanimous with program structure (see table 3). Major of skaters that belong into this group has performed same kinds of elements. Dispersion with skaters ranked 16-30 has been bigger but still there can be found leading element for each element spot. The differences between first and latter 15 skaters are:

- Element differences with the 3rd , 4th and 5th element
- The amount of skaters that have performed the element which was the most popular of their own "group." Top skaters have been more unanimous.

7.1 The first element

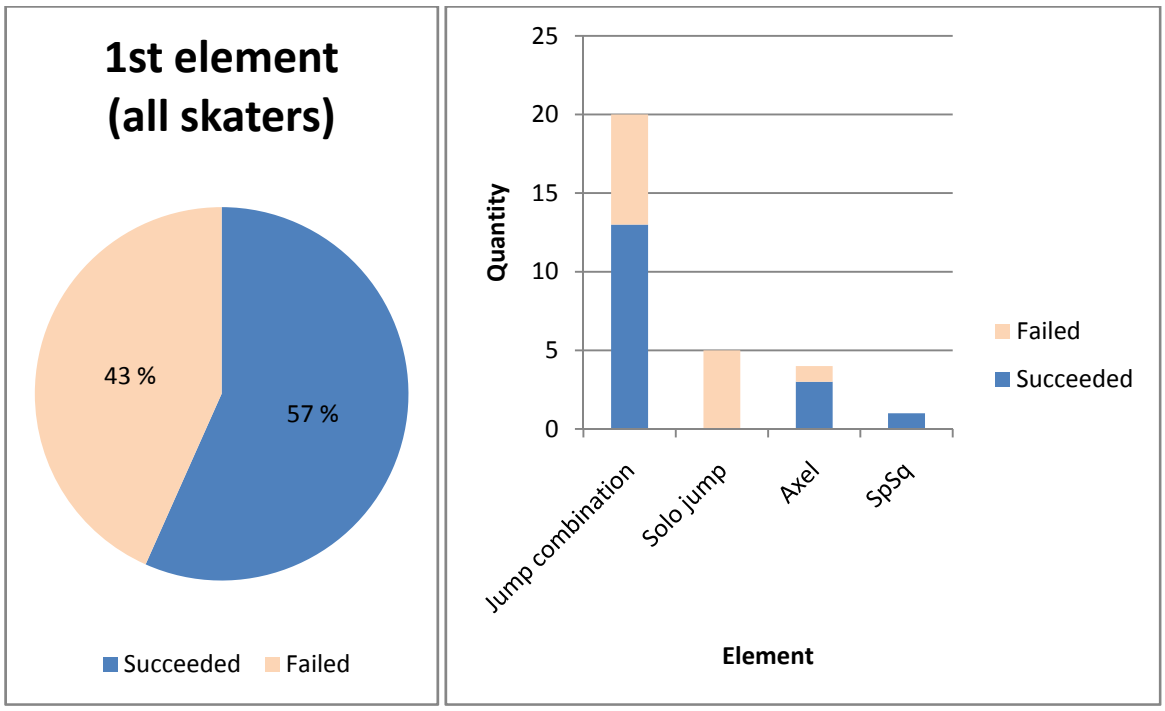

Figure 1. Succeeding rates of the first element

Figure 1 states succeeding rates of the first element. At the left side from the circular diagram can be seen the total succeeding rate of the element which is 57%. 43% from all elements got some sort of deduction by not reaching the base value of planned element. From the bar diagram at the right side can be seen each element performed. It is stated how many of each has been performed and succeeding rates of those. It is easy to see the ratio of successful ones and non-successful ones as the blue color stands for succeeded element and the red one for failed element.

Table 4. Element structure of first element

	Skaters ranked 1-15			Skaters ranked 16-30		
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Solo jump		3Lz (10)	3F (13)			3Lz&lt (26)
						3Lo&lt (27)
						1S (30)
Axel			2A (14)		2A (24)	2A (28)
					2A (25)	
Jump combi-nation	3Lz+3T (1)	3Lz+2T (6)	3T+3T (11)	3Lz+2T (16)	3F+2T (21)	3T+2T (29)
	3A+2T (2)	3F+2T (7)	3Lz+2T (12)	3Lz&lt+ COMBO (17)	3Lo+2T (22)	
	3Lz+2T (3)	3F+2T (8)	3Lz+2T (15)	3S+2T (19)	3T+3T (23)	
	3Lz+ 3Lo&lt (4)	3T+2T (9)		3T+3T (20)		
	3F+3T (5)					
SpSq				SpSq4 (18)		
LSp						
CCoSp						
FSp						
StSq						

At the left side of the table 4 is marked all eight elements that are required in ladies short program. At the next columns there are presented every skaters' performed first element (For definitions see appendix 1). Skaters are divided into groups so that at the first group there are skaters ranked 1 to 5. At the next group there are skaters ranked 6 to 10, at the third group 11 to 15 etc. After every element there is rank reported in quantity. Any mistake in a performance of the element is marked with red color. Element is called failed when the grade of execution value reaches negative figure.

From the figure 1 it is easy to see that two out of three competitors' opening element was jump combination. According to appendix 2 and table 4 it seems that skaters placed most valuable and technically hardest element for the first element. Latter half of participants performed easier and so consequently less valuable elements than skaters ranked 1 to 15. Interestingly still mistakes were divided quite evenly.

Table 5. Timing of first element and the scores

Skaters/Group	**Average time of performed element in seconds**	**Average planned base value**	**Average score of panel**	**Difference in performed element's base value and GOE on average**	**Ranked according to average planned base value**
1-5/ Group 1	18,20	9,46	9,32	0,56	1st
6-10/ Group 2	21,00	7,52	6,64	0,20	2nd
11-15/ Group 3	19,40	6,32	6,28	-0,04	4th
16-20/ Group 4	26,80	6,36	5,60	0,32	3rd
21-25/ Group 5	18,80	5,62	5,02	-0,60	5th
26-30/ Group 6	20,40	4,86	2,27	-0,25	6th
Average from all	19,67	6,69	5,85	0,03	

At the left side of the table 5 can find which group statistics are considering. On the second column is said every group's average time of performed element in seconds. *Average planned base value* column shows scores that skaters have beforehand informed the organizers that they will try to complete and if possible to overcome at the competition. *Average score of panel* states how much group has scored on average at this element spot. The second last column, *difference in performed element's BV and GOE on average*, tells if a group has performed element well or if they haven't been successful with this element. Non-successful performance from the group has been indicated with negative red value which shows how many points they missed from the base value. The last column ranks groups to the order which is defined by the planned base value of an element. It shows clearly how groups have planned their programs when compared to other groups. For example, group 4 average planned base value (PBV) is higher than their reached rank.

First element was performed, on average, after 19,67 seconds from beginning. The mean base value (BV) of the first element was calculated to be 6,69 points (range 3,4-11) between all 30 skaters. Mean score of panel (SOP) was 6,72 (range 0,1-12) which means addition of 0,03 points on average. Inside the top five skaters, planned base value reached 9,46 points (range

7,3-11). With last five skaters that didn't qualified for free skating, mean value was 4,86. Total difference of 4,6 points on planned base value. Skaters' 1 to 5 scores of panel was 9,32 (range of 8,30-12) when the last group only earned 4,61 (range of 0,1-5,5).

Mistakes were included 13 all together and all of them were done in jumps. The ones that were effecting to scores negatively were: 3 downgrades, 1 missed one and 6 that were performed poorly. 3 of the flaws were easements with jump combinations which technically weren't mistakes and didn't lead into deductions other than lowering earned scores.

Group 1 is clearly ahead of other groups. Their planned base value (PBV) and also execution of element was above others reaching positive grade of execution (GOE) 0,56 points. Other notable feature is timing. They performed the element sooner than any group even though it was technically harder. The reasons lie probably on better technical, physical and psychological skill bases which are not the aim of this study.

According to table 5 and the development of planned base values (PBV) and score of panel (SOP), it is fair to state that PBV of first element in these Games suggested future rank after short program.

7.2 The second element

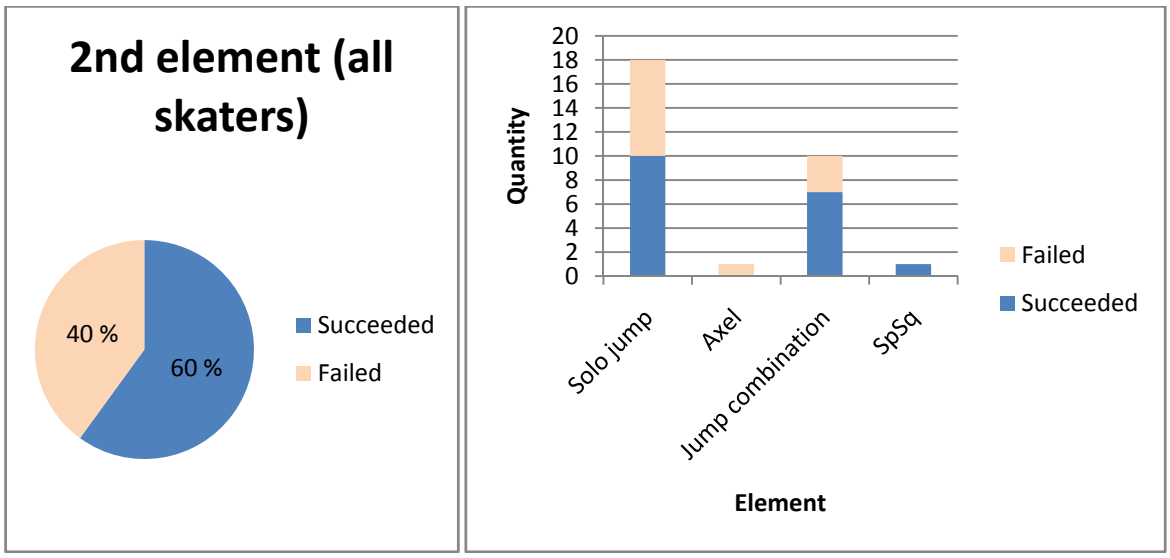

Figure 2. Succeeding rates of the second element

28 skaters performed jump element also as a second element of a program. Average time between all skaters was approximately 43 seconds from the beginning of program. What it comes to points, mean base value was 5,51 when earned scores of panel was 4,70 which means that skaters missed 0,81 points on average. The ones who were ranked the highest didn't have the highest planned base value goal. Actually they had third lowest (5,60) as a group when the last five skaters were seeking 6,08 points and reaching the second highest score goal of the element. Still, group 1 gathers highest SOP and group 6 lowest ones.

Group 6's high PBV is explained at the table 7 which shows a lot of jump combinations spotted into a second place when most of the skaters are carrying out solo jump. Half of this group's elements are failed with huge deductions since the other jump is downgraded, another easement and both jump combinations are missing the second jump.

Table 6. Timing of second element and the scores

Skaters/Group	**Average time of performed element in seconds**	**Average planned base value**	**Average score of panel**	**Difference in performed element's base value and GOE on average**	**Ranked according to average planned base value**
1-5/ Group 1	39,40	5,60	5,88	0,28	4th
6-10/ Group 2	40,80	6,10	5,74	-0,36	1st
11-15/ Group 3	39,80	5,82	4,66	-1,16	3rd
16-20/ Group 4	42,80	4,74	5,14	0,18	5th
21-25/ Group 5	39,00	4,72	3,88	-0,84	6th
26-30/ Group 6	36,80	6,08	2,92	-3,16	2nd
Average	39,77	5,51	4,70	-0,14	

Generally the second element was quite the same with all skaters. Timing was close to each other and the main tendency is to perform the second hardest jump (and element) of program.

Table 7. Element structure of second element

	Skaters ranked 1-15			Skaters ranked 16-30		
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Solo jump element	3F (1)	3F (6)		3S (16)	3S (21)	
	3F (2)	3Lz (7)	3F (12)	3Lo (17)	3T (22)	
	3F (3)	3Lz (8)	3F&lt (13)		1S (23)	
	3F (4)			3Lo (19)		
	3Lz (5)	3Lo (10)	3S (15)			
Axel						2A (28)
Jump combi-nation		3T+3T (9)	3Lo+2T (11)	3S+2T (18)	3T+2T (24)	3S+2T (26)
			3Lz+2T (14)		3T+2T (25)	3S+2T (27)
						3Lz&lt + COMBO (29)
						2T+ COMBO (30)
SpSq				SpSq4 (20)		
LSp						
CCoSp						
FSp						
StSq						

Mistakes were done 11, mainly with solo jump element (see table 7 and figure 2). 7 of them being poorly performed, 1 downgraded which leads significantly lower base value and the last 3 total flaws by missing the second jump in combination or missing rotations at the first jump of combination.

7.3 The third element

Figure 3 clearly states increase in succeeding ratio with third element when compared to first two elements. This is explained by element structure and is reflected also to PBV and SOP values. Only 10% from the elements were failed and all of them with solo jump with skaters ranked mainly to the group 6.

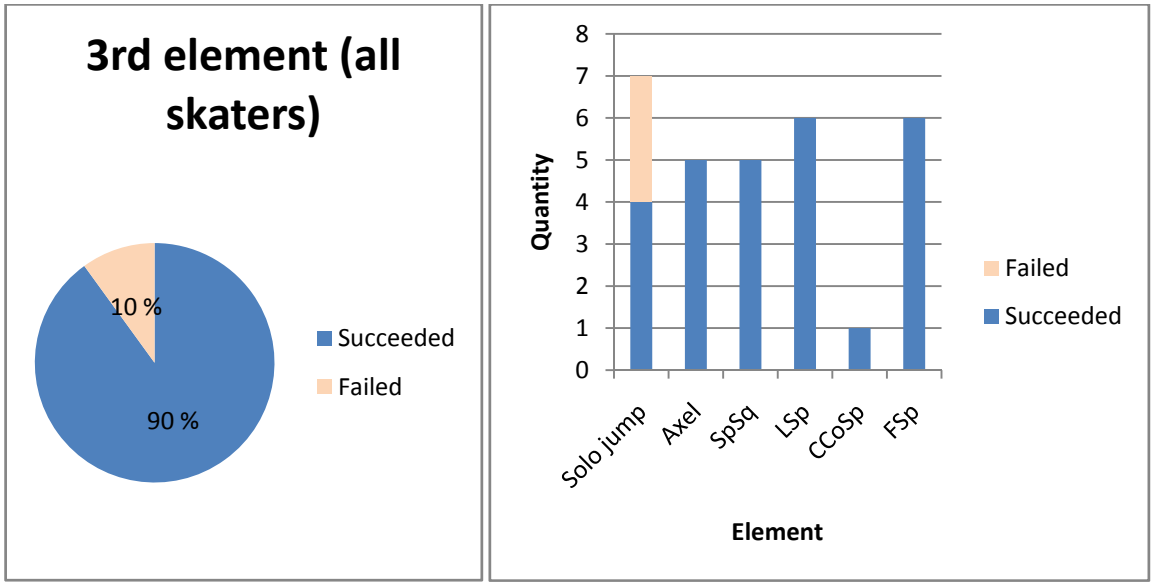

Figure 3. Succeeding rate of the third element

At the third element, ranking considering planned base value is turned upside down. Skaters are separated into two groups: the ones that continues jumps and the ones that don't. Mean time for the third element is 50,83 seconds. The variation at PBV with different groups varies between 3,00 and 3,88. Although, PBV is relatively small, it seems like that skaters have performed the elements with good quality since average GOE is 0,36 points higher than planned base value. Only group that didn't receive higher marks were the lowest ranked group. They ended up losing almost half a point with this element which is closely related to number of jumps: 4/5.

Table 8. Timing of third element and the scores

Skaters/Group	**Average time of performed element in seconds**	**Average planned base value**	**Average score of panel**	**Difference in performed element's base value and GOE on average**	**Ranked according to average planned base value**
1-5/ Group 1	45,20	3,00	3,60	0,60	6th
6-10/ Group 2	49,60	3,04	4,00	0,96	5th
11-15/ Group 3	50,40	3,48	4,04	0,56	4th
16-20/ Group 4	58,60	3,48	3,04	0,38	3rd
21-25/ Group 5	51,20	3,68	3,80	0,12	2nd
26-30/ Group 6	50,00	3,88	1,48	-0,46	1st
Average	50,83	3,43	3,33	0,36	

The structure of this element is the very first that varies between the groups. Groups 1-4 did mainly flying spins, layback spins or spiral sequences, skaters behind them performed jumps. All of the mistakes happened with jumps. Deductions came from missing rotations at the solo jumps. This is the first clear structural difference between skaters who qualified for free skating and skaters that didn't.

What it comes to timing, it is also the first time when there are bigger gaps. Timing issue seems to be related to element to come. Element 2 was done around 40 seconds in all groups (tables 6 and 8) consisting mainly jumps, now the range is between 45,20-58,60 seconds because of differences to go into element. Meaning, spiral sequences and jumps need faster speed with totally different pattern to approach the element than spins do. After the next couple elements, when skaters are performing again same kinds of elements with the same pattern, timing returns to the one main channel.

Overall from this element to the fifth, skating rhythm and performing jumps differs between the best and weaker ranked skaters. Especially, group 6 is making their own choices all the way to the last element of program –curiously they also differed from not qualifying for the free skating competition (see tables 9-19).

Table 9. Element structure of third element

	Skaters ranked 1-15			Skaters ranked 16-30		
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Solo jump element			3T (14)	3T (18)	3S (24)	2S (28)
				1S (20)	3S (25)	2F (29)
Axel			2A (12)		2A (22)	2A (27)
					2A (23)	1A (30)
Jump combi-nation						
SpSq	SpSq4 (4)	SpSq4 (6)		SpSq4 (16)		
		SpSq4 (7)		SpSq3 (19)		
LSp	LSp4 (1)	LSp3 (9)		LSp3 (17)	LSp3 (21)	LSp3 (26)
	LSp4 (2)					
CCoSp			CCoSp4 (15)			
FSp	FSSp4 (3)	FSSp4 (8)	FCSp4 (11)			
	FCSp4 (5)	FSSp4 (10)	FCsp4 (13)			
StSq						

7.4 The fourth element

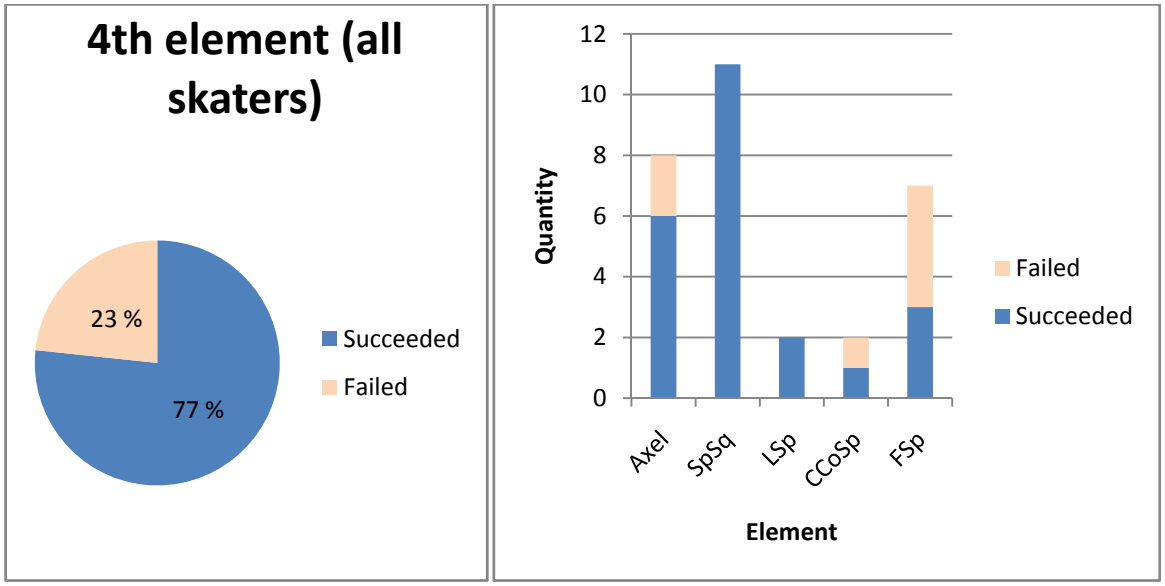

Figure 4. Succeeding rate of the fourth element

There are clear pattern of what elements skaters 1 to 15 have done (table 11), mainly spiral sequences and double axels. Quite controversy, from ranked 16 to 30 there are no common structure with elements.

There are 7 mistakes which all are errors at quality of execution, most of those placed on the latter half of the skaters and with flying spin. 4 out of 7 flying spins has gotten bad execution marks. When compared those numbers to table 8, 12 and 15 (also figures 3, 5 and 6) when there was done 22 flying spins and only 2 with bad execution can't help asking if the timing or element structure wasn't the best possible one for doing flying sit spin as a fourth element. From all spins, only 6 flying spins got negative GOE value and 4 were done as a fourth element.

Table 10. Timing of fourth element and the scores

Skaters/Group	**Average time of performed element in seconds**	**Average planned base value**	**Average score of panel**	**Difference in performed element's base value and GOE on average**	**Ranked according to average planned base value**
1-5/ Group 1	69,60	3,44	5,00	1,56	2nd
6-10/ Group 2	71,80	3,24	3,85	0,61	3rd
11-15/ Group 3	67,20	3,24	3,79	0,55	3rd
16-20/ Group 4	76,60	3,50	3,64	0,14	1st
21-25/ Group 5	59,00	2,72	2,92	0,20	6th
26-30/ Group 6	57,60	3,16	3,39	0,23	5th
Average	66,97	3,22	3,77	0,55	

Skaters reached half point of the program, element wise, already after the first minute. Fourth element earned to skaters mean points of 3,77 and it was the first element where all groups came up with more points than planned base value was (mean 3,22 points).

Average timing was 66,97 (range of 57,60-76,60) seconds which means that there was approximately 16 seconds between third and fourth element. It is notable that there is quite big time difference, up to 19 seconds on average times. Also there are clear difference between the first 15 skaters and rest of them. Timing of the first three groups is more or less closer to 70 seconds when the latter three are aiming around 60 seconds timing –though the fourth group stands out with the mean time of 76,60 seconds from all groups.

Table 11. Element structure of fourth element

	Skaters ranked 1-15			Skaters ranked 16-30		
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Solo jump element						
Axel	2A (3) 2A (4)	2A (6) 2A (7)		2A (16) 2A (17) 2A (19) 2A (20)		
Jump combi-nation						
SpSq	SpSq4 (1) SpSq4 (2) SpSq4 (5)	SpSq4 (8) SpSq3 (9)	SpSq4 (11) SpSq4 (13) SpSq4 (15)		SpSq4 (21)	SpSq4 (26) SpSq4 (28)
LSp		LSp3 (10)			LSp3 (22)	
CCoSp				CCoSp4 (18)	CCoSp4 (24)	
FSp			FSSp4 (12) FSSp4 (14)		FSSp2 (23) FSSp1 (25)	FSSp4 (27) FSSp4 (29) FSSp4 (30)
StSq						

7.5 The fifth element

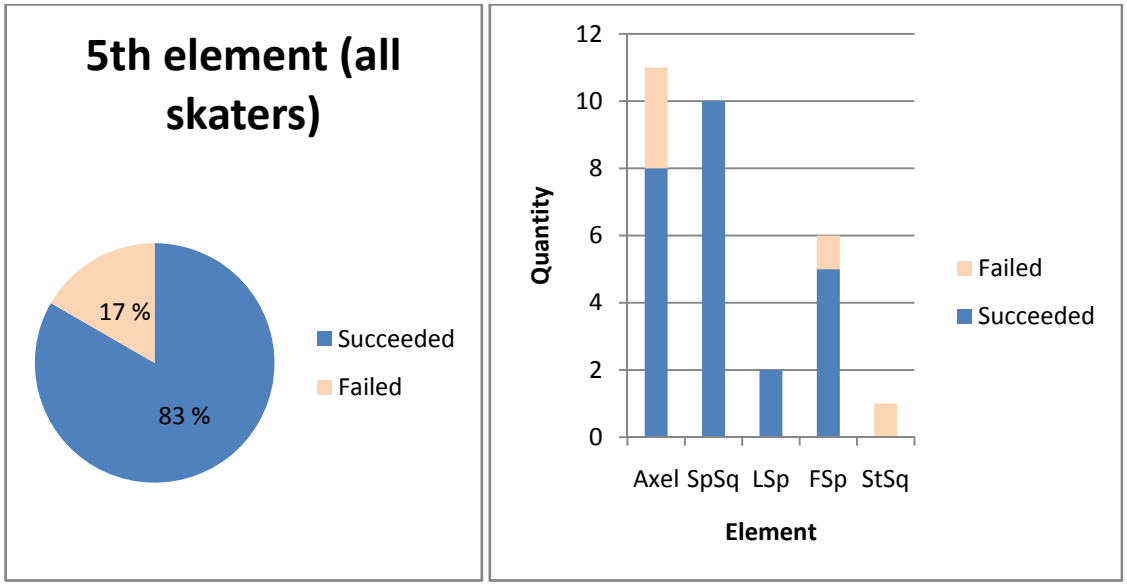

Figure 5. Succeeding rate of the fifth element

The fifth element was divided into a three categories: axel, spiral sequence and to spins (flying spin mainly). All groups performed all of those elements but most popular one was axel among the first three groups when spiral sequence reached number one spot among skaters ranked 16 to 30.

3 out of 5 mistakes happened with jumps. Top ten skaters didn't fail at all which is clearly seen on higher GOE's (table 12) when compared to rest of the skaters.

Table 12. Timing of fifth element and the scores

Skaters/Group	**Average time of performed element in seconds**	**Average planned base value**	**Average score of panel**	**Difference in performed element's base value and GOE on average**	**Ranked according to average planned base value**
1-5/ Group 1	88,40	3,06	4,16	1,10	5th
6-10/ Group 2	89,80	3,10	3,50	0,40	4th
11-15/ Group 3	90,80	3,44	3,00	0,10	1st
16-20/ Group 4	90,40	2,96	3,14	0,18	6th
21-25/ Group 5	82,00	3,36	3,29	-0,07	2nd
26-30/ Group 6	77,40	3,14	2,57	0,13	3rd
Average	86,47	3,18	3,28	0,31	

Element was performed at the time of 86,47 seconds on average. Base value was 3,18 and skaters were able to elevate it to 3,28 on average. Only group 5 got negative GOE.

Table 13. Element structure of fifth element

	Skaters ranked 1-15			Skaters ranked 16-30		
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Solo jump element						
Axel	2A (1)	2A (8)	2A (11)	2A (18)	2A (21)	1A&lt (26)
	2A (2)	2A (9)	2A (13)			
		2A (10)	2A&lt (15)			
Jump combi-nation						
SpSq	SpSq4 (3)		SpSq4 (12)	SpSq4 (17)	SpSq3 (22)	SpSq3 (27)
					SpSq3 (23)	SpSq3 (29)
					SpSq4 (24)	SpSq4 (30)
					SpSq4 (25)	
LSp	LSp2 (5)	LSp3 (7)				
CCoSp						
FSp	FSSp4 (4)	FSSp3 (6)		FSSp4 (16)		FSSp3 (28)
				FCSp2 (19)		
				FSSp3 (20)		
StSq			SlSt3 (14)			

Considering tables 12 and 13 and figure 5 can be said that the fifth element was based on easier elements (appendix 2) than previous elements which can be seen on succeeding rates and the ratio of earned points (SOP vs. PBV). From analyze cannot be seen any big surprises. The only standing out difference is the timing of this element with group 6 (table 12). They are ahead of everyone else which is explained by the element structure of previous elements.

7.6 The sixth element

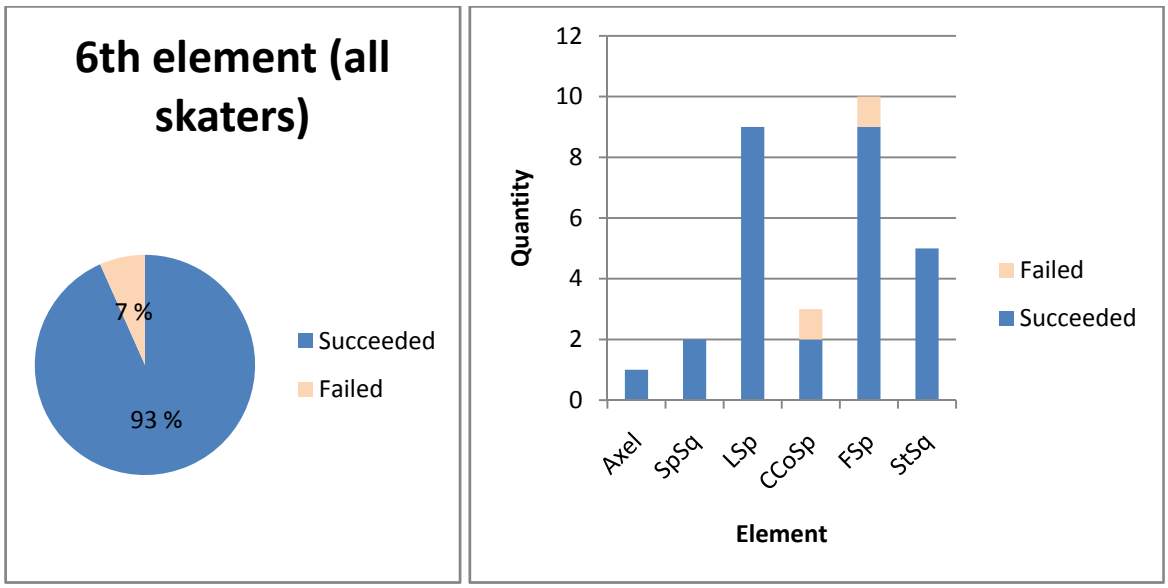

Figure 6. Succeeding rate of the sixth element

It is justified to say that the sixth element is based on spins. With 22 spins it is on a same league as the first and last two elements from both ends of ladies' short program, considering resemblance of skaters' choice.

Mean time of performing the element was 101,60 seconds (range of 95,40-105,40). Average base value was 2,84 and all groups were able to lift the score higher with good execution. Rather small number of mistakes (2) and both of them appeared in last two groups. Generally spins are the easiest to perform with, at least, zero level of grade of execution. This can be seen in figure 6 with only 7% of failing rate and with table 13 on earned SOP values which are clearly higher than planned base values.

The sixth element "operates" as a gathering element. 22 skaters are performing spins quite the same time at programs receiving close values with each other. Groups 1-4 are able to lift GOE values clearly higher than the last two groups. One possible reason for this is the amount of flying spins at the groups 5 and 6. Quite often ladies find flying spin hard to do. That combined to late time position in a program might do the trick. Also step sequences are quite common among last two groups and when compared mean GOE's from groups 4-6's seventh element to this one, there are big similarities to find. All groups are, in score wise, a lot behind the first three groups. The same pattern continues on the next element. This fact represents a huge difference of these groups. All groups are performing approximately same value ele-

ments but the higher ranked groups are performing those a lot better. This might reflect the differences in physical condition or at skill base.

Table 14. Timing of sixth element and the scores

Skaters/Group	**Average time of performed element in seconds**	**Average planned base value**	**Average score of panel**	**Difference in performed element's base value and GOE on average**	**Ranked according to average planned base value**
1-5/ Group 1	103,00	2,76	3,18	0,42	4th
6-10/ Group 2	99,00	3,00	3,52	0,52	2nd
11-15/ Group 3	105,40	3,04	3,58	0,54	1st
16-20/ Group 4	104,80	2,68	3,00	0,32	6th
21-25/ Group 5	102,00	2,70	2,73	0,03	5th
26-30/ Group 6	95,40	2,88	2,90	0,02	3rd
Average	101,60	2,84	3,15	0,31	

Table 15. Element structure of sixth element

	Skaters ranked 1-15			Skaters ranked 16-30		
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Solo jump element						
Axel	2A (5)					
Jump combina-tion						
SpSq		SpSq3 (10)	SpSq4 (14)			
LSp	LSp2 (3)	LSp4 (6)	LSp4 (11)	Lsp4 (16)	LSp3 (23)	
	LSp3 (4)	LSp4 (8)	LSp3 (13)	LSp3 (19)		
CCoSp		CCoSp4 (9)	CCoSp4 (12)			CCoSp4 (27)
FSp	FSSp4 (1)	FSSp4 (7)	FCSp4 (15)	FSSp4 (17)	FCSp4 (21)	FSSp4 (26)
	FSSp4 (2)			FSSp4 (18)	FSSp2 (22)	
					FCSp2 (24)	
StSq				SlSt2 (20)	SlSt3 (25)	SlSt3 (28)
						SlSt2 (29)
						SlSt2 (30)

7.7 The seventh element

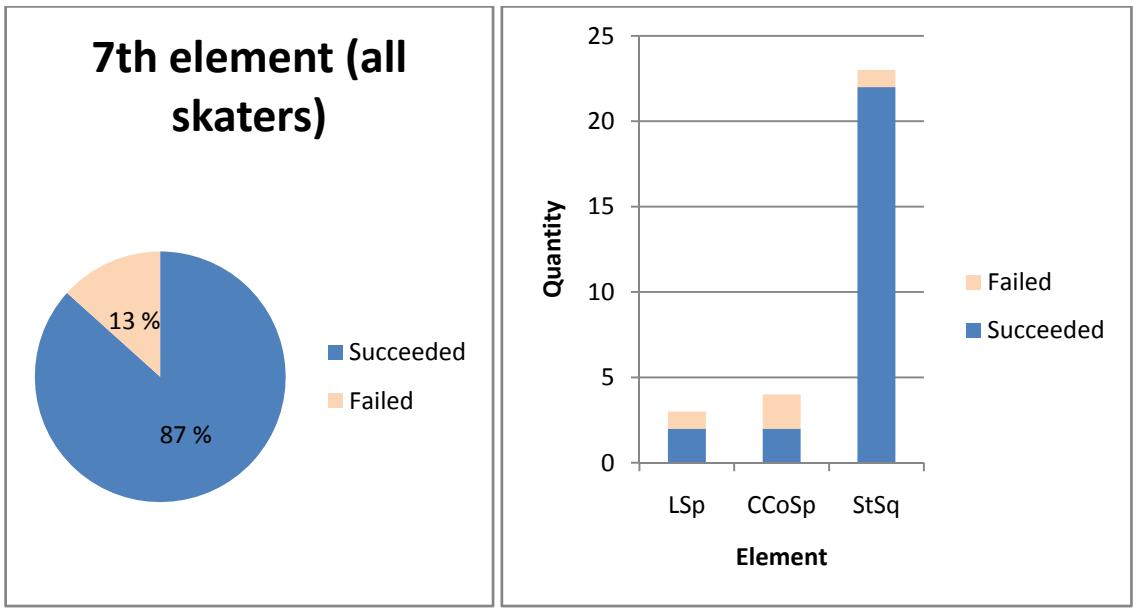

Figure 7. Succeeding rate of the seventh element

On seventh element there happens even bigger gathering inside program structures than with sixth element. Figure 7 represent the ratio of elements which states skaters to favor clearly step sequence as a second last element. The percentage of successfully performed elements is reasonably high (87%) which is closely related to the elements of performed.

Table 16. Timing of seventh element and the scores

Skaters/Group	**Average time of performed element in seconds**	**Average planned base value**	**Average score of panel**	**Difference in performed element's base value and GOE on average**	**Ranked according to average planned base value**
1-5/ Group 1	117,20	3,30	4,04	0,74	2nd
6-10/ Group 2	116,40	3,10	3,70	0,60	3rd
11-15/ Group 3	124,20	3,34	3,84	0,50	1st
16-20/ Group 4	122,00	2,54	2,60	0,06	6th
21-25/ Group 5	119,20	2,84	2,86	0,02	5th
26-30/ Group 6	125,60	3,06	3,12	0,06	4th
Average	120,77	3,03	3,36	0,33	

Mean time of starting the element is 120,77 seconds with a range of 116,40-125,60 (see table 16). Mean value of the element spot is 3,03 and grade of execution higher that to 3,36 reaching 0,33 points positive difference. The weakest value is done by group 4 and it is explained through easier element structure (four times level 2, once level 3).

Table 17. Element structure of seventh element

	Skaters ranked 1-15			Skaters ranked 16-30		
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Solo jump element						
Axel						
Jump combina-tion						
SpSq						
LSp					LSp2 (24)	LSp4 (28)
					LSp3 (25)	
CCoSp			CCoSp4 (14)	CCoSp2 (20)		CCoSp4 (29)
						CCoSp4 (30)
FSp						
StSq	SlSt3 (1)	CiSt3 (6)	SlSt3 (11)	SlSt2 (16)	SlSt3 (21)	SlSt3 (26)
	SlSt3 (2)	CiSt3 (7)	SlSt3 (12)	SlSt3 (17)	SlSt3 (22)	SlSt2 (27)
	SlSt3 (3)	SlSt3 (8)	CiSt3 (13)	SlSt2 (18)	SlSt3 (23)	
	SlSt3 (4)	SlSt3 (9)	SlSt3 (15)	SlSt2 (19)		
	SlSt3 (5)	SlSt2 (10)				

Skaters ranked 16 to 30 continue making mistakes in a regular base.

7.8 The eighth element

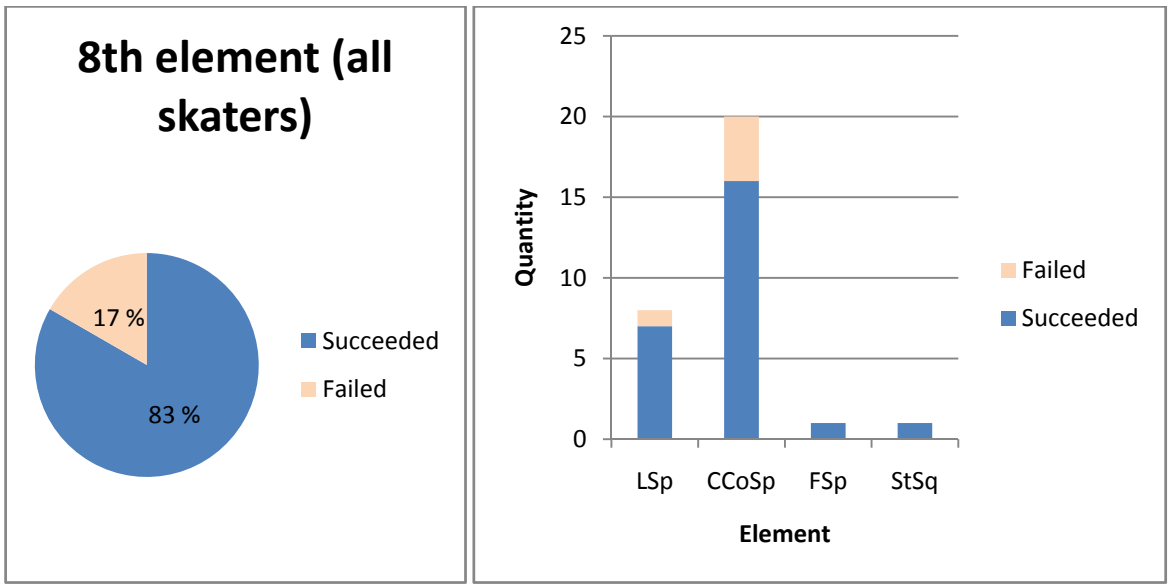

Figure 8. Succeeding rate of the eighth element

The succeeding rate of eighth element was 83 percent and major part of mistakes was included to combination spin.

The last element is started only 18 seconds before the end (see table 18) and it is very much the same between the skaters in every way, even more than the first two elements but less than the previous one. Now also planned base values are quite close to each other (range 2,74-3,50 points) and obviously the elements too which are combination- and layback spins.

On average, skater earned 0,29 points more than the base value of element performed and it is the third lowest difference in BV and GOE after the first two elements which generally were the hardest to perform at program.

Table 18. Timing of eight element and the scores

Skaters/Group	**Average time of performed element in seconds**	**Average planned base value**	**Average score of panel**	**Difference in performed element's base value and GOE on average**	**Ranked according to average planned base value**
1-5/ Group 1	151,80	3,50	4,22	0,72	1st
6-10/ Group 2	150,40	3,40	3,63	0,23	2nd
11-15/ Group 3	152,20	2,86	3,16	0,30	5th
16-20/ Group 4	149,00	3,06	3,23	0,17	4th
21-25/ Group 5	146,40	3,26	3,33	0,07	3rd
26-30/ Group 6	151,20	2,74	2,98	0,24	6th
Average	150,17	3,14	3,43	0,29	

Table 19. Element structure of eighth element

	Skaters ranked 1-15			Skaters ranked 16-30		
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Solo jump element						
Axel						
Jump combina-tion						
SpSq						
LSp			LSp4 (12)	LSp3 (18)		LSp2 (27)
			LSp4 (14)	LSp3 (20)		LSp3 (29)
			LSp3 (15)			LSp3 (30)
CCoSp	CCoSp4 (1)	CCoSp4 (6)	CCoSp3 (11)	CCoSp4 (16)	CCoSp4 (21)	CCoSp4 (26)
	CCoSp4 (2)	CCoSp4 (7)		CCoSp4 (17)	CCoSp3 (22)	
	CCoSp4 (3)	CCoSp4 (8)	CCoSp4 (13)	CCoSp4 (19)	CCoSp4 (23)	CCoSp4 (28)
	CCoSp4 (4)	CCoSp4 (10)			CCoSp3 (25)	
	CCoSp4 (5)					
FSp		FSSp4 (9)				
StSq					SlSt3 (24)	

There are only 5 poor executions that have decreased points and all of them are spread into middle groups (groups 2, 4 and 5). Mistakes that were made by skaters ranked 7th and 10th places can be said to be small surprise. Groups 1 to 3 made only 3 mistakes with spins when groups 4 to 6 made 13 mistakes altogether and all of those were spread more or less to all spin element spots. Evidence which proposes possible gap with skill differences among the better and worse half of skaters qualified for the Olympic Games.

The last element is one of the most solid element spots in every way. Base values are close to each other and skaters are quite unanimous of how to end short program.

7.9 Skating time and the structure of timing elements

Skating time throughout all competitors was quite the same. Average short program skating time was 168 seconds (range 164-170 seconds) when maximum time is 170 seconds. All groups' mean times were inside a half a second. Convergent use of total time reinforces believe of rush during short program and a need of usage of maximum time without deductions.

Mean time for execute an element in a short program would be every 21,25 seconds. It is a short time to finish the element and prepare for the next one. Considering this, it is quite reasonable to aim to use the maximum allowed performance time. This enables a little slower rhythm for performing elements and also allows better concentration to each of them. This kind of behavior potentially enables better scoring on program components when there is more time, for example, for transitions and executing choreography.

Table 20. Timed values from every element

Rank/group	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**
1-5/ Group 1	18,20	39,40	45,20	69,60	88,40	103,00	117,20	151,80
6-10/ Group 2	21,00	40,80	49,60	71,80	89,80	99,00	116,40	150,40
11-15/ Group 3	19,40	39,80	50,40	67,20	90,80	105,40	124,20	152,20
16-20/ Group 4	26,80	42,80	58,60	76,60	90,40	104,80	122,00	149,00
21-25/ Group 5	18,80	39,00	51,20	59,00	82,00	102,00	119,20	146,40
26-30/ Group 6	20,40	36,80	50,00	57,60	77,40	95,40	125,60	151,20
Average	19,67	39,77	50,83	66,97	86,47	101,60	120,77	150,17

When examined table 20 and figure 9 can be said that timing the element spots were quite the same throughout the program with every group. The only clear differences between the groups are at the middle of the program structure. Group 1 performs 3rd element sooner than others. 4th and 5th element is performed sooner b y the groups 5 and 6. Group 6 continues fast pace with 6th element also but reaches the 7th element as a last group from all the groups. Otherwise groups are very unanimous from timing the elements, especially the middle groups which don't differed at all.

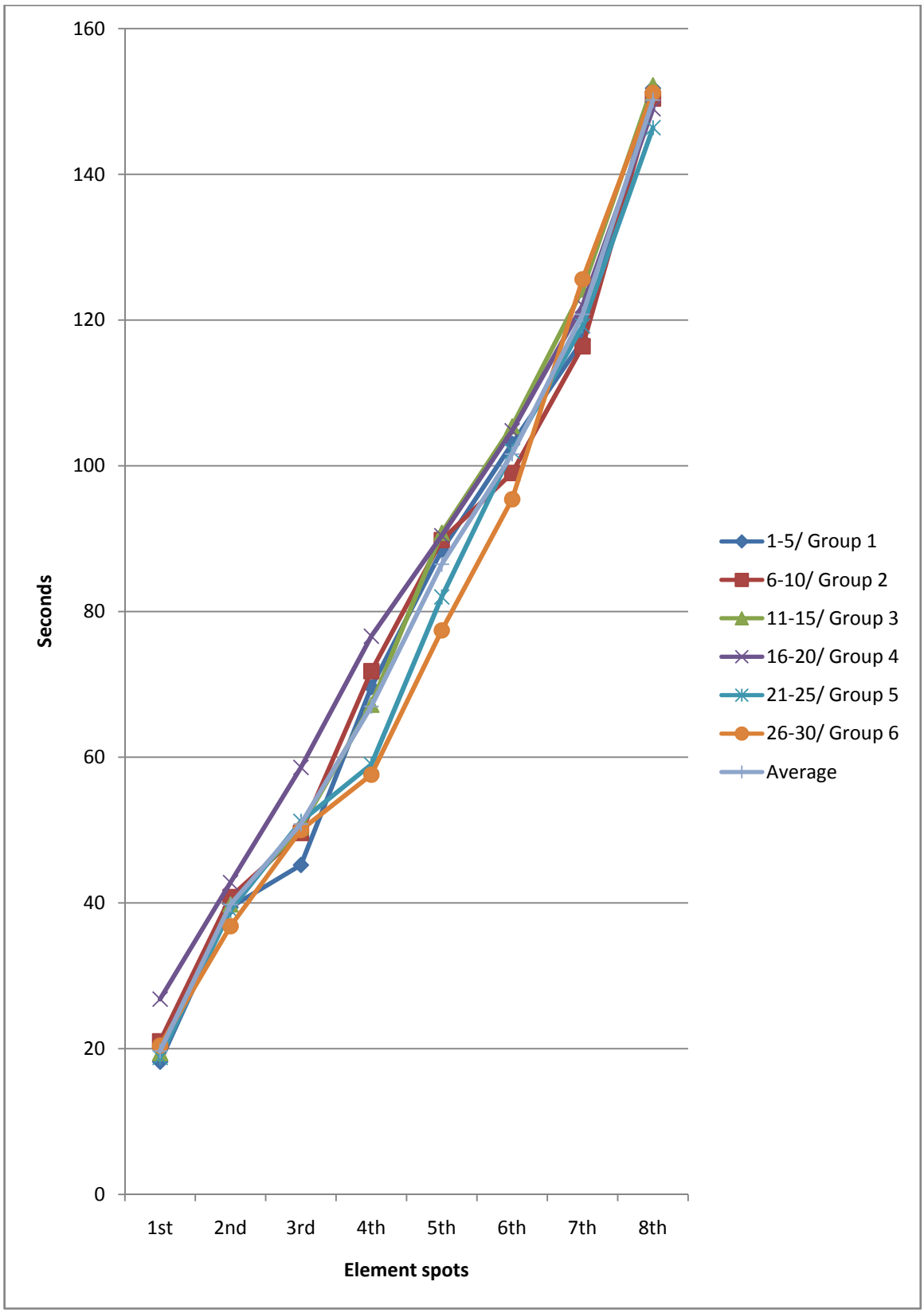

Figure 9. Timing of every element with each group

8 Results and discussion of jump elements

According to results, sooner the jump combination was the better score skater was able to get out of it. The highest scores were performed approximately at 20 seconds. What it comes to GOE value, it suggest that when combination has been performed between 20 and 30 seconds, skaters might increase the possibility to score more since combination has been done with better quality at that time. Though it's needed to remember that there are couple skaters that were planned to do triple-triple combination and ended up performing only triple-double which earned them high GOE value and so forth effected to jump combination's mean value by increasing it at certain time. Of course it is needed to remember that easements were mistakes but according to rules unless the element was performed poorly, there wasn't any deductions made at the grade of execution or at the base value. *Succeeding rates and earned points from those also suggests playing it safe if skater isn't managing the element with good consistence.* Lutz combination did give the highest score from all combinations when performed well. When didn't, the mean score was the lowest of all combinations which states major crush.

60% from all solo jumps got some sort of a deduction from execution. The only jumps that were performed at decent level were toe loop and loop. All lutzes got deduction, 7 out of 9 salchows got deduction which is interesting considering the fact that it is generally acknowledge being one of the easiest jump elements in figure skating. Flip statistics are almost as bad as salchow's, only 4 skaters earned positive GOE value. Top-5's average values from performing solo jump (time 39,4 sec and planned base value 5,60 points) were on the same line as everyone else's (39, 8sec/ 5,51points) and they still reached positive GOE (0,28points vs. -0,14points). Taking into account all skaters and earned points, results suggest not to rush or delay (compared to 40 seconds time limit) too much with solo jumps since scores drop crucially. *All of this suggests that either solo jump came too soon considering the previous element (not enough time to concentrate), skaters were generally trying too difficult elements while trying to reach highest possible score or other times than approximately 40 seconds doesn't support performing solo jump because of other non-named reasons. This means that reasons might lie on other factors like technical, physical or in mental side.*

Double axel is easy jump and presumption is that every skater in this level manages this jump. 8 skaters earned negative GOE value and *statistics show clearly that later the jump is in the program the higher the GOE value becomes.* This is probably affected by the fact that higher the skater was at the results, later she performed axel –type of jump. The highest SOP was earned between 70 and 90 seconds time limit.

8.1 Triple-triple combination

Only eight skaters planned to do triple-triple jump combination (Mao Asada's triple axel – double toe loop is counted in since triple axel is extremely rare done by a women). Six of them tried to perform it as a first element, two as a second element. Half of them were able to perform it well and earned at least the base value of combination.

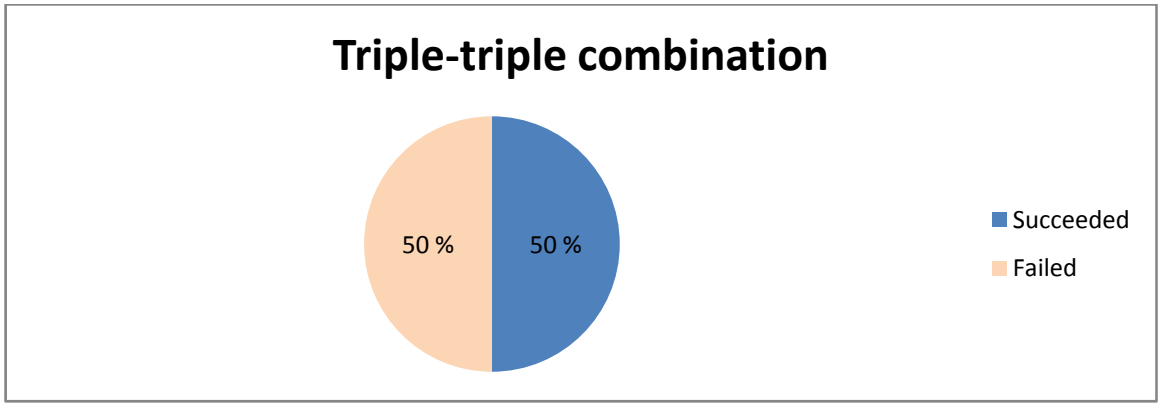

Figure 10. Succeeding rate of triple-triple jump combination

When considered the higher BV of triple-triple combination compared to triple-double's points (7/8 toe loop combinations = value difference 2,7 points, see appendix 2) and mean value of missed points on triple-triple combination, it is justified to say that even trying triple-triple combination skater earned 1,32 points (mean value). With triple-double combination, skaters average SOP was -0,07 points. Of course has to remember that triple-triple is difficult jump element and includes bigger risk of getting deductions.

Based on previous statements can be said that in Vancouver only ladies who had quite solid triple-triple combination tried to perform it and were successful with it.

Table 21. Timing of triple-triple jump combination and the scores

Jump element as performed	Time in seconds	Element structure	Base value	Grade of execution	Speculative score from 3+2 (2A+2T) combination (base value/GOE= plus one)
3Lz+3T	19	1	10,00	12,00	7,30/7,50
3A+2T	18	1	9,5	10,10	4,80/5,00
3Lz+3Lo&lt	**12**	**1**	**11,00**	**6,30**	**7,5/8,00**
3F+3T	21	1	9,50	9,90	6,80/7,00
3F+2T	**21**	**1**	**9,50**	**8,60**	**6,80/7,00**
3T+2T	**27**	**1**	**8,00**	**6,30**	**5,30/5,50**
2T+COMBO	**41**	**2**	**8,00**	**0,30**	**5,30/5,50**
3T+3T	36	2	8,00	9,00	5,30/5,50
Average	22,71		9,19	7,81	6,14/6,38

Difference in base value and GOE	-1,38
Earned points in percentage from base value	85,03%

8.2 Jump combination

Table 22. Jump combination analyze, consisting all combinations from all participants

Element	Time	BV	GOE	SOP	Average				Skaters
3Lz+3Lo	12	11,00	-1,20	6,30	**Time**	**BV**	**GOE**	**SOP**	
3T+2T	13	5,30	0,20	5,50					
3Lz+2T	16	7,30	0,00	7,30					
3Lz+2T	16	7,30	-1,20	6,10					
3T+3T	17	8,00	0,20	8,20					
3T+3T	18	8,00	-0,20	7,80					
3A+2T	18	9,50	0,60	10,10					
3Lz+3T	19	10,00	2,00	12,00					
3F+2T	19	6,80	-2,20	4,60	16,44	8,13	-0,20	7,54	9
3Lz+2T	21	7,30	1,00	8,30					
3Lz+2T	21	7,30	0,40	7,70					
3F+3T	21	9,50	0,40	9,90					
3F+2T	21	9,50	1,80	8,60					
3Lz+2T	23	7,30	0,40	7,70					
3Lz&lt+CO	23	7,30	-1,00	0,90					
3F+2T	24	6,80	0,20	7,00					
3S+2T	25	5,80	0,60	6,40					
3T+3T	25	8,00	1,00	9,00					
3Lo+2T	25	6,30	0,00	6,30					
3T+2T	27	8,00	1,00	6,30					
3T+2T	28	5,30	0,20	5,50	23,67	7,37	0,50	6,97	12

3Lz+2T	34	7,30	-1,00	6,30					
3Lz&lt+CO	35	7,30	-1,00	0,90					
3T+3T	36	8,00	0,40	8,40					
3T+2T	37	5,30	0,00	5,30					
3S+2T	39	5,80	0,80	6,60	36,20	6,74	-0,16	5,50	5
3Lo+2T	40	6,30	0,40	6,70					
2T+COMBO	41	8,00	-1,00	0,30					
3S+2T	45	5,80	0,80	6,60					
3S+2T	46	5,80	0,00	5,80	43,00	6,48	0,05	4,85	4
Mean	26,17	7,37	0,12	6,61					30

Successful	
Number	20
Mean time	26,95
BV	7,04
SOP	7,52
GOE	0,48

Unsuccessful	
Number	10
Mean time	24,60
BV	8,05
SOP	4,81
GOE	-0,60

Three skaters weren't able to perform jump combination and another 7 skaters were judge to get fewer points than their planned base value was. Mean BV was 7,37 (range of 5,30-11,00) points. Those that were victorious with this element, reached 7,52 points even though their planned value was to get 7,04. The unsuccessful ones tried to reach higher but ended up earning only 4,81 points.

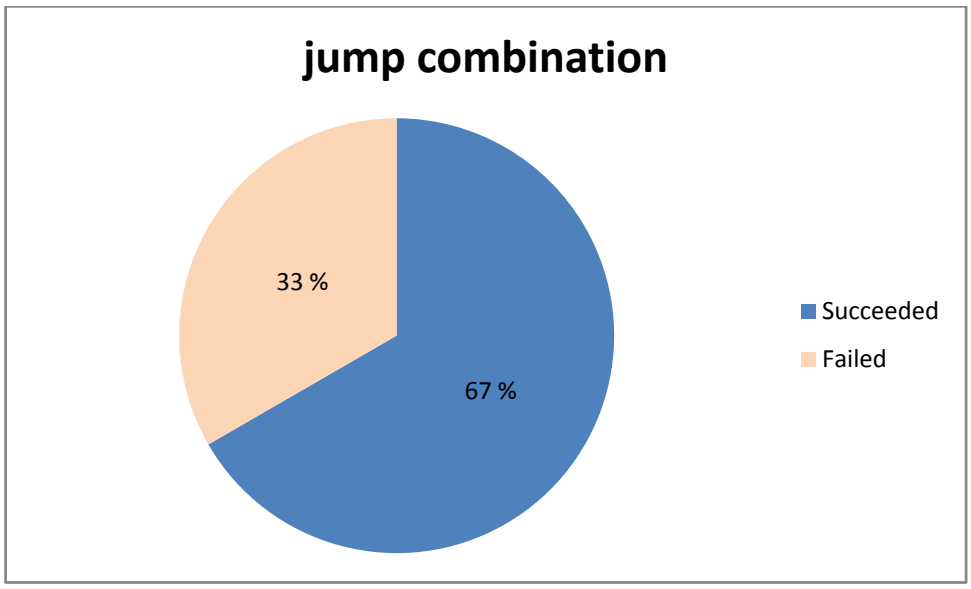

Figure 11. Succeeding rate of all jump combinations

The highest average SOP value with jump combination has performed before 20 seconds. Although the GOE value is way bigger at the range of 20 to 30 seconds time limit when SOP is over 0,5 points smaller. The difference between the first and second groups' calculated mean GOE values is more than 0,7 points. This addresses that there would have been possibility to earn more points through jump combination if it would have been performed between 20-30 seconds. After 30 seconds the quality drops so that the GOE is close to zero again. Also triple-triple combination's mean timing was 22,71 seconds (table 21) which supports the hypothesis to perform jump combination after the first 20 seconds but still before reaching 30 seconds time limit.

Half of the lutz combinations weren't successful. Most of the combinations were done by skaters ranked 1-15. Like noticed from the table 22 before, again GOE value is at its biggest between 20 to 30 seconds (table 24). Although it is needed to consider that triple-triple combinations are at the first group which lifts quality questions on the table again –Without those, GOE could possibly be higher but possibly SOP lower (triple-triple combination's mean advantage was 1,32 points). It seems that easier lutz combination skaters were trying to do, more points they earned. On controversy to axels' mean values, longer skater waited with lutz combination more sure it was to end with mistake. Also too soon performed combination seemed to be risky. Successful ones were on a both side but near of 20 seconds.

8.2.1 Jump combinations –classification according to first jump

Axel

Table 23. The only triple axel combination of short program competition

Element	Time	BV	GOE	SOP
3A+2T	18	9,50	0,60	10,10

Lutz

8 out of 10 skaters performed lutz combination on the first 23 seconds. It is alerting that when the element was unsuccessful skater earned only 4, 10 points as a mean value. Even toe loop combination gave more points when failed. This suggests higher risk rates from reaching higher points and also states how significant failure happened when it happened. Skaters weren't able to control the failure at all.

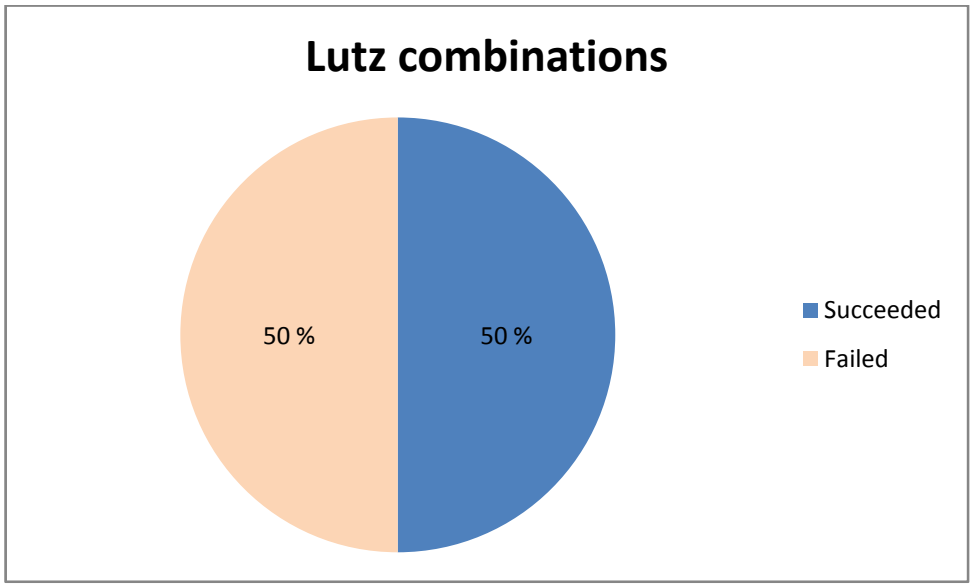

Figure 12. Succeeding rate of lutz combination

Table 24. Lutz combination analyze

Element	Time	BV	GOE	SOP	Average				
3Lz+3Lo&lt	12	11,00	-1,20	6,30	**Time**	**BV**	**GOE**	**SOP**	**Skaters**
3Lz+2T	16	7,30	0,00	7,30					
3Lz+2T	16	7,30	-1,20	6,10					
3Lz+3T	19	10,00	2,00	12,00	15,75	8,90	-0,10	7,93	4
3Lz+2T	21	7,30	1,00	8,30					
3Lz+2T	21	7,30	0,40	7,70					
3Lz+2T	23	7,30	0,40	7,70					
3Lz&lt+COMBO	23	7,30	-1,00	0,90	22,00	7,30	0,20	6,15	4
3Lz+2T	34	7,30	-1,00	6,30					
3Lz&lt+COMBO	35	7,30	-1,00	0,90	34,50	7,30	-1,00	3,60	2
Mean	22,00	7,94	-0,16	6,35					10

Successful

Number	5
Mean time	20,00
BV	7,84
SOP	8,60
GOE	0,76

Unsuccessful

Number	5
Mean time	24,00
BV	8,04
SOP	4,10
GOE	-1,08

It seems like that combinations that were performed near 20 seconds earned the highest amount of points.

Flip

Table 25. Flip combination analyze

Element	Time	BV	GOE	SOP	Skaters
3F+2T	19	6,80	-2,20	4,60	
3F+3T	21	9,50	0,40	9,90	
3F+2T	21	9,50	1,80	8,60	
3F+2T	24	6,80	0,20	7,00	
Mean	21,25	8,15	0,05	7,53	4
Successful					
Number	2				
Mean time	20,00				
BV	8,15				
SOP	8,45				
GOE	0,30				
Unsuccessful					
Number	2				
Mean time	22,50				
BV	8,15				
SOP	6,60				
GOE	-0,20				

Flip combination has been very solid element. All jumps placing approximately to the same time and there are only one mistake effecting to average points decreasingly. The other mistake has been easement and so forth hasn't affected to points. Taking consider all the flips, the mean value of those is bigger than with lutzes (7,53 vs. 6,35). The same thing can be seen with salchow and loop combinations. With new rules, it is quite usual to score more points with technically easier elements (see appendix 2). In other words: perform easier and less valuable elements with good quality and possibility to earn higher points and to be ranked higher increases.

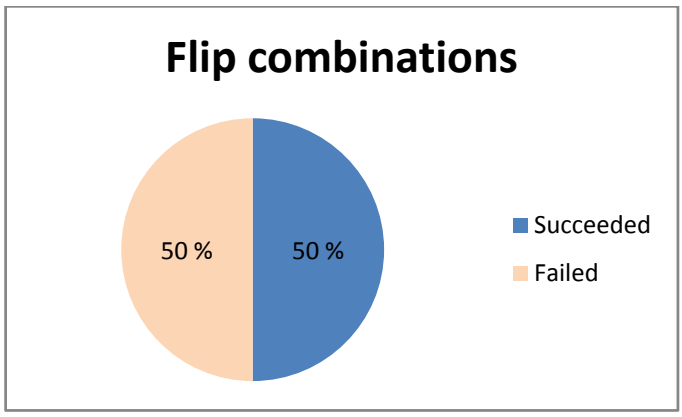

Figure 13. Succeeding rate of flip combinations

Comparing tables 22 and 28 and then connecting the information to element structure tables, can be seen the technical skill gap between the first 15 skaters and latter 15. The higher ranked skaters are taking chances and performing high end jumps with faster pace, the lower ranked skaters are stuck with easier elements. Only group 1 is far ahead comparing to others but with planned base values there aren't really any world changing differences. Biggest differences come from quality and triple-triple combinations.

Loop and Salchow

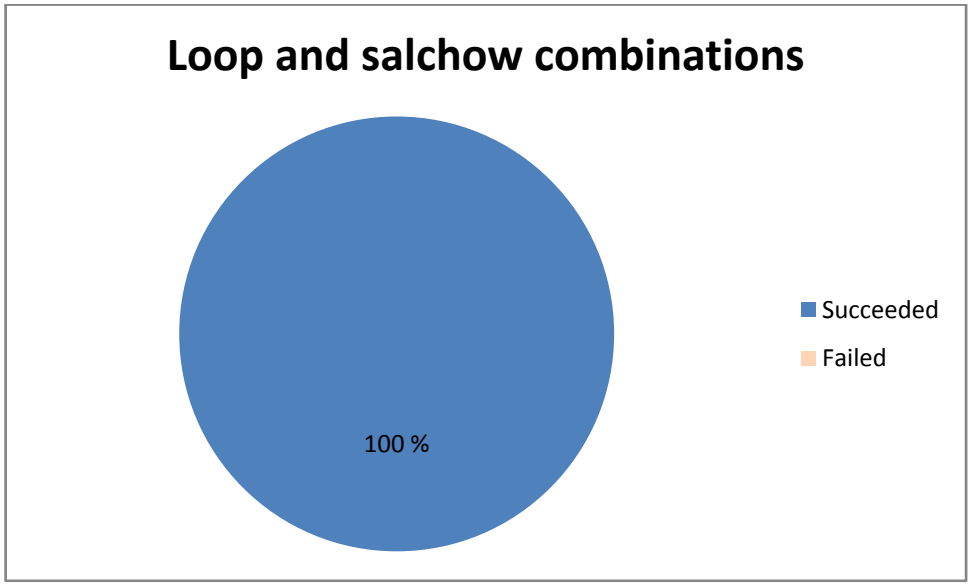

Figure 14. Succeeding rate of loop and salchow combinations

Table 26. Loop and salchow combination analyze

Element	Time	BV	GOE	SOP	Skaters
3Lo+2T	25	6,30	0,00	6,30	
3Lo+2T	40	6,30	0,40	6,70	
Mean	32,5	6,3	0,2	6,5	4
Element	**Time**	**BV**	**GOE**	**SOP**	**Skaters**
3S+2T	25	5,80	0,60	6,40	
3S+2T	39	5,80	0,80	6,60	
3S+2T	45	5,80	0,80	6,60	
3S+2T	46	5,80	0,00	5,80	
Mean	38,75	5,8	0,55	6,35	4

Toe loop

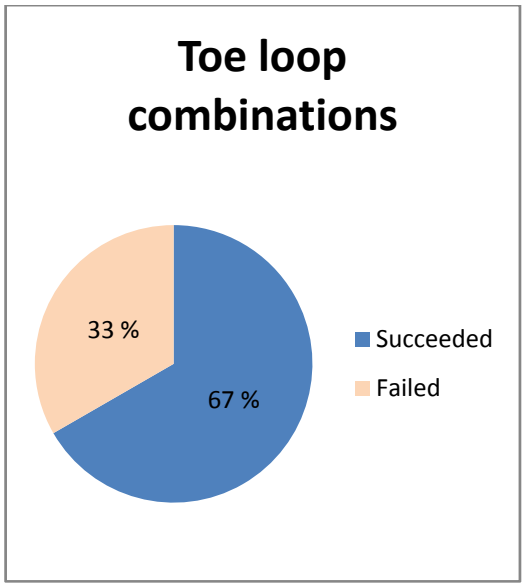

Figure 15. Succeeding rate of toe loop combinations

Toe loop combinations are continuing quite the same pattern as other jump combinations before. Skater has earned biggest points by doing the combination as soon as possible, mainly before first 20 seconds but biggest GOE values that states the quality of performed element is outstanding when performed after 20 seconds but before 30 seconds.

Table 27. Toe loop combination analyze

Element	Time	BV	GOE	SOP	Average				
3T+2T	13	5,30	0,20	5,50	**Time**	**BV**	**GOE**	**SOP**	**Skaters**

3T+3T	17	8,00	0,20	8,20					
3T+3T	18	8,00	-0,20	7,80	16,00	7,10	0,07	7,17	3
3T+3T	25	8,00	1,00	9,00					
3T+2T	27	8,00	1,00	6,00					
3T+2T	28	5,30	0,20	5,50	26,67	7,10	0,73	6,83	3
3T+3T	36	8,00	0,40	8,40					
3T+2T	37	5,30	0,00	5,30					
2T+COMBO	41	8,00	-1,00	0,30	38,00	7,10	-0,20	4,67	3
Mean	26,89	7,10	0,20	6,22					9

Successful

Number	6
Mean time	26,00
BV	6,65
SOP	6,98
GOE	0,50

Unsuccessful

Number	3
Mean time	28,67
BV	8,00
SOP	4,70
GOE	-0,07

8.3 Solo jump

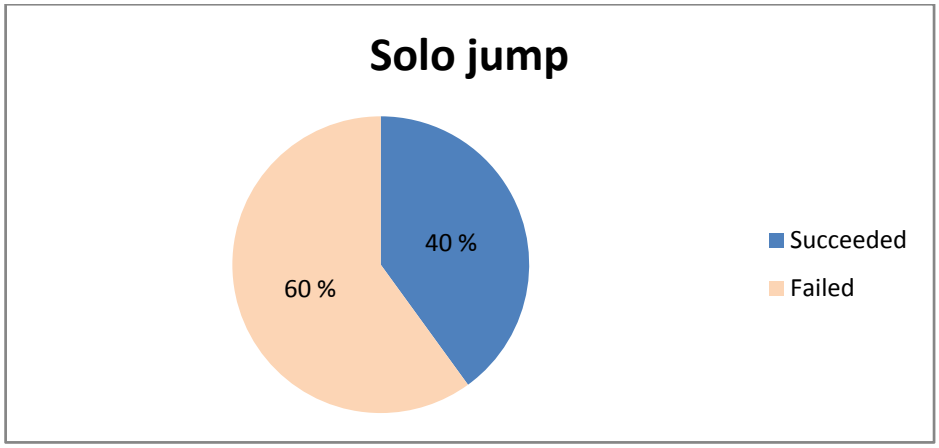

Figure 16. Succeeding rate of all solo jump elements

Solo jump includes more mistakes than any other element in short program. 60% from all skaters couldn't get even zero GOE value. Most of the mistakes are only quality mistakes but there are also three downgrades and five easements. Both of them decreasing base value from

planned to double or to even single jump level, the last one being very close to zero (see appendix 2).

The most popular ones were flip and salchow which have one point difference at base value (appendix 2) but 1,95 points difference at the average scores of panel value for flip's benefit. Other difference between those two jumps is mean timing which is about 6 seconds later with salchow. This notification indicates clear level difference at skill level since salchow is generally knowledge to be one of the easiest jumps to perform.

Table 28. Solo jump analyze, including all jumps and skaters

Element	**Time**	**BV**	**GOE**	**SOP**	**Average**				Skaters
3Lz	17	6,00	-0,80	5,20	**Time**	**BV**	**GOE**	**SOP**	
3F	19	5,50	-2,20	3,30					
3Lz&lt	22	6,00	-1,00	0,90					
1S	23	4,50	-0,30	0,10					
3Lo&lt	29	5,00	-0,76	0,74	22,00	5,40	-1,01	2,05	5
3F	30	5,50	-0,60	4,90					
3F	31	5,50	0,20	5,70					
3F	39	5,50	-0,60	4,90					
3Lz	39	6,00	-1,00	5,00					
3F	39	5,50	0,20	5,70					
2S	39	4,50	-1,00	0,30	36,17	5,42	-0,47	4,42	6
3S	40	4,50	-0,80	3,70					
3Lz	40	6,00	-1,40	4,60					
3S	42	4,50	0,20	4,70					
3F	42	5,50	1,20	6,70					
1S	42	4,50	-0,30	0,10					
3S	43	4,50	0,00	4,50					
3F&lt	44	5,50	-1,00	0,70					
3Lz	45	6,00	-2,00	4,00					
3Lo	45	5,00	0,80	5,80					
3Lo	45	5,00	0,20	5,20					
3T	45	4,00	0,00	4,00					
3S	46	4,50	-0,20	4,30					
3F	47	5,50	1,60	7,10	43,54	5,00	-0,13	4,26	13
3S	52	4,50	-0,20	4,30					
3Lo	52	5,00	1,00	6,00					
2F	56	5,50	-1,00	0,70					
3T	56	4,00	1,00	5,00					

3T	63	4,00	1,00	5,00					
1S	73	4,50	-0,30	0,10	58,67	4,58	0,25	3,52	6
Mean	41,50	5,07	-0,27	3,77					

Successful	
Number	12
Mean time	45,83
BV	4,83
SOP	5,45
GOE	0,62

Unsuccessful	
Number	18
Mean time	38,61
BV	5,22
SOP	2,66
GOE	-0,86

According to table 28, time-wise further skater pushed the element, higher GOE value she earner. Although after 40 seconds base value started to decrease which compensates the score difference between BV and GOE. This means that those who were trying technically harder and so forth valuable element performed it sooner than those who were performing less valuable and easier solo jumps.

8.3.1 Solo jumps -classified by name

Lutz

Table 29. Lutz analyze

Element	Time	BV	GOE	SOP		Skaters
3Lz	17	6,00	-0,80	5,20		
3Lz&lt	22	6,00	-1,00	0,90		
3Lz	39	6,00	-1,00	5,00		
3Lz	40	6,00	-1,40	4,60		
3Lz	45	6,00	-2,00	4,00		
Mean	32,60	6,00	-1,24	3,94		5

Lutz possesses the worst statistics as a solo jump. All said competitors failed to perform the jump without deduction in GOE.

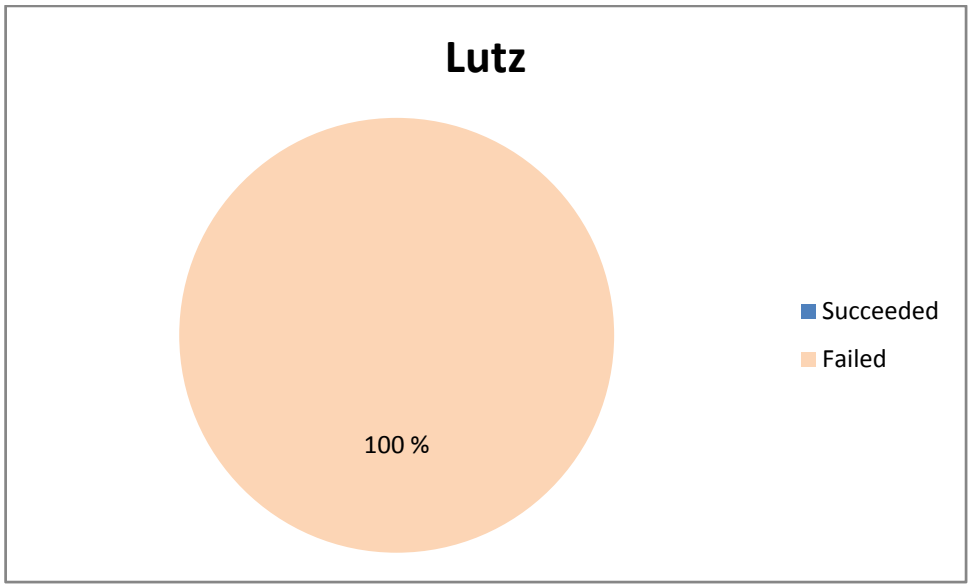

Figure 17. Succeeding rate of lutz as a solo jump

Flip

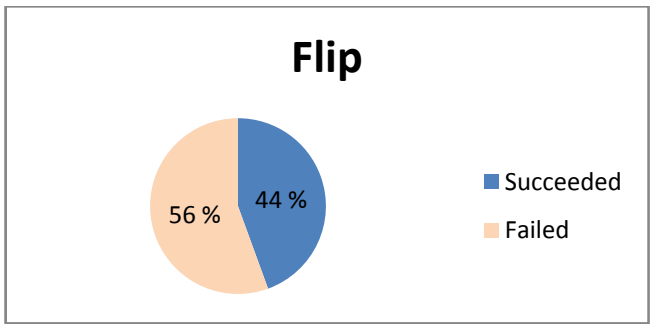

Figure 18. Succeeding rate of flip as a solo jump

Table 30. Flip analyze

Element	Time	BV	GOE	SOP	Average			
3F	19	5,50	-2,20	3,30	Time	BV	GOE	SOP
3F	30	5,50	-0,60	4,90				
3F	31	5,50	0,20	5,70				
3F	39	5,50	-0,60	4,90				
3F	39	5,50	0,20	5,70	31,6	5,50	-0,6	4,9
3F	42	5,50	1,20	6,70				
3F&lt	44	5,50	-1,00	0,70				
3F	47	5,50	1,60	7,10				
2F	56	5,50	-1,00	0,70	47,25	5,50	0,20	3,80
Mean	38,56	5,50	-0,24	4,41		Skaters		9

Successful	
Number	4
Mean time	39,75
BV	5,50
SOP	6,30
GOE	0,80

Unsuccessful	
Number	5
Mean time	37,60
BV	5,50
SOP	2,90
GOE	-1,08

Toe loop

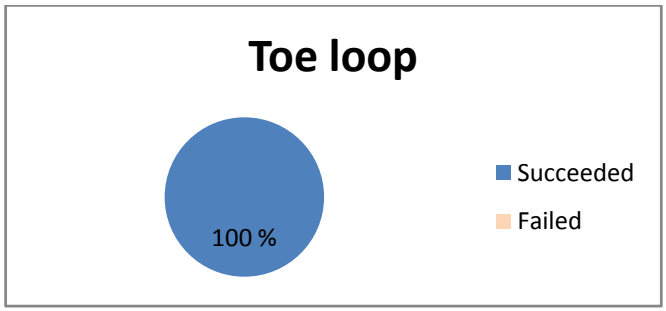

Figure 19. Succeeding rate of toe loop as a solo jump

All toe loop solo jumps were successful, though it is needed to remember that since it is the less valuable jump element that is possible to perform as a solo jump, there were only 3 skaters that were decided to perform it as a solo jump.

Table 31. Toe loop analyze

Element	Time	BV	GOE	SOP		Skaters
3T	45	4,00	0,00	4,00		
3T	56	4,00	1,00	5,00		
3T	63	4,00	1,00	5,00		
Mean	54,67	4,00	0,67	4,67		3

Loop

Table 32. Loop analyze

Element	Time	BV	GOE	SOP		Skaters
3Lo&lt	29	5,00	-0,76	0,74		
3Lo	45	5,00	0,80	5,80		
3Lo	45	5,00	0,20	5,20		
3Lo	52	5,00	1,00	6,00		
Mean	42,75	5,00	0,31	4,44		4

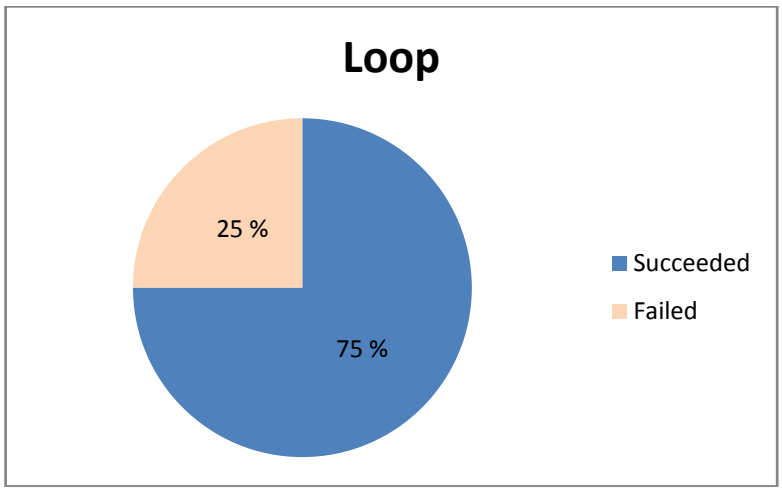

Figure 20. Succeeding rate of loop as a solo jump

Salchow

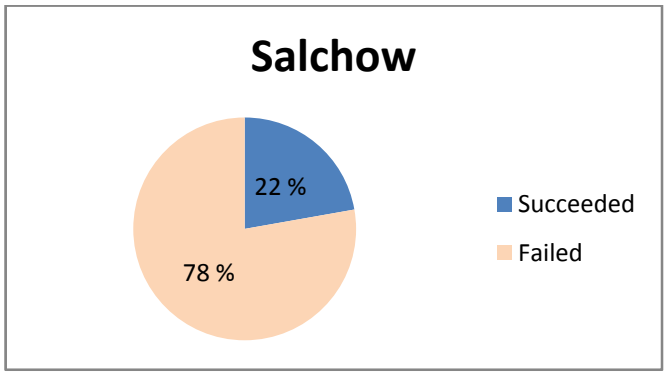

Figure 21. Succeeding rate of salchow as a solo jump

Salchow possesses one of the worst statistics of solo jumps with 78% failed. Almost half of the jumps were easements which decreases scores a lot (see appendix 2). 8 out of 9 skaters that performed salchow as their solo jump belonged to skaters 16 to 30 which reinforce the perception of huge skill difference in ladies series.

Table 33. Salchow analyze

Element	Time	BV	GOE	SOP		Skaters
1S	23	4,50	-0,30	0,10		
2S	39	4,50	-1,00	0,30		
3S	40	4,50	-0,80	3,70		
3S	42	4,50	0,20	4,70		
1S	42	4,50	-0,30	0,10		
3S	43	4,50	0,00	4,50		
3S	46	4,50	-0,20	4,30		
3S	52	4,50	-0,20	4,30		
1S	73	4,50	-0,30	0,10		
Mean	44,44	4,50	-0,32	2,46		9

Successful

Number	2
Mean time	42,50
BV	4,50
SOP	4,60
GOE	0,10

Unsuccessful

Number	7
Mean time	45,00
BV	4,50
SOP	1,84
GOE	-0,44

8.4 Axel

It is mandatory to perform one axel type of jump in short program. This rule makes axel perhaps the easiest element to analyze since there is larger pool of numbers compared to other jump elements.

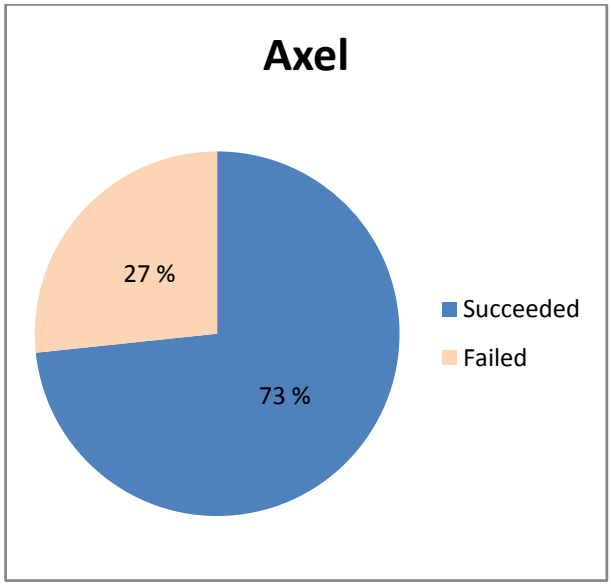

Figure 22. Succeeding rate of axel as a solo jump

7 skaters from 30 performed the jump with bad quality (table 34). Mean time of execution was 70,69 (range of 13-115) seconds and average GOE ended up being 0,32 (range of -0,96 – 1,6) points. There are clear pattern how scoring develops from the start towards to end –it is getting bigger. Even though SOP value is a bit smaller at the last stage, the GOE is still arising. SOP value is effected by two total flaws in a last group, without those, they probably would have been the highest ranked among this element. Also mean values of successful and non-successful jumps indicates that later skater schedules axel, more likely she belongs to higher ranked skaters. These statistics reinforces earlier observation how skaters in groups 4, 5 and 6 performed axel sooner than average skater at the first three groups. Also mean times of successful and non-successful axels are enforcing other statements.

Quality differences on jumps are playing a big part on end results. Unsuccessful axel dropped scores to 1,62 points when successful one raised it to 4,21 points. Difference of 2,59 points is more than couple ranks at the end result. With that difference according to short program results, lady from 24th rank would have risen all the way to 19th. The percentage of failed axels

is alerting. Double axel is considered in every way one of the easiest elements in short program.

Table 34. Axel analysis

Element	Time	BV	GOE	SOP	Average			
2A	13	3,50	0,04	3,54	**Skaters**	**Time**	**GOE**	**SOP**
2A	15	3,50	0,60	4,10				
2A	17	3,50	1,00	4,50				
2A	19	3,50	-0,64	2,86				
2A	23	3,50	-2,50	1,00	5	17,4	-0,30	3,20
1A	50	3,50	-0,50	0,30				
2A	52	3,50	0,80	4,30				
2A	53	3,50	1,00	4,50				
2A	57	3,50	0,00	3,50				
2A	59	3,50	0,00	3,50				
2A	68	3,50	1,00	4,50	6	56,5	0,38	3,43
2A	70	3,50	1,60	5,10				
2A	74	3,50	1,20	4,70				
2A	74	3,50	-0,48	3,02				
2A	77	3,50	0,00	3,50				
2A	82	3,50	1,00	4,50				
2A	82	3,50	0,20	3,70				
2A	86	3,50	-0,64	2,86				
2A	89	3,50	0,20	3,70	8	79,25	0,39	3,89
1A&lt	93	3,50	0,00	-				
2A	95	3,50	1,60	5,10				
2A	96	3,50	0,80	4,30				
2A	96	3,50	1,00	4,50				
2A	96	3,50	-0,96	2,54				
2A	97	3,50	0,40	3,90				
2A	100	3,50	1,00	4,50				
2A	101	3,50	0,00	3,50				
2A	101	3,50	1,60	5,10				
2A&lt	104	3,50	-0,40	0,40				
2A	115	3,50	0,60	4,10	11	99,45	0,51	3,45
Mean	71,80	3,50	0,32	3,52				

Successful	
Number	22
Mean time	73,14
SOP	4,21
GOE	0,71
Unsuccessful	
Number	8,00
Mean time	68,13
SOP	1,62
GOE	-0,77

9 Summary and Conclusions

The research question was is there any common program structure at this level and is it possible to find similar patterns from competitors' programs which would suggest their future standings at the results. Hypothesis was that the jumps are mainly at the beginning of the program, except double axel with the best half of skaters. The rest of the elements are filling the program after the first minute with skater ranked 16-30. This hypothesis was proven quite true.

The research question considering jumps was: What kind of timing skaters use at the program with jumps and how it is affecting to succeeding rates and quality with jumps?

9.1 Program structure and jump elements

Skaters 1-15 had a quite the same program structure with only minor differences on elements. They mainly tried to perform the hardest jump elements on a first two elements and then have a small "breathing break" before double axel, the last two spins and step sequence which is quite physical to perform with the new demands of the judging system. Most of the mistakes happened among the hardest and most valuable jumps. After those elements there were only occasional failures.

Skaters 16-30 mainly opened with easier jump and then did all the jumps in a row. They did mistakes through the program and also with spins which should be "the easy ones" from element list to perform with good quality. The reasons for these results can be various, one can speculate at all parts of sport. Perhaps physically they weren't as well prepared as the better ones? With some of the skaters it is fair to state that their skill level at the performance was totally at the different level compared again to ones ahead. What it comes to technical skill differences there can be many reasons, one being psychological. The only thing that can be said for sure from this research is the differences at their program structure. With last 15 skaters and especially with the last 6 skaters that were qualified from free skating, the order of elements differed clearly compared to the top 15 skaters. Quite probably because of the element structure also the timing of the elements was commonly either sooner or later than other groups' timing.

The higher ranked skaters were able not just to perform with good quality harder and more valuable elements, they also planned to do totally different caliber elements than e.g. skaters ranked 20-30. On many element, skaters lost too much points considering the base value and it is reasonable to present the hypothesis to plan the program according to skill level of the skaters' normal, everyday skill level, not according to a what it might take to qualify for free skating. By doing this, the chances to qualify for free skating increases because of higher GOE values that seem to be the key factor to earn highest score from the performance at modern figure skating.

With jump elements it seems that skaters need approximately 20 seconds preparation time for each element (for the jump combination and solo jump). The highest average score and also clear cluster with jump combination is around 20 seconds –give or take. With solo jump there also can be seen a cluster with jumps after the next 20 seconds and the end result is the highest performed SOP scores from this element. When jump combination was delayed from this 20 second rule, it lowered the earned scores. If solo jump were performed way before or after 40 seconds it lowered dramatically scores in both cases. These two founded results suggest performing first physically more demanding and also more valuable jump combination and then solo jump with a time difference of 20 seconds which is used to preparation before each jump element.

With axel there are tendency to push the jump further away in program. This tendency seems to be effective since scores arose with that tactic and obviously also the number of failures decreased.

9.2 Future researches

When summing up everything from program structure- and jump element analyze, it seems that skill level at ladies series is quite radical in all elements from jumps to spins and step sequences. This notification fights against this research's results. It is obvious that no matter how perfect program structure would be, skater with less talent couldn't perform it like a skater with more talent. There can be dozen and more reasons for failures at every element. This research concentrated only on tactical side of the sport –to cold numbers. When performing any action at any time, it is based on four main factors: psychological, physical, technical and tactical. This fact means that it is impossible to separate those perfectly from each other and to state for sure that this research was measuring purely tactics. Everything matters and effects

to performance like health, finding the flow state, good/bad night sleep etc. Canadian skater, Joannie Rochette, loosed her mother just couple days before this short program competition. She literally died into her arms at the airport of Vancouver. She placed into a second rank. It is impossible to know how things effect to skaters but with enough data we can state major guidelines for the optimal program structure.

Even though the findings of the research suggest quite clearly what is a successful program structure, again all the findings cannot be trusted blinded when the research only covered one short program competition. It is needed to get more data from future or past competitions. One solution for this matter could be to get ISU to understand the benefits of this kind of statistics. By getting their attention, it would be simple to create computer program that calculates automatically all the tables that is presented at this research. The ISU judging system is based on computer programs and competition organizers hold all needed information from every skater at every competition. Just small add to the code and figure skating world would start to create needed statistics to improve performances on the ice. Those statistics could also be used by commentators at TV broadcasting or spectators. This kind of information could be very interesting for fans and to bring an extra excitement to follow competitions when there are known that this specific element from skater X hasn't been successful in a past three competition. What will happen now?

Considering the future studies, it is important to get larger database with the same attributes to ensure the reliability of calculated values of this study. The main target should be two groups: top 15 and the latter 15. Those groups would be good to separate into smaller groups so that it enables follow up also with top skaters and the ones who will be qualified from free skating. In that way it would be possible to compare the findings of this research to future studies' results –how the program structure changes and how the elements have been performed in it? The hypothesis is that the main differences on succeeding rate and the program structure stays the same between the higher ranked athletes and the lower ranked athletes. On following studies should also concentrate to a time between the elements in order to define needed preparation times for the successfully performed elements.

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Appendices

Appendix 1. The abbreviations of elements in figure skating

Abbreviation	Full name
Jumps	
T	Toe loop jump
A	Axel jump
S	Salchow jump
Lo	Loop jump
F	Flip jump
Lz	Lutz jump
Spins	
USp	Upright spin
LSp	Layback spin
CSp	Camel spin
SSp	Sit spin
FUSp	Flying upright spin
FLSp	Flying layback spin
FCSp	Flying camel spin
FSSp	Flying sit spin
CUSp	Change foot upright spin
CLSp	Change foot layback spin
CCSp	Change foot camel spin
CSSp	Change foot sit spin
CoSp	Combination spin
CCoSp	Change foot combination spin
Step sequences	
SlSt	Straight line step sequence
CiSt	Circular step sequence
SeSt	Serpentine step sequence
Spiral sequences	
SpSq	Spiral sequence of any pattern

(Jacobson, 2010)

Appendix 2. Scale of some of the jump values

Jump	**+++**	**++**	**+**	**Base value**	**-**	**- -**	**- - -**
Single Toeloop	1,0	0,6	0,3	**0,4**	-0,1	-0,2	-0,3
Single Salchow	1,0	0,6	0,3	**0,4**	-0,1	-0,2	-0,3
Single Loop	1,0	0,6	0,3	**0,5**	-0,1	-0,2	-0,3
Single Flip	1,0	0,6	0,3	**0,5**	-0,1	-0,2	-0,3
Single Lutz	1,0	0,6	0,3	**0,6**	-0,1	-0,2	-0,3
Axel	1,5	1,0	0,5	**0,8**	-0,2	-0,4	-0,5
Double Toeloop	1,5	1,0	0,5	**1,3**	-0,3	-0,6	-1,0
Double Salchow	1,5	1,0	0,5	**1,3**	-0,3	-0,6	-1,0
Double loop	1,5	1,0	05,	**1,5**	-0,3	-0,6	-1,0
Double Flip	1,5	1,0	0,5	**1,7**	-0,3	-0,6	-1,0
Double Lutz	1,5	1,0	0,5	**1,9**	-0,3	-0,6	-1,0
Double Axel	3,0	2,0	1,0	**3,5**	-0,7	-1,4	-2,1
Triple Toeloop	3,0	2,0	1,0	**4,0**	-1,0	-2,0	-3,0
Triple Salchow	3,0	2,0	1,0	**4,5**	-1,0	-2,0	-3,0
Triple Loop	3,0	2,0	1,0	**5,0**	-1,0	-2,0	-3,0
Triple Flip	3,0	2,0	1,0	**5,5**	-1,0	-2,0	-3,0
Triple Lutz	3,0	2,0	1,0	**6,0**	-1,0	-2,0	-3,0
Triple Axel	3,0	2,0	1,0	**8,2**	-1,4	-2,8	-4,2

(International Skating Union 2008b, 1.).