“Today holds our only chance at success.”

– Pete Vordenberg

Cross Country Coaches Education
Level 100

As far as being a coach, it’s always fascinated me.

It’s a greater responsibility than most people give it credit for because you’re dealing with people.”

– Steve Prefontaine

TEAM - LOYALTY - INTEGRITY - RESPECT - ACCOUNTABILITY - PERSEVERANCE
Welcome to Level 100!

Thank you for taking the time to explore this manual to learn the fundamentals for effective coaching in cross-country skiing. You are demonstrating to your team that you are working to provide them with the highest opportunity to successfully pursue the fantastic lifestyle of cross country skiing, and you are ensuring that the environment you create for them will allow their talent to blossom to its brightest colors. In the process, you are doing your part to help the USSA reach its vision of Best in the World!

Level 100 is recommended for coaches working with all ages and levels of cross country skiing, from youth to adult and introductory level to world class. This manual is set up to integrate resources under a common theme – the USSA Cross Country Training System (CCTS). Together with the Cross Country Development Pipeline (CCDP), the CCTS provides the framework for the manual. Its sections match the areas of emphasis outlined in the CCTS, and each section builds from the earliest developmental phase through the full maturation phase for world class performance.

Certification Procedure

If you purchased this manual as part of your effort to attain Level 100 certification with USSA, you will receive an email with details for the corresponding on-line exam.

Follow these steps to get your Level 100 certification:

- **Purchase Level 100 manual and pass online test**
- **Participate in a U.S. Ski Team-approved technique clinic**
- **Furnish proof of current CPR/First Aid certification, send to education@ussa.org**
- **Obtain USSA Coaching Membership/License**

For certification questions and comments, contact the USSA Sport Education department at (435) 647-2050 or email education@ussa.org.
TABLE OF CONTENTS

INTRODUCTION 4
Development Pipeline & Cross Country Training System 5
USSA Coaches Development 13
SECTION 1 – Programming 19
SECTION 2 – Training 28
SECTION 3 – Technical & Tactical 47
SECTION 4 – Equipment Selection & Preparation 68
SECTION 5 – Performance Psychology 73
SECTION 6 – Competition 89
APPENDIX – References, Contacts, Forms 95

Additional Required Level 100 Reading:
ACSM Female Athlete Triad Article
Available with Level 100 manual download

Additional Required Level 100 Resource:
USST Excel Training Planning Document
Available with Level 100 manual download

Additional Recommended Level 100 Resource:
U.S. Ski Team Cross Country Technique Fundamentals CD-ROM
Available at USSA Education Shop

Additional resources: NENSA & CXC Children's materials

Acknowledgements

The U.S. Ski Team cross country coaching staff would like to thank NENSA (www.NENSA.net) and CXC (www.CXCSkiing.org) for their contributions to our ongoing goal of providing exceptional educational materials to the U.S. cross country skiing community. NENSA and CXC have provided outstanding regional educational materials that complement the USSA’s education material. Finally, we thank you for purchasing this resource in your pursuit of coaching excellence.

Credits

EDITORS: Jon Nolting, Bryan Fish

CONTRIBUTORS: Bryan Fish, Jon Nolting, Matt Whitcomb, Chris Grover, Peter Vordenberg, Andy Newell, Adam Korzun

© Copyright 2011 by the United States Ski & Snowboard Association, 1 Victory Ln, Park City, UT 84060
INTRODUCTION

There are many attributes that lead to cross country skiing success. It is critical that the Level 100 coach understands the most fundamental steps. There is little shortage of information. The goal is to sift through the information and understand how to prioritize. A coach must recognize what is truly fundamental.

The key components that the USSA believes are integral to a successful program are:

1. Optimistic, motivating and knowledgeable coaching
2. Organized and consistent practices that challenge athletes without overloading or frustrating them
3. A core of teammates with common interests and goals

The contexts of these three key components evolve based on the age, ability level and the goals of your athletes. This manual will give insight into how they change with the development of a skier. However, for any program, a focus on these fundamental components is paramount.

There are many steps to move from youth skier to elite ski racer. The coach at the elite level knows that he/she is one of the many coaches and programs that have contributed to the success of an athlete. Without a motivating youth coach, that helped cultivate an outdoor endurance lifestyle within the athlete, they would not have risen to that level.

This is long term athletic development in practice. It is a stepwise process, starting with the acquisition and mastery of the fundamentals. As coaches, we need to keep our sights on the three key components of successful programming. Innovations and additions to the program must support these three key components for consistent progress and success to take place.
The Development Pipeline

The worth of an Olympic medal is not determined by the value of its metal. The primary merit of sport is in the process and challenge involved in working toward a goal. Sport is action, and the purpose of a goal - such as an Olympic medal - is to give direction and purpose to action.

Sport can teach teamwork, honesty, perseverance, hard work and fair play. It can bring people together from across the world and enable unlikely friendships. Sport can bring good health, happiness and joy to those who participate. These qualities fit into the primary value of sport - the process and challenge of pursuing a goal. The Olympics stand as an ultimate athletic dream. An Olympic gold medal stands as the ultimate athletic goal, and thus, it is the ultimate athletic challenge. But the medal itself is only a symbol of the process and the challenges taken on and met that are required to earn it. Three steps make up the podium at the Olympic games, but it takes many million more to reach these final few steps. It is each one of the million, each day, each action, each challenge faced that matter the most.

Each step is a challenge in itself. Challenges confronted are the key to personal growth. Continued growth requires new levels of challenge. The pipeline is a pathway of challenge that moves from simple to the increasingly complex. This is done by adding new challenges as old ones are met and new skills are developed. This is the guiding principle of the development pipeline. Each step is the right step at the right time in the right direction.

In this way the value of sport does not end with the completion of an Olympic dream. It does not matter whether the dream ends with a medal or even having actually made the Olympic team. It does not depend on the dream being Olympic at all. Regardless of the dream, the outcome pales in comparison to the process. In essence, sport becomes a way of life and the lessons of sport a way of living.

The Development Pipeline

The direct path to the Olympic podium is found through the combination of the USSA Cross Country Training System (CCTS) and the Cross Country Development Pipeline (CCDP) shown on pages 7 and 12, respectively.

From an athlete's perspective, this pipeline is the pathway to success at the highest level in sport. But it is also the most satisfying way to participate in sport as each step presents challenges at the level appropriate to the athlete's age and stage of development and maturity.

From the coaches' perspective, the pipeline helps determine what sort of activities, expectations and methods of coaching can be most successfully implemented. In this way the pipeline is also a coaching outline. Because this tool drives development for athletes and coaches, the pipeline will serve as the framework for the entire coaches education system.
The USSA Cross Country Training System (CCTS) is the long-term athlete development framework for a cross country coach, athlete, or parent to design age-appropriate training and competition plans that allow them to maximize certain critical periods that exist in the development of every developing skier (see figure 1 on page 7). Within each developmental phase, the CCTS outlines the recommended progression for an athlete in the domains of sport participation, conditioning training, technical and tactical skills, equipment, performance psychology, and competition. These recommendations are based on current research by sport scientists on child development and its relation to high performance in athletics. The USSA national team coaching staff and sport science staff have applied these principles to the sport of cross country skiing. As such, it is not just a report of what we have been doing, but rather what we should be doing to maximize the long-term potential of cross country skiers in the United States.

A coach that understands these developmental phases and applies the proper training, equipment, and competition plans within each will be working to bring out the athlete’s full potential. Coaching without these age-appropriate needs in mind may lead to short-term success, but will undermine the athlete’s long-term potential. The content provided inside this manual is intended to give the Level 100 coach a clear understanding of how to work within each domain for each phase, and to apply these concepts in their coaching.

A challenge for the coach is that age-appropriate training is not just tied to the skier’s age. Rather, it is factor of the skier’s biological age and training age. Biological age refers to the physiological rate of development of the individual, which may vary substantially, particularly in the years during and immediately before and after puberty. Training age refers to the amount of time the athlete has spent actively participating in cross country skiing. In order to maximize the long-term potential for each individual athlete, the coach must know the developmental phase of the athlete as outlined in the CCTS and understand how to design training and competition programs that will take advantage of the critical periods for accelerated development that exist in the phases.

Coaching scenario:
Coach Susan will be working with a group of 13 and 14 year old girls this season. As would be expected with a group of athletes this age, a couple of her group members are physiologically very mature – they have gone through puberty and are fully developed. One girl in the group, who is 14, is much smaller than the others, and has just started her growth spurt. The appropriate intensity, volume and focus of training will be different for these girls to lead to the best long-term outcome. See the developmental phases on the next page and identify the phases of athletes in Susan’s group, and think about ways she can manage her group to allow each athlete to get the training they need.
# USSA LEVEL 100 CROSS COUNTRY

## Foundation Stage

### PHASE 1
- **Biological Age**: Pre Puberty
- **Age**: 2-5 years old
- **Play Age**: 1-4 years in sport
- **Participation**: Ski around 1-3 days per week, or as much as is enjoyable

### PHASE 2
- **Biological Age**: Pre Puberty
- **Age**: 6-10 years old
- **Training Age**: 1-4 years in sport
- **Participation**: Ski 2-6 days per week, or as much as is enjoyable

### PHASE 3
- **Biological Age**: Pre Puberty
- **Age**: 10-13, (4-22)
- **Training Age**: 4-8 years in sport
- **Participation**: Ski 4-6 days per week

### PHASE 4
- **Biological Age**: Puberty
- **Age**: 11-14, (4-22)
- **Training Age**: 4-8 years in sport
- **Participation**: Ski 4-6 days

### PHASE 5
- **Biological Age**: Post Puberty
- **Age**: 12-16, (4-22)
- **Training Age**: 6-11 years in sport
- **Participation**: Ski 4-6 days

### PHASE 6
- **Biological Age**: Full Maturition
- **Age**: Females: 16-17, 10-23

---

### Training Emphasis

- **Focus on fun, skill, agility, and coordination**
- **Emphasize outdoor recreation**
- **Participate in all sports**, including balanced-based sports like gymnastics

### Technical and Tactical Emphasis

- **Has fun in snow**: Games and play on skis enhances skier's enjoyment and skill on snow
- **Ensures at risk**: Games and play on skis enhances skier's enjoyment and skill on snow

### Equipment Selection and Preparation

- **Ski**: Skis one pair of classic skis, soft flex and between oro and forehead in height
- **Boots**: Uses boots that are comfortable and warm
- **Poles**: Uses one pair of poles for all techniques, or ski with no poles, poles should fit snugly under the arm

### Ancillary Equipment: Clothing

- **Protects the elements and keeps children comfortable**
- **Extends periods of skiing**

### Performance Psychology Emphasis

- **Fun, variety, and success**: Positive parental support is essential

### Competition Emphasis

- **Competition only exists in the form of games on skis**
- **Local racing leads to state and divisional championships**

---

**Figure 1: Cross Country Training System matrix**
We'll start by defining the developmental stages and phases defined by the CCTS (see above).

There are three stages across the top that are broken down into phases based on the biological development of the athlete. An important point to notice is that starting in the Pre and Post Puberty Stage, there is overlap between the age ranges to account for individual growth patterns.

The **Foundation Stage** consists of Phases 1 and 2, and generally represents the young athlete’s introduction to the sport. The focus in this stage is on fun first and foremost. Play on snow is an important emphasis. In this stage, athletes of the same age are generally pretty similar in their physiological development. Coaching groups may need to account for differences in experience in cross country skiing, but generally the appropriate training plan will be based on the skier’s chronological age.

In the **Pre and Post Puberty Stage**, a group of athletes of the same age may be in very different developmental phases based on their growth stage. The time just prior to, during, and following a child’s growth spurt is an important time for coaches to challenge their athletes with the right training stimulus. Mistimed training and competition plans can slow progress and ultimately limit an athlete’s long-term potential. This can be a challenging proposition for a coach who works with 13 and 14 year olds, for example, some of who will be pre-puberty, some in the middle of puberty, and some post-puberty. While the same age, and perhaps of the same experience level, these athletes have different training needs.

The final stage is **Full Maturation**. For a cross country skier, there is still a lot of development yet to happen in this stage. While the training volume will continue to build as the skier gains experience, strength, and power, athletes in this stage are prepared for all types of training. Note that the starting age range for this phase listed under Phase 6 is for an early developing athlete – that is an athlete with an early growth spurt relative to his or her peers. Later maturing athletes may not move into phase 6 until ages 18, 19, or older.
Sensitivity Windows

One of the key factors in the development of the CCTS is to design training, competition, and recovery to take advantage of certain **sensitivity windows**, or critical periods of development, that arise in an athlete's growth cycle. During these sensitivity windows, athletes are able to make gains in a given area at an accelerated rate. Some of these windows are based on age, while others are based on developmental phase which varies by individual. In the figures below, the sensitivity windows are shown for girls and boys (figures 3 and 4, respectively). The rate of growth curve corresponds with the developmental phases and average ages. The sensitivity window boxes outlined in black are based on the growth curve. The other windows are based on age.

---

**Figure 3:** Sensitivity windows for girls relating to rate of growth, developmental phase, and chronological age (adapted from Balyi & Way, 2005)

**Figure 4:** Sensitivity windows for boys relating to rate of growth, developmental phase, and chronological age (adapted from Balyi & Way, 2005)
Suppleness/flexibility
The sensitivity window for rapid development of an athlete's flexibility is from around ages 6-9 (CCTS phase 2). Note that it is important for athletes to focus on their flexibility through their growth spurt, but that work done during this period is to maintain the gains achieved earlier. Flexibility is an important component for both injury prevention and ease of movement during the performance of a skill (Hill).

Speed
Two periods for development exist for speed that appear to be tied to chronological age. The first speed window is from ages 6-8 for girls and 7-9 for boys. This window is optimal for the development of quickness and agility skills, emphasizing change of direction in very short bursts (around five seconds) with full recovery between. A quick stride in the feet and arm swing, with movement in different directions, can be a goal. The second window is from ages 11-13 for girls and 13-16 for boys. Speed development in this window should take place over 5-20 bursts and should emphasize a fast movement tempo. This quickness is now combined with a bit greater strength for more significant gains in overall velocity.

Motor skills
The period where athletes can make the most rapid gains in movement skills for sport is from around ages 8-12 (late phase 2 and phase 3). The length of this window depends on an athlete's physiological growth, with rapid gains ending with the onset of the adolescent growth spurt. A broad base of sport skills with the development of proper skills that make the foundation of an efficient technique for classical and freestyle skiing must be acquired during this critical period. Habits learned during this time often remain with the athletes for years to come, good or bad. In some cases, bad habits developed during this period can be the main factor keeping them from their ultimate potential. Another implication is that skiers who start their growth spurt late may benefit in the long run because they will be in this motor skills window longer.

Stamina/endurance
This sensitivity window is essential for cross country skiers, and occurs at the onset of the adolescent growth spurt (CCTS phase 4 main emphasis). From the start of the growth spurt to the peak of the growth spurt (called peak height velocity, or PHV, the point at which the rate of growth is the highest), training should emphasize the development of aerobic capacity. After PHV, training should focus on aerobic power. We'll discuss these in greater detail throughout the manual.

Strength
The critical period for gains in strength relates to PHV and is different for boys than girls. Girls enter this window when they achieve PHV. For boys, the window opens 12-18 months following PHV. To prepare for this window of opportunity, young athletes should have practiced many of the core movements in strength training, learning the proper motor skills during that window, to take full advantage and to avoid injury.

It is important to understand that the five skill areas discussed are all trainable outside of these sensitivity windows, but that gains will not be as rapid. Because of the importance placed on performance in competitive sports, particularly in the U.S., many young athletes don't get the advantage from proper training in these areas at the right time because of pressures to win in the short term. In time, the resulting deficiencies will keep them from achieving their full potential. As coaches, we must help athletes maximize these early developmental opportunities.
The Cross Country Training System matrix and its supporting resources on the web at trainingsystem.ussa.org outline the design and plan for athletic development toward the goal of becoming the best in the world. Although not every athlete will choose this as a goal, this step-wise process through the formative stages of development is optimal both for athletes with World Cup or Olympic aspirations and those who are participating purely for the recreation and enjoyment of skiing. As coaches, our job is to provide support and guidance, so the athlete can make the choice of which path to take. The materials in this manual, as well as the steps in the USSA Coach Education certification ladder are designed to provide you as a coach with the knowledge to effectively implement these strategies. Each major section of the manual covers an area of emphasis in the CCTS (as defined by the rows in figure 1), with specific coaching recommendations in these areas by each development phase. At the end, the coach should see the way to the top step of the Olympic podium, or to an athlete’s own full potential, by way of a long-term athlete development process.

DEVELOPMENT AND THE U.S. SKI TEAM

Development results from the step-by-step process of dreaming, learning, trying, failing, learning and trying again. Success is a result of the exact same process. The U.S. Ski Team understands that there are stages of athletic development in which athletes of different ages

Determineing an athlete's biological age

When children enter the adolescent growth spurt, they grow first in the extremities (lower limbs, feet, and hands). By periodically measuring sit height and arm span in addition to standing height, the coach or parent can observe this accelerated growth early and adapt the training program accordingly. Directions for taking these measurements are given on the USSA Physical Assessment CD-ROM, or can be found at the Canadian Sport For Life website www.ltad.ca.
and development levels are physiologically and psychologically best suited to learn, try and succeed at mastering specific skill sets. To recognize this development, the Cross Country Development Pipeline (CCDP) in figure 5 shows the athlete advancement and support offered for high performing athletes. This pipeline, along with the training principles of the CCTS and the level of professionalism in the preparation practiced by our international competition have shaped the structure of the U.S. Ski Team, its preparation projects and the competition schedule for U.S. skiers at all levels of development. Athletes that progress on the athletic pipeline need further programming and coaching support. It starts at the regional level with programming such as regional team preparatory camps, clinics and competitions in addition that supplement the local club programming. The next step up the pipeline requires national programming like junior national camps and competitions. Finally, international opportunities and experience are necessary for athletes at the top of the pipeline.

**U.S. Ski Team Development Statement**

The USSA is dedicated to training and competing ethically and by the rules. We aim to build partnerships within the ski community and assist in the development of skiing in the USA at all levels.
Based on the CCDP model, the support system for top athletes in training and racing is identified as below.

<table>
<thead>
<tr>
<th>Team / Group</th>
<th>Camps</th>
<th>Racing</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Ski Team A-Team</td>
<td>U.S. Ski Team Camps</td>
<td>World Cup Level</td>
</tr>
<tr>
<td>U.S. Ski Team B-Team</td>
<td>U.S. Ski Team Camps</td>
<td>U23, OPA and World Cup level</td>
</tr>
<tr>
<td>U.S. Ski Team D-Team</td>
<td>Regional and USST Camps</td>
<td>Domestic, JWC/U23, COC level</td>
</tr>
<tr>
<td>U.S. National Training Group</td>
<td>Regional and USST Camps</td>
<td>Domestic, JWC/U23, COC level</td>
</tr>
<tr>
<td>U.S. National Elite Group</td>
<td>Regional Elite Group camp</td>
<td>Domestic, JWC/U23, COC level</td>
</tr>
<tr>
<td>J1 Regional Elite Group</td>
<td>REG</td>
<td>Domestic, J1, JWC level</td>
</tr>
<tr>
<td>J2 National Elite Group</td>
<td>J2 NEG</td>
<td>Domestic, youth-international</td>
</tr>
<tr>
<td>J2 Regional Elite Group</td>
<td>Regional J2 Elite Camp</td>
<td>Domestic</td>
</tr>
<tr>
<td>Club</td>
<td>Regional, club and local</td>
<td>Domestic</td>
</tr>
</tbody>
</table>

**COACHES DEVELOPMENT PIPELINE**

We've talked about the development of athletes via the development pipeline. After all, as coaches we have decided to educate ourselves for the benefit of these athletes. But where do we as coaches fit into the pipeline?

While the highest level a young athlete can aim for is a gold medal at the Olympic Games, this is not so for a coach. This is not to say, however, that coaches cannot aim for higher and higher levels of expertise even if they do not wish to coach a different level of athlete than they currently do. Therefore, the coaching pipeline is not so dissimilar to the athlete pipeline. Both aim to challenge the participant at a higher level as they move up the pipeline so that they become better athletes or coaches and maintain interest in the sport through increased levels of challenge.

Level 100 is the introductory level, the entrance into the USSA coaching pipeline. Level 100 is for all coaches, even those who have coached for years. There is always something to learn or review when it comes to the fundamentals of anything. At the same time, Level 300 is also for everyone, as long as the previous levels have been attained first. Even if Level 300 is oriented toward coaches working only with elite-level racers, it is important for a youth coach to be familiar with what this caliber athlete will be doing so that they can better coach their athletes toward that level. It is also important to have many of our best coaches working with young athletes.

Our goal as coaches is to provide opportunities for our athletes to grow and improve, and to help supply the motivation they will need through this growing process. **For us to motivate, we must be motivated ourselves.** For us to supply opportunities, we must understand which opportunities are important and how to create them. The goal of coaches education is to challenge and educate the coach at a level that is motivating and appropriate to that coach’s current level.
COACHING CHARACTERISTICS

As coaches, our first job is to motivate. Motivation may be the most critical ingredient for ultimate success. The old proverb, where there is a will, there is a way, speaks to our task. We must create the will through motivation. It is not so much the will to triumph we are trying to create as the will to try. Not so much the will to win, but the will to work. It is not so much the will to arrive at any particular destination as it is to set out on this life-long journey that is ski racing. To set out on any journey takes nerve and in ski racing, as in life, it is our dreams and goals that give us a destination and our motivation. It is also important that we teach the importance of the journey - the process and the joy of the sport itself. This will help us set out without fear of failure. Heed the words and wisdom of one of our great leaders:


We’ll come back to motivation often over the course of this manual.

In addition to being motivators, these are four other essential attributes of the ski coach:

- Coaches are by nature optimists. They have an innate sense that everyone can be a better skier than they ever dreamed of. Great coaches never underestimate the potential of their athletes.
- Coaches are designers, influenced by the needs of their athletes. The essential act of coaching is the design of the curriculum, which takes content and shapes it into a specific plan with identified lessons in an appropriate form and sequence for directing learning.
- Coaches must also act and think like assessors, determining the extent to which the day's lesson plan has been achieved. Knowing how much training volume and intensity will get just the right training response, monitoring the skiers' form with an eye on efficiency and power, evaluating the conditions to pick the right wax, and, most importantly, acting on these assessments to modify the program as needed are skills of a great coach.
- Finally, coaches are leaders. They summon their passion and enthusiasm for cross country skiing and combine it with their desire to teach and inspire young athletes. Coaches need to pay as much attention to their leadership skills as to the technical and physical demands of their sport.

"The great coaches have this wonderful quality for being able to mentally and physically push you harder than you ever want to be pushed, and for some reason you don't hate them for it.”

-Phil Simms, referring to Bill Parcells
COACHING STYLES

Each coach has a coaching style that is natural to them. But not all athletes learn the same way or are motivated the same way. The more you learn about yourself as a coach, the better you can adapt to your athletes’ needs. As the Professional Ski Instructors of America (PSIA) puts it, "from self-knowledge comes the realization that your natural [coaching] style is not the only one…and that, while it works best for you, it won't work best for all of your students."

Regardless of which style a coach leans towards, there is no one style which leads to success. Most coaches possess a blend of multiple styles. It is helpful to have an awareness of the advantages and disadvantages of each style. We offer five styles here:

- **Command/authoritarian**: strong disciplinarian, athletes should listen – absorb and comply, is well-organized, may be disliked or feared. When winning, usually good team spirit. When losing, possible dissention.
- **Easy-going/submissive**: provides little coaching or guidance, casual, may not be prepared, may be well-liked but inadequate, gives the impression of not taking the sport seriously.
- **Cooperative/nice guy**: well-liked, shares decision making with the athletes, gives instruction and guidance but also lets the athletes assume responsibilities and self-learning, likes to individualize their coaching, may not stick to a plan or keep focus on goals.
- **Business-like**: intelligent logical approach, well-planned and organized, expects 100% all the time, may lack emotion and motivational skills, may set too high of goals for some athletes.
- **Intense**: emphasizes winning, can be very emotional, high anxiety is often transmitted to skiers, tendency to wear out athletes.

The purposed of presenting these coaching styles is to create an awareness of the variety of character and personality traits found within all coaches and to help them understand, evaluate and improve their coaching style.

Each coach will have a personal lens through which they view their athletes. Having an awareness and sensitivity to one's motivations and goals as a coach will determine one's success, the style one uses, and the respect and allegiance returned from the athletes. How a coach reads and interprets their athletes will depend on their understanding of themselves. Take a moment to assess your coaching style. Think about the coaching styles used by coaches you had when you were an athlete. How well did they meet your needs? The needs of others on your team? How well does your style mesh with the skiers in your group? Can you adapt to better meet their needs?

"Your athletes won't become what you want them to be, they will become what you are."
Jon Hammermeister, U.S. Ski Team sport psychology consultant

LEARNING STYLES

Athletes learn in a variety of ways. To learn a new skill in sport, we may use **visual** cues, **auditory** cues, or **kinesthetic** cues. Each individual may respond differently depending on which type of cues are used, and an individual’s learning preference may also change as they develop.
Visual cues are powerful learning tools for most athletes, particularly for younger skiers. Children tend to be great visual learners in general, using mimicry to learn new skills. Having a visual role model is a critical factor for young learners. Ideally, you as a coach have worked to refine your example. If not, work on it. You may be able to use athletes in your group as demonstrators. Be careful not to single out the same one or two to demonstrate every time, as it may disrupt the social dynamics of the group, or you may be perceived to play favorites. An excellent opportunity is to use athletes from your club who are older and more experienced where you can. There is also all kinds of video footage on USSA Center of Excellence TV you can show your athletes (go to www.dartfish.tv/ussa). Use these visual examples not only for skill learning, but also for future belonging. The more young skiers see good skiing, the more their passion for the sport will grow.

Auditory cues are often the coaches go-to method to teach a skill, but it is often the least effective, particularly for young athletes. The challenge with the auditory style of learning is that it has to go through extra processing before the athlete can put it to use. The coach tells the athlete what to do, then the athlete tries to understand the words, internalizing it into their own message, and then tries to execute the message. This method is heavy in thinking and less focused on doing. Just like the old game of telephone, where friends whisper a message into another’s ear and on down the line, the message at the end often gets mixed up. When telling athletes what to do, the coach is wise to heed this advice:

- KISS – keep it simple skicoach!
- Keep it short
- Use familiar vocabulary – make comparisons with things kids know and enjoy
- Relate new ideas to previous learned ones
- Start by reviewing the last skill practiced

Skiing time is critical to the development of skills and to the overall enjoyment of the sport. When in doubt, the coach should err on the side of less talk and more action. Keep feedback brief, to the point, and both positive and instructive. Watch veteran coaches, they spend less time in long discussions and more time skiing giving frequent positive reinforcement, especially with younger athletes.

A primary use of auditory-style learning is when giving an athlete feedback on their performance. There are three steps to better feedback, each step requiring greater knowledge, experience and confidence by the coach.
The coach may not always use all three steps, but should be mindful of all three to make the right delivery that the athlete will respond to for positive change.

Kinesthetic learning refers to feeling the desired skill. Kinesthetic awareness is a developing skill for athletes through phase 4. Younger skiers may not know what a particular movement or execution of the skill should feel like. Coaches can encourage kinesthetic learning by assisting athletes into the proper position, or to have athletes focus on the feelings they experienced when they have executed a skill correctly. Creative drills and exercises that by nature of the drill will allow the athletes to make and feel the desired movements are excellent for kinesthetic learners. The kinesthetic learner remembers what they do, so the important job for the coach is making sure that they associate the right feelings with the good things they do, and to be careful about ingraining any poor habits along the way as they will tend to be harder to correct down the road. Most athletes use some degree of kinesthetic learning for skill acquisition. Athletes that are heavily biased toward kinesthetic learning thrive in an active, moving training environment and generally struggle with long discussions or waiting in lines.

It is important to consider these three distinct learning styles when introducing a new skill. Assess what learning style each of your athletes prefers to use, and make sure that you cater your teaching to that style.

PEDAGOGY

Pedagogy is the art and science of teaching, and "sport pedagogy" is the "art and science of teaching sport skills – not specific skills such as dribbling, throwing, or tumbling – but the process that coaches use to teach all types of skills" (American Sport Education Program, or ASEP). This process entails developing a yearly plan, designing and sequencing specific skills within the yearly and daily plan, and the management of athletes as they participate in the learning process. The science behind coaching has come far in the last few decades, giving coaches more information on how to effectively bring out the full potential in their athletes. But knowledge alone will make a coach a good coach. The "art" is taking your knowledge of your athletes, how they learn, and what makes them tick, and combining that with your sport knowledge to help them excel. There is always something to learn. Often coaches focus only on gaining more sport knowledge as an educational goal, but the art of coaching requires at
least as much attention if not more. The **ASEP Coaching Principles course** offers a comprehensive look into all of the elements a coach must draw upon to teach skills and manage athletes in a general sport setting. It is the next step on the educational path for a USSA coach, and we encourage you to start this course as soon as you finish the Level 100 manual and exam.

There are many pedagogical tips for cross country coaches included in this manual. The sequence of the subsequent sections follows the areas of emphasis outlined by the Cross Country Training System. There is a lot of information covered here. At the end you should have a basic understanding of the key factors that will lead cross country skiers to success. This is the start of your journey. We hope you'll continue to pursue your education as a coach to higher levels, and maintain a constant hunger to learn.

**EFFECTIVE HABITS OF THE CROSS COUNTRY COACH**

- All comments are positive
- Use non-vulgar language
- Keep athlete comparisons between coaches
- Always speak positively about teammates
- Never smoke or drink alcoholic beverages in front of athletes
- Eat nutritious foods in front of athletes
- Never abuse equipment or permit athletes to do so
- Set the correct tone, respect, and appreciation for the public, volunteers, and ski center management
- Be energetic, excited about skiing and racing, and show a genuine passion for winter and snow sport
="High quality practice is the most accessible and most direct path to higher performance."
Daniel Coyle
Programming starts with local clubs. It is here that an athlete develops consistent habits for cross country skiing. Participating in outdoor activities throughout the year is a key contributor in developing a healthy outdoor endurance lifestyle.

Consistent and progressive programming is a cornerstone of a successful athletic plan. It is the responsibility of the coach to put in place an annual plan based on the needs of the athletes. First consider the goals for the season, then build backward.

The ski program must be well-suited for the athlete. The goals and CCTS developmental phase of the athlete are important factors in determining the program. An effectively designed program will take advantage of the critical periods of development (sensitivity windows). Fit the program with the goals and vice versa. Be clear with incoming skiers and their families what goals and expectations the program has.

Endurance athletics places a high importance on volume and intensity of training. Equally important is the quality of execution. In his book *The Talent Code*, Daniel Coyle coined the term deep practice for the type of effort one puts forth when they are fully focused at the task at hand. Another term that can be used is mindful preparation. Mindful refers to the focused concentration required for practice that is directly targeted at achieving the end goals. Mindful preparation also means that the athlete understands the role, reason and purpose for the training. To support this, the coach has four main roles in supporting the athletes in the execution of training sessions:

1. Both coach and athlete must understand the purpose of the training session or exercise.
2. Appropriately plan the training sessions within the day, week or training phase.
3. Effectively communicate to the athlete what the goals of the session are, so they can engage with the end goal.
4. Develop strategies to aid individual athletes to help them achieve the training goal.

At the USSA, the management of the training program is guided by the simple three step process below. This process is used for Olympic quadrennial and annual plans, as well as for daily training plans.

MANAGING THE TRAINING PROGRAM

*Step 1 – Evaluation:* Programming must start with a thorough evaluation of the athletes’ abilities.

*Step 2 – Planning:* Design a training plan appropriate to the abilities of the group, factoring in each individual within the group.

*Step 3 – Implementation:* The coach does their best to implement the program consistent with the plan.

Once the implementation step is completed, the coach is in a position to repeat the cycle above, by evaluating the success of the program. Keep these important considerations in mind:

- The program needs to be specific to the athletic requirements of the group.
The program should be regularly evaluated. Evaluation is integral to the operation of the program.

The plan should be flexible to address unforeseen obstacles and changes to the program.

The planning process is dynamic and continues to evolve with each cycle.

The ability of the program to improve athlete performance is in direct proportion to the quality and integrity of the evaluation.

The key for all coaches is to develop a systematic approach to training to ensure the planning process is well thought out and executed, and yet remains flexible and innovative to maintain spontaneity and fun. Without a plan to follow, a program will appear without direction, without clear goals and objectives, and often will react to the mood of the day. Organized and consistent practices that challenge the athletes without over-training them; combined with optimistic, motivating, and knowledgeable coaching; done with a core of teammates with common interests and goals, will yield tremendous results.

**LESSON PLANNING**

To deliver quality practices and competition, coaches are encouraged to prepare a daily lesson plan. Lesson plans are organizational strategies the coach designs to assist with the planning, implementation and evaluation of a coaching session. Two important steps in designing a successful lesson plan are to ensure the goals for the daily sessions are consistent with the general goals for the specific training or competition phase, and that the coach evaluates the lesson to help design future sessions.

Each training session should have a **session goal** that is specific, quantifiable and communicated in such a way that both the coach and athlete have a clear understanding of the desired outcome for the day. We discuss goals in greater detail in section 5. Based on these goals, the coach should outline the **session details**. This is a summary of activities and exercises that will be used to accomplish the session goals. Finally, the coach does an **evaluation** of the session to improve it for subsequent groups. It should be simple and useful and pertain directly to the goals of the session. Even for the part-time coach, lesson planning is an essential task.

The plan is put in place to guide rather than dictate training. During implementation, the coach is evaluating to ensure the plan is eliciting the training responses desired.
Programming and lesson planning is done with the best interest of the athletes in mind. Consider both team and individual athletes when planning. Their needs are well described in the CCTS, so we will review the programming recommendations outlined in the first row of the CCTS matrix on page 7 for athletes of each developmental phase. Read through all of the phases, even if you only coach athletes in one or two of the phases, to help understand the progression of an athlete through their full career under a long-term athlete development model.

### PHASE 1 – AGES 2-6 – PRE-PUBERTY

**Biological age:** Pre-puberty

**Play age:** 1-4 years in sport

Play age refers to the amount of time the child has been skiing. Skiing experience at this phase should be viewed as play rather than training.

**Participation**

This is an excellent time for children to first experience cross country skiing. It should be introduced as a fun outdoor activity. Sliding on snow is an adventure, and skiing may quickly morph into game play on or off skis. Skiing is done only as much as is enjoyable for the child, with an emphasis on play versus training.

Outside of skiing, children should be participating in a wide variety of sports. This is an excellent time for balance and coordination based sports such as gymnastics.

The most important factor at this phase is that children enjoy being active, enjoy the outdoors, and for cross country skiers, discover a love for snow.

**Coaching notes**

Play, games, and fun.

### PHASE 2 – AGES 6-10 – PRE-PUBERTY

**Biological age:** Pre-puberty

**Training age:**

1-4 years in sport

Training age refers to the amount of time the child has been engaged in regular participation in skiing.

**Participation**

Ski 2-6 days per week, or as much as is enjoyable. Encourage outdoor recreation. Parents emphasize activity versus training. Incorporate fun races. Athletes should play many other sports. This is a time to encourage all kinds of sliding sports, including alpine skiing, Nordic jumping and ice skating.
Sensitivity Windows
Males: Suppleness, Speed, Skills (2nd half)
Females: Suppleness, Speed, Skills (2nd half)

Do other sports on snow, including alpine skiing or Nordic jumping.

Coaching notes
Athletes at this developmental phase lack the cognitive development to learn the sport through detailed description of efficient technique and training principles. However, they are very adept at mimicry. Therefore, showing instead of telling is important for coaching at this level. Encourage and recruit top local athletes with good technique to participate and demonstrate in local youth sessions on occasion. Practice time should be spent skiing (or in activities), not listening to coaches talking or waiting in lines for a turn.

Goals for the season are process based, not competition based. Season plan aims to maximize skill development and enjoyment as a number one priority. Develop a broad base of skills in young athletes through athletic “play.” The aim is to create a broad spectrum of movement patterns that will be called on later as the athlete ages and narrows their focus on a particular sport. Coaching the efficient movement of fundamental skills through the creation of skill “play” drills is the art of youth development coaching. Athletes in this stage and in phase 3 will naturally adapt the movements learned in one sport to another sport better than at any other point in their development. Sport specificity should not constrain coaches in this phase when designing training.

PHASE 3 – BEFORE GROWTH SPURT

Biological age: Pre-puberty (before growth spurt)

Chronological age range (for most athletes):
Girls age - 10-13 (J4-J3)
Boys age - 11-14 (J4-J3)

Training Age:
4–8 years in sport
PHASE 4 – DURING THE GROWTH SPURT

Biological age: Puberty (during growth spurt)

**Chronological age (for most athletes):**
Girls: 11–14: (J4–J2)
Boys: 12–15: (J4–J2)

**Training Age:**
5–9 years in sport

**Participation**
Train 4-6 days per week. Emphasize fun training. The competition period is December-April. The number of race starts is between ten and twenty. Skiers should still be playing complementary sports, though narrowing it down toward those that fit best around a skiing schedule is recommended. Annual training volume ramps up, J3: 250-350 hours, J2: 350–450+ hours.

**Sensitivity Windows**
Males: Stamina, Speed #2
Females: Stamina, Speed #2, Strength

The primary focus in this phase is on stamina – developing aerobic capacity and aerobic power (see section 2).
Coaching notes
This is a critical development phase for girls in particular, as girls have a harder time developing their aerobic fitness if they don’t maximize the opportunity here to set their aerobic foundation. Athletes should be training year round. Different activities will make up their year round programming, but the cross country coach must ensure athletes are building their aerobic base through their activities the whole year.

Coaches need to be aware of individual needs during this phase. Athletes go through their growth spurt at different ages. An early maturing athlete may go through their growth spurt at age 11. They need to do more aerobic base training than their same aged peers who have not started their growth spurt. However, there are social, psychological, and cognitive factors to consider. Each athlete is different. The coach needs to know their athletes well, and be able to make a plan that will work for them. It may involve training on certain days with an older group if the athlete is psychologically and socially comfortable around an older group. With their same age peers, early maturers can help push the group. Strike a balance. Remember, this is also a time when athletes are typically making decisions whether to continue in a certain sport as they narrow their choices. Lack of fun is at the top of most children's lists for quitting a sport.

New skiers may be moving into the sport at this phase that may have fewer than the 5-9 years of training listed above. In this case, you would train fitness as a phase 4 athlete, but you may focus on the technical skills within phase 3 of the CCTS. Choosing the appropriate training program requires consideration of biological age, chronological age and training age together.

Athletes of this age should now have a more mature view of competition and can start to be introduced to the athlete development pipeline. Coaches should be working with athletes to be taking more and more responsibility for their own training and preparation, so they can adapt to working with different coaches in different environments.

Biological age: Post puberty (after the growth spurt)

Chronological age (for most athletes):
Girls: 12–16: (J4–J1)
Boys: 14–17: (J2–J1)

Training Age:
6–11 years in sport

Participation
Train 5-6 days for a total of 6-10 training sessions per week. The competition period may start as early as November and runs to April. The number of race starts can range from 20 to 30. Skiers should participate in complementary sports that do not impede year-round training goals for skiing.
Annual training volume of at least 500 hours by age 17.
**Sensitivity Windows**
Males: Stamina, Speed #2, Start of Strength  
Females: Strength, Anaerobic Power  

**Coaching Notes**
Year round training is important for the development of physical skills and good training habits. Cross country skiing is an individual sport, but athletes enjoy the camaraderie and motivation of peers participating and training together. This is a critical age where numerous opportunities pull young adults in many directions. Peer pressure and peer groups are a strong stimulus at this age. Coaches use this to their advantage with a focus on team building. A positive team environment is necessary for athletes at this age to ramp up their training intensity and volume to the level they need for future demands of the sport. The coach should emphasize and reward effort over results. Make training interesting by adding variety into the program on a regular basis. Complementary activities and sports can be effective in keeping ski training mentally fresh and motivating.

Another important aspect is family. Year round programming should engage the parents and siblings if at all possible. Family members can be a strong ally in maintaining the motivation of our young adults. Find ways to involve family members directly into training activities and communicate regularly with parents so they can reinforce the effort message at home.

The phase 5 athlete has an increasing need for additional resources. Training methods become more sophisticated with testing, competition travel, and full year programming. Refer to the Elite Club Competency Document on the USSA website that outlines specific needs and optimal attributes of an effective club/organization.

**PHASE 6 – FULL MATURATION**

**Biological Age: Full maturation**

**Chronological Age:**
Female: 16+ J1+
Male: 17+ J1+

**Training Age:**
Minimum 10+ years in sport

**Participation**
Ski/train six days a week. The competition period runs from November to April. The number of race starts should be between 20 and 40. Annual training volume (hours) continues to increase from 450 to 500+ for ages 16-17, 550 to 600+ for ages 18-19, 650-700+ for ages 20-21, and over 700 for skiers 22 and older.

*Photo 3: Matt Whitcomb photo*
Sensitivity Window
Males: Strength
Females: End of Strength

Coaching Notes
There is still a range in age when skiers enter this phase. Late maturing girls may enter at 17 or 18, and late maturing boys may enter a couple years later. Once they do enter phase 6, they have the physical, psychological, and cognitive skills to achieve mastery in all the domains. The coach and athlete should have high expectations. However, sport science research indicates that no matter how good the coaching at this level, deficiencies or bad habits acquired in earlier phases, or programming that was not consistent with long-term athlete development principles, will limit the athlete's overall potential. Thus, the phase 6 coach should be involved with the club coaches working in the phases below, creating a program wide focus on age appropriate training.

KEY TAKEAWAYS
- Creating a season-long plan is an essential function for a coach.
- Programming starts with an evaluation of needs, followed by planning and implementation.
- Programming must be age-appropriate, in alignment with the Cross Country Training System, and built with the end goal for the season in mind.
- Use daily lesson planning to organize training sessions.
- Emphasis in the earlier phases of development is on skill development and enjoyment of sport. Only in later phases is there a focus on specific competition preparation, tapering, and peaking.
- Use the recommendations for training volume and training and competition ratios from the Cross Country Training System for the individual developmental phases.
- Programming should maximize the sensitivity window for the given developmental phase.
“Designing a training program that is appropriate in both load volume and load intensity is the essence of good coaching.”

Jozef Drabik
Cross country skiing is a sport that places a high physical demand on both the upper and lower body. Therefore, physical conditioning is one of the main contributors to enjoyment and execution of the sport. Physical conditioning goes hand-and-hand with the technical and tactical aspects of the sport (section 3). A skier needs a certain amount of physical fitness to execute and maintain technique. Likewise, skiers can take better advantage of their physical conditioning as technique improves. Therefore, training aspects are intimately linked to the technical and tactical progression of cross country skiing.

First and foremost, cross country skiing requires the full development of an athlete's aerobic potential. As such, the sensitivity windows in a skier's development relating to aspects of aerobic fitness are very important for the coach to understand. Upper and lower body strength endurance are also critical components in the development of a cross country skier. These attributes and the other physical training factors that the coach must consider will be described later in this section by the athlete's developmental phase in the CCTS. A major attribute of a good coach is the ability to educate his or her athletes about key training principles and to inspire and motivate them to acquire effective training habits. For this approach to be effective, it must be grounded in the age-appropriate recommendations of the CCTS.

Let’s start with a brief overview of important sport physiology concepts that make up the basis for the principles of training design for a cross country coach. Sport physiology refers to the immediate and long-term effects of exercise on the body's muscles and systems.

ENERGY SYSTEMS

There are two basic systems used to provide energy to the muscles – aerobic and anaerobic. The aerobic energy system works with oxygen delivery to the muscles and is sustainable for long periods. The body uses the anaerobic energy system (without oxygen) for high intensity work, but it is not long lasting. If we break it down, there are actually two systems that work anaerobically: ATP-PCr and anaerobic glycolysis. Energy is converted to fuel for the muscles through the process of metabolism.

FUEL SOURCES & ENERGY SYSTEMS OF THE BODY

- Phosphate system (ATP-PCr)
  Readily available energy
- Anaerobic glycolysis
  Anaerobic breakdown of carbohydrate (lactate production)
- Aerobic system
  Breakdown of fats and carbohydrates
Aerobic energy pathways are more efficient and more sustainable, but cannot produce adequate energy to the body when exercise intensity increases toward moderate and high exercise intensity. Anaerobic energy pathways are called upon at greater percentages as the intensity of exercise increases. Energy contribution is not entirely aerobic at low intensity efforts and then completely anaerobic at higher intensity levels. There is a certain percentage of aerobic and anaerobic energy contributions at all times. The primary contributors based on high intensity effort at different durations are shown in figure 1.

As you can see, the store of carbohydrates (glycogen) is limited, while the existing energy storage of fats is virtually unlimited. Fats are burned only during low intensity exercise, as they require more oxygen in order to burn. As intensity increases, carbohydrate becomes the more important fuel for energy. A benefit of training is that energy will be used more economically. This allows the well-trained athlete to burn fats for a longer time, saving carbohydrates. As a result, training may increase aerobic capacity by 50% (Janssen, 2001).

Catabolism of protein occurs when there are inadequate fuel sources in the muscle. This is when muscle tissue is broken down for energy – not good! It can happen when training is too hard and the athlete’s diet or lack of rest depletes the available supply of glycogen. Protein is crucial in repairing and rebuilding muscle tissue damaged during exercise, but protein is not a primary fuel source like fat and carbohydrate.

MUSCLE RECRUITMENT

Muscle recruitment happens much in the same manner as energy contribution. There are three primary muscle fiber types for the skeletal muscular system that are called upon to do work. Slow twitch muscle fibers (Type I) are considered the aerobic muscle type analogous to aerobic energy contribution. Like energy contribution, slow twitch muscle is not the only muscle fiber type recruited at low intensity effort. There is a certain percentage of all muscle fiber type doing work at any given time. However, slow twitch muscle fibers (Type I) are the primary contributors at low intensity effort. Greater percentages of fast twitch muscle fiber type (Type IIa then Type IIb) are additionally recruited as the intensity of exercise increases (see figure 3).
Table 1: Intensity of exercise and muscle fiber type recruitment (adapted from Janssen, 2001)

<table>
<thead>
<tr>
<th>Intensity of Exercise</th>
<th>Muscle Fiber Recruitment</th>
<th>Fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>Type I</td>
<td>Fats</td>
</tr>
<tr>
<td>Moderate</td>
<td>Type I + IIa</td>
<td>Fats, carbohydrates</td>
</tr>
<tr>
<td>Maximal</td>
<td>Type I + IIa + IIb</td>
<td>Carbohydrates</td>
</tr>
</tbody>
</table>

Muscle fiber composition can be influenced by training. We each inherit a certain percentage of slow-twitch and fast-twitch fibers, but that composition can change based on a consistent training stimulus. Cross-country skiers and other endurance sport athletes have been shown to have a greater percentage of slow-twitch fibers than other athletes.

Table 2: Characteristics of different types of muscle fibers (adapted from Janssen, 2001)

<table>
<thead>
<tr>
<th></th>
<th>Type I</th>
<th>Type IIa</th>
<th>Type IIb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Supply</td>
<td>Aerobic</td>
<td>aerobic-anaerobic</td>
<td>anaerobic</td>
</tr>
<tr>
<td>Fuel</td>
<td>Fats</td>
<td>carbohydrates &amp; fats</td>
<td>carbohydrates</td>
</tr>
<tr>
<td>Exercise Intensity</td>
<td>Light</td>
<td>Moderate</td>
<td>Maximal</td>
</tr>
<tr>
<td>Exercise Duration</td>
<td>Long (Hours)</td>
<td>Intermediate (30-120 Minutes)</td>
<td>Short</td>
</tr>
<tr>
<td>Lactate Production</td>
<td>None (Low)</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>Exercise Pace</td>
<td>Slow</td>
<td>Fast</td>
<td>High/ Maximal</td>
</tr>
</tbody>
</table>

However, according to Martin and Coe (Better Distance Running), if months pass without any training stimulus at higher intensities, a sizeable number of muscle fibers – the entire fast-twitch complement – will fail to receive even a minimal training stimulus to improve their performance potential. Since slow-twitch and fast-twitch muscle fibers work together to power the cross country skier, it is important to vary training intensities for appropriate development.

Figure 3: Muscle fiber recruitment with changes in muscular force (adapted from Martin & Coe 1997)
SUPERCOMPENSATION MODEL

The supercompensation model, also called the stress then recovery model, refers to the ability of our bodies to adapt to and eventually overcompensate for the stress of exercise. The body can adapt to small amounts of stress and then recovery is necessary. Supercompensation happens in four steps:

1. **Training stress phase.** The actual training or workload that stresses the body and the subsequent fatigue or tiring due to this training stress. There is a predictable drop-off in performance because of the stress.

2. **Recovery phase.** Such recovery may include a lighter training session, a recovery session, active rest or passive rest. As a result of the recovery period, the energy stores and performance will return to the baseline.

3. **Supercompensation phase.** It is the actual "supercompensation" phase which includes the adaptive rebound from the point of greatest fatigue to a performance level above the baseline levels.

4. **Loss of supercompensation.** Step four is the loss of the supercompensation effect. This decline is a natural result of the application of a new training stress, which should occur at the peak of supercompensation. There will also be a decline in performance if no training stress is applied and a detraining effect occurs.

The body is put into a state of short-term overload/stress and then the body recovers and adapts (super-compensates) to the overload. The body strengthens itself, so it can better handle this stress load when it is confronted with it once again in the future. This is the basic premise for hard days followed by easy days. Common violations of the supercompensation model include inadequate recovery after stress or applying too large a stressor. In either case, the body does not rebound and strengthen.

GENERAL PHYSICAL ADAPTATION TIMELINE

It is important to understand that different training stimuli have a unique timeline for adaptation. There are certain modalities of training that require full recovery to elicit a positive training response and other modes of training that do not require full recovery.

Each athlete is unique, but typically the athlete that is more physically fit will respond, adapt and recover more rapidly. We’ll review a general coaching guideline as to how the body responds to
training, but understand that adaptation needs to be monitored and evaluated on an individual basis.

The time for optimal adaptive response to occur will change with the particular physical component being trained and the system that is being stressed. Some training tasks require complete recovery before being repeated. These are activities of high neural demand (maximal strength, speed and speed strength). Such efforts require great mental concentration. Conversely, some training tasks can be trained without complete recovery. These activities are of high metabolic demand (basic endurance, speed endurance and strength endurance) (Gambetta, 2007).

**General Physical Adaptation Timeline:**
- Flexibility – Day to Day
- Strength – Week to Week
- Speed – Month to Month
- Endurance – Multiple Months to Multiple Months
- Work Capacity – Year to Year

It is important to note that the reverse is true. Detraining essentially happens at the same rate.

**Six Week Adaptation Plateau**
The human body adapts to the same training stimulus after approximately six weeks. Further training at the same level will likely result in minimal or no performance gains. This "adaptation plateau" happens in a two-step process. The first step is a two week fast adaptation period where the primary adaptation is a result of improved neuromuscular coordination followed by a four week stabilization period where actual physical adaptation takes place.

This is the general premise for training periods being four to six weeks in duration. This is an adequate amount of time to change an aspect of physical fitness in your athletes. Changing training stimuli can happen in many ways. The ideal approach depends on the time of the year in relation to the competitive season, as well as the physical attribute being focused on. Making the training stimulus more rigorous can be done using the following methods:

- Increase in training volume
- Increase in training intensity
- Increase in frequency per week of training units or intensive workouts
- Reducing recovery times
- Increasing the difficulty of the training environment
- Increase in force, pace, speed of movement, power or technical demand
Effectively applying the principle of the six week adaptation plateau, in combination with the theory of supercompensation, the planning process and the physical adaptation timeline will greatly assist in optimizing performance progression.

*Field testing* is a more specific form of monitoring performance progress. Testing is advisable after a four to six week training period to determine whether the training provided the desired physiological responses. Many tests can be used that also are an integral part of an athlete's training, so they support rather than disrupt the overall training goals. We'll dive deeper into field testing and the other physiological concepts in the Level 200 manual. You can also check the bibliography at the end of this manual for good reading on these topics. But with this basic information you have a better background to design effective training for your skiers.

**EFFECTIVE TRAINING DESIGN**

As physical conditioning is the primary determinant in the ultimate success of a cross country ski racer, we will attempt to present a wide range of fundamental training concepts in this section. As you continue into Level 200 coach training and beyond we'll go more in depth with these concepts.

The importance of planning was emphasized in the previous section. As you design a training plan, you'll need to identify the following factors:

- **How much**—general training volume is typically measured in number of hours per week, month and year. Training volume increases with age and proficiency.
- **How well**—the quality of execution and the importance of deliberate practice.
- **How hard**—specific training efforts elicit specific demands on the body. Variation of training intensities is appropriate to target specific systems and adaptations of the body.
- **Training type**—ski training components such as skill development, ski-specific technique, tactical pacing, neuromuscular speed, strength, endurance, intensity and recovery are examples of training modality.

There are numerous ways to train. Our goal is to outline the fundamental training principles, so that you can adapt them to your unique situations and environment. The art of coaching lies in your ability to implement and link the fundamentals in an innovative manner to elicit positive responses within your skiers. Athletes learn in different ways and at different rates. Coaches must use their knowledge, experience, available tools and resources, and an understanding of each individual to develop the training plan.

**DEFINITIONS AND CONCEPTS FOR TRAINING DESIGN**

*Work capacity* is defined as the total amount of training within a given period of time (day, week, month and/or year). Total work capacity is often measured over a full year. It is dependent upon training consistency as well as the amount of training an athlete can positively absorb. The timetable for consistency of training for the sport of cross country skiing is year-round. However, training at each developmental phase looks different. Phases 1 through phase 3 are primarily focused on developing general athletic skills as well as the fundamentals of the sport through skill development games and participation in several other sports. Therefore, year around training for these early phases means getting youth outdoors, doing a
multitude of physical activities, developing physical speed and coordination both on and off skis. In short, setting the groundwork for a lifestyle that includes year around outdoor endurance activity. The other end of the spectrum is phase 6 where athletes have chosen cross country skiing as their primary sport. These athletes have a year-round focus on cross country, though they may include other endurance sport activities to complement their sport-specific ski goals.

How much an athlete trains is important to the development of skills and physical fitness for endurance sports. However, developing increased work capacity from year to year is not a primary cause of planning or logging training. Instead, it is a result of an athlete that enjoys the sport and is motivated to become better at it.

_to maintain consistency in training, the coach must work to develop the culture of a skier into their athletes._ It is paramount to understand the contributing factors necessary to cultivate passion in a young skier, for the work capacity will naturally accumulate if passion and motivation are cultivated. Think about the kid shooting a basketball at the local playground for hours on end, or the group of friends playing touch football at every school recess, or the youngster strumming his guitar every night to his favorite songs. These kids aren't worrying about logging 300 hours of training at the age of thirteen. They're doing it because it is what they want to do, and if it's their primary passion they'll naturally do it more. This is important because it lays the groundwork for motivation for training in the future that becomes more focused, more difficult, and less inherently enjoyable.

Authors such as Malcolm Gladwell (Outliers) and Daniel Coyle (The Talent Code) highlight the importance of numerous hours of "deep practice" to become truly great at any specific activity. They reference the work of Anders Ericsson who has showed that 10,000 hours of deliberate practice, or a minimum of 10 years is required to achieve high level expertise in endeavors such as sport. The examples display that the individuals that reached greatness in their respective craft - spent many hours in their craft. The activity was an integral part of their lives. They developed an identity that they were a basketball player, a football player or a musician.

The question, then, is how do we as ski coaches help foster, facilitate and educate our athletes, so that they have the skills and tools to put themselves in a position that will allow them to master the sport of cross country skiing if they decide to choose cross country as a primary sport for their future?

1. Programming – a year-round club that provides an age-appropriate amount of year-round endurance training. This provides an environment for consistency and sets the foundation for the creation of athletic endurance habits. Athletic habits then can evolve an athlete's identity. An athlete will begin to identify themselves as endurance enthusiasts and later as cross country skiers as they progress beyond phase 4 in the CCTS.

2. A positive, knowledgeable and motivating coach. A strong coach can guide and foster the progress and growth of their athletes. Coaching needs to be age and level appropriate. A coach should also recognize the general vision and steps from youth to international elite as well as the steps, options and alternative opportunities along this path, so they can steer their athletes in the appropriate directions.

3. Other goal-oriented teammates. A peer group to learn and motivate one another is also important. This is both important for the social and motivational aspects, as well as improvement physically and technically.
Training volume is a measure of how much training an athlete does in a day, week, month and/or year. Volume is often measured in terms of distance or time. Due to the variable environments and training modes for cross country skiing, volume is best tracked as the amount of time in training. Figure 6 shows the recommended hourly volume of training for a high performance cross country skier by age.

Training intensity is a measure of effort or how hard an athlete is training. Different training efforts elicit different effects on the body. Cross country skiers typically break down training intensities into five intensity zones. The U.S. Ski Team has added two additional levels, with level 6 and 7 representing over-speed efforts. See Table 3 for a description of these intensity zones. Use these training levels in your training planning. The breathing reference is a good way to monitor training for younger athletes. A heart rate monitor is important for older athletes. Note that Level 2 training from the table makes up a small part of the overall volume of training. These training levels will be covered in greater detail in the Level 200 manual.
NOTE: Level 2 allows for better biomechanics with a rhythm closer to that used on snow. However, due to the increase in intensity great care needs to be taken in the volume selected and its potential to have a greater negative impact on other training sessions due to residual fatigue.

**Progression** is defined as a planned pattern of advancement that leads toward a training goal. A progressive plan contains three steps: a starting point (baseline), a stepwise path, and an end goal.

Progression is much like travelling in your car to a new destination. You need to know where you are in order to know where you are going. You might slow down, speed up, or take a detour, but the focus is maintained on the final destination (end goal). Since athletes typically have numerous goals, the route to the destination is not always simple to find. The process of goal setting is explained in Section 5, but it is important to note here that goal setting should drive the progression and planning for the athletes.

![Photo 3: Skating drill progression](image)
The fundamental steps in a sport progression cannot be skipped or rushed. In his book *Athletic Development – The Art & Science of Functional Sports Conditioning*, Vern Gambetta does a good job outlining the general steps of athletic progression:

**Progression moves from**

*Complexity of movement patterns:*

- Simple to Complex

*Intensity and effort:*

- Easy to Difficult

*Sport specificity:*

- General to Specific

*Speed of movement:*

- Slow to Fast

Beware of these common violations of progression:

- Trying to build too quickly in work capacity/ training capacity
  - Typical result – the athlete may tolerate a higher training volume for a while, but it likely will not make him/her better. In this situation, the athlete is tolerating training, but not eliciting a positive training response. Continuing in this direction will eventually result in a negative effect on performance due to inadequate recovery between training sessions, and could lead to injury.

- Skipping ahead to more advanced technical skills before mastering fundamental skills
  - Typical result – the fundamental technical flaws manifest throughout all aspects of the sport from that point forward. The technical flaw will be witnessed regardless of improvement in strength or endurance. The athlete will ultimately hit a plateau that they cannot overcome without correcting the fundamental deficiency. Time spent in the future to correct the problem is usually longer than in the present as the body needs to re-learn and adjust their neurological patterning to acquire the new skill. This normally coincides with a short-term performance drop, and often at an undesirable time. The best approach is to address technical inefficiencies when they first arise through well-coached sessions.

Recovery is a critical aspect of training planning. Ensuring proper recovery in the training plan is essential for progression. Table 4 shows approximate recovery times for training in the training intensity zones defined in Table 3. Modes of monitoring recovery such as orthostatic heart rate monitoring are discussed in Level 200.
### Table 4: Approximate recovery times

<table>
<thead>
<tr>
<th>Training type / Session Descriptors</th>
<th>Lactate (mmol/L)</th>
<th>Main goal(s)</th>
<th>Energy system (Approximate)</th>
<th>Recovery Timeline (hrs)</th>
<th>Velocity reference (Continuous effort)</th>
<th>HR range (% max HR)</th>
<th>HR range (% La Thresh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance / Recovery Level 1 Easy A1 (Aerobic-1)</td>
<td>&lt; 1</td>
<td>Inc. aerobic efficiency</td>
<td>90 - 98% Aerobic, 2 - 10% Anaerobic</td>
<td>4-8</td>
<td>Slow</td>
<td>60 - 70</td>
<td>65 – 75</td>
</tr>
<tr>
<td>Distance / Technique Level 2 Moderate A2 (Aerobic-2)</td>
<td>1 – 3</td>
<td>Increase aerobic efficiency *Note: this is only a small contributor to the volume of distance training - see &quot;pros and cons&quot;</td>
<td>80 - 90% Aerobic, 10 - 20% Anaerobic</td>
<td>6-20</td>
<td>Medium</td>
<td>70 - 80</td>
<td>75 - 90</td>
</tr>
<tr>
<td>Threshold / steady state Level 3 Steady Lactate Thresh.</td>
<td>3 – 5</td>
<td>Increase work capacity at Lactate Threshold. Improve lactate metabolism</td>
<td>60 - 80% Aerobic, 20 - 40% Anaerobic</td>
<td>20-30</td>
<td>50 Km race pace</td>
<td>80 - 90</td>
<td>90 - 100</td>
</tr>
<tr>
<td>VO2 max Level 4 Hard Max Aerobic</td>
<td>5 – 10</td>
<td>Increase maximal aerobic capacity</td>
<td>40 - 60% Aerobic, 40 - 60% Anaerobic</td>
<td>30-48</td>
<td>5 Km race pace</td>
<td>90 - 100</td>
<td>100 - 110</td>
</tr>
<tr>
<td>Tolerance &amp; Peak Lactate Level 5 Very Hard Supra-Maximal</td>
<td>&gt; 10</td>
<td>Increase anaerobic capacity</td>
<td>10 - 20% Aerobic, 60 - 90% Anaerobic</td>
<td>40-60</td>
<td>Sprint race pace</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Speed Level 6 &amp; 7 Pace/Max velocity Resisted &amp; Assisted speed</td>
<td>N/A</td>
<td>Increase time or biomechanical efficiency at a specific velocity &amp; Increase Max Velocity</td>
<td>2 - 10% Aerobic, 90 - 98% Anaerobic</td>
<td>40-60</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Strength</td>
<td>N/A</td>
<td>Increased strength</td>
<td>Varies</td>
<td>40-72</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Specificity** in training means that training activities should be appropriate and relevant to the sport for which an athlete is training. In order to produce a positive training effect, the more your training "looks" and "feels" like competition, the more likely it will improve performance and reduce injury in your sport. Ultimately, if you want to be a good skier, you must ski a lot; if you want to be a good basketball player, you play a lot of basketball.

The principle of training specificity also states that training must progress from highly general training to highly specific training. It is important to remember that athletic fundamentals are the foundation for which sport-specificity builds upon. The implication then for cross country coaches is that training early in an athlete’s career, and training prior to and during their growth spurt, is focused on general athleticism, incorporating as broad a range of complementary movement skills and fitness domains as possible. Another way to state this is that sport-specificity (in any sport) is linking fundamental physical, technical and tactical attributes together in a very specific manner to optimize performance in any given sport. Therefore, we should always maintain a high level of general physical aptitude.

Training specificity and individualized training become much more important as an athlete reaches phase 6. At this level, the training sessions and formats should be carefully designed in a manner that motivates and progresses the athlete with an understanding of each athlete’s individual strengths and weaknesses.

**Training planning** is closely related to progression. Training planning is the map or blueprint that is put into place to take the athlete from their present baseline fitness (starting point) to their
goal (finishing point). We plan from the big picture of long-term athlete development to more detailed day-to-day or short-term goals and objectives. We don’t plan in the other direction.

A good approach is to look at the overall year and generate a theme of the year. This theme is a means to guide our overall direction in training and competition. Then break the training into months and weeks. Each month and week has goals that align and support the overall theme of the year. These goals are more concise and directed than the overall yearly theme, they are specific goals for the particular training block. Then the weeks are broken down into specific daily training sessions which support the goals above, and hence support the yearly theme. Gambetta (2007) defines the term "context," meaning that what you do today in training should fit with what you did yesterday and must flow into what you are doing tomorrow. This training flow is important. As long as you have developed a sound plan built around an agreed upon theme by your team of athletes and coaches, you can apply the concept of training flow to adapt to day-to-day variables that may cause you to modify your plan. From this standpoint, it is more important to observe the training flow principle than to adhere strictly to a set plan that may not have accounted for something unexpected (athlete illness, blizzard impacted training, athletes recovery slower or faster than expected from earlier training loads, upcoming event canceled, etc.)

It is in the training domain that coaches must be most mindful of the sensitivity windows for accelerated development identified in the discussion of the CCTS earlier. The rest of this section will explain how the coach can apply the concepts of training presented above in an age-appropriate fashion to get maximal long-term results. Be sure to read through all phases to help understand the progression above and below the phases you work with, and to help you identify any potential deficiencies your athletes may have from a previous phase. We’ve also added some simple and important nutrition tips from USSA’s High Performance Dietician Adam Korzun that coaches should work with their athletes on, understanding the critical link between the ability to sustain and benefit from training efforts and the proper fueling of the body.

**PHASE 1 – AGES 2-6 – PRE-PUBERTY**

The most important aspect for this level and age is **enjoyment** of the sport of skiing and outdoor activity in general. There is not “training” at this age, but rather play. The role of the coach and parent is to provide an environment where the kids have fun skiing, and get to do a lot of other active things.

**ADAM’S NUTRITION TIP:**
- Encourage variety at meals and introduce fruits and vegetables.
THE ABC'S OF TRAINING

- **AGILITY:** Agility is the ability to change direction quickly with good balance and body control. Emphasize sports and activities that require rapid changes in direction. At this phase, include short intervals (≤5 seconds) of agility work in the early part of all workouts.

- **BALANCE:** Balance is the ability of the athlete to maintain equilibrium. Dynamic balance is discussed in section 3, and is important for skiers. As a sliding sport, it is beneficial to practice on many different surfaces. Activities like skateboarding, in-line skating, ice skating, and alpine skiing all help aid in cross country skiing balance.

- **COORDINATION:** Coordination is the ability to control the body during complex movement patterns. It is developed by progressing from simple to more complex movements. Children in the motor skills sensitivity window can make rapid gains in coordination if taught the proper movement patterns in a progressive fashion.

- **SPEED:** The speed sensitivity window for phase 2 is for very short duration (≤5 seconds) with an emphasis on changes in direction and rapid movements. It should be done right after the warm-up, and should be part of workouts year-round.

Emphasis on training should continue to focus on FUN. Young skiers at this age need to work on their ABC's – agility, balance, coordination, and speed. These skills need to be a point of emphasis for coaches both on and off snow. Make fun conditioning activities part of a social club environment where the athletes feel a sense of team and can push each other in a positive way.

The intent is to develop a broad spectrum of skills and movement patterns. Games and activities should include a diverse number of sports. Sports that develop full body coordination like gymnastics and swimming, as well as sports that develop hand-eye coordination like ball games should be included. It is essential for endurance athletes to participate in a wide variety of sports at this phase in their development to establish a broad athletic base. Specialization, or an exclusive focus on endurance sports, is detrimental to a skier's future potential in this phase, as it doesn't take into account the speed and motor skills sensitivity windows, and it often leads to future burnout at the time when a focus on aerobic training becomes very important.

Skiers at this age and level have limited stamina and limited attention spans, so brief sessions that keep kids moving will captivate their attention. Change the activities often and set up activities so everyone is involved. Seek to eliminate lines and waiting.

Aerobic endurance should be done in a format that cultivates the enthusiasm of the athletes. Scenic hikes and skis are an example to keep athletes engaged and interested. Frequent stops and mixing in games may be other strategies to begin the development and enjoyment of endurance sport. The training goal is to make endurance activities inherently enjoyable for the athlete, rather than to progressively ramp up the duration and/or intensity of endurance training. The art of coaching at this level is to strike a balance of challenging the athletes, maintaining mental engagement and development of fundamental habits. As long as the athletes are being active and athletic, whether it is playing soccer, doing gymnastics, or going on a bike ride, they are getting the aerobic training stimulus they need at this phase.
Athletes in this phase are in a sensitivity window for flexibility. Coaches should start all sessions with dynamic stretching, and include static stretching after the cool down.

Coaches should teach and encourage basic healthy lifestyle habits. The importance of eating a balanced diet including whole grains, fruits and vegetables; staying hydrated and getting ample sleep should be emphasized. Partner with the parents to facilitate this.

**ADAM'S NUTRITION TIPS:**
- Young children should bring a water bottle to training or practice. Encourage the children to drink water as a part of training.
- Encourage a balanced snack after each practice. Fresh fruit and/or vegetables, granola bars, sandwiches, yogurt, or milk are good choices.

**PHASE 3 – BEFORE GROWTH SPURT**

**Age range (varies based on biological development)**
Girls age: 10-13  
Boys age: 11-14

Boys and girls generally develop at a different pace. Females develop faster which means the timeline of critical sensitivity periods for development are in a tighter window for girls versus boys. It also means that different athletes of the same age will be able to focus on different training aspects based on their level of maturation and development of the fundamentals of the sport. Entering these phases, direct training based on each individual's developmental age, as opposed to a general program for chronological age wherever possible.

In this phase, training sessions will become more regular and year-round. Complementary sports continue to play a key role in the training of phase 3 skiers. Athletes here are at the height of the motor skills sensitivity window, meaning that movements learned in this phase will become well-ingrained. This is both an opportunity and a potential hazard for the coach. In this phase, athletes do an excellent job of transferring skills learned in one sport or activity to another. Cross country is among the more dynamic of endurance based sports, with many coordinated movement patterns required for efficient skiing technique. Since the young phase 3 skier does not have the strength and experience to simulate the demands of skiing of a World Cup caliber skier through skiing alone, they will acquire and transfer many of the skills through their involvement in other sports. The coach aids this transfer by making sure that ski training has a focus on the fundamental skills outlined in section 3 of this manual. There are many complementary activities and sports that can be effective in keeping ski training mentally fresh and motivating. For example, introducing ultimate Frisbee or soccer can be a great way to develop rapid acceleration, full body awareness and anticipation. These are general skills that will aid an athlete in mass starts and sprint competitions. Also, ice skating/speed skating is an excellent means to develop weight transfer and dynamic balance necessary on skis. Alpine and back country skiing improves the comfort and balance of a skier at high downhill speeds. Whitewater or flat water canoes or kayaks can be introduced for some general upper body strength. Mountain biking and trail running are great for general metabolic fitness activities.
The aerobic capacity of athletes in this phase shows steady improvement and athletes should be able to increase the volume and intensity of their aerobic training, but not significantly until phase 4.

The physical and cognitive maturation of athletes at this age and level allows for the opportunity to outline fundamental training principles, technique and how to implement such principles into training. This introduction should be relatively broad-based and appropriate for a variety of sports. This introduction should lay the groundwork for more sport-specific training principles important in future phases.

**ADAM’S NUTRITION TIPS:**
- Balanced nutrition should be the focus here.
- Begin to educate the athletes on the differences in carbohydrates, protein and fats.
- Focus should be placed on good carbohydrates and lean proteins as well as the need for good balanced meals to support training.

**PHASE 4 – DURING THE GROWTH SPURT**

**Age range (varies based on biological development)**
Girls age: 11-14  
Boys age: 12-15

Athletes in phase 4 have displayed a passion for endurance sports and have a background of technical proficiency as well as some racing experience. These athletes are now at an experience and maturity level appropriate for a more formal plan.

The growth spurt can interrupt coordination, and it is natural for technique progress to slow or plateau. Sometimes technique declines during this period. The coach should mitigate this by keeping a technical focus for each training session, and by keeping fundamental drills as part of the warm up. Reinforce known skills. This is not a good time to introduce new complicated movements.

Phase 4 is a sensitivity window for aerobic development, making it a critical time for cross country athletes. **This is when the foundation for the aerobic engine of a cross-country skier is built.** Aerobic training is the training priority in phase 4. Girls have a shorter sensitivity period for endurance than boys, and it is more difficult for them to develop post-puberty (Drabik, 1996), so it is especially important to get them appropriate training at this age. From the start of the growth spurt until the peak of the growth spurt, athletes can make great gains in aerobic capacity, becoming more efficient at using this energy system. Then, after the peak in the growth spurt, is an appropriate time to work on increasing aerobic power through higher intensity distance and interval training.

**SEQUENCE FOR DEVELOPING ENDURANCE:**
1. Increase workout frequency  
2. Increase variation and duration of workouts  
3. Increase intensity, when gains from step 2 decrease

*From Children & Sports Training, Jozef Drabik, 1996*
It is important to emphasize flexibility training during the growth spurt. As athletes experience rapid growth in their bones, tendons, ligaments, and muscles, they can rapidly lose their suppleness. This would negatively impact their technical efficiency if left unaddressed.

Girls enter into a sensitivity window for strength starting at PHV (height of their growth spurt). We'll expand on strength training in phase 5 below, but it is important to understand that girls enter this window much earlier than boys in general, due to the fact they achieve PHV earlier and that the window opens immediately at PHV for them as opposed to boys whose strength window starts twelve to eighteen months after PHV.

**ADAM’S NUTRITION TIPS:**
- Begin to teach athletes the basics of sports nutrition.
- Continue to encourage food over supplements and other sports products (bars, etc.)
- Stress the importance of good nutrition before training and competition, and good nutrition after workouts.
- Begin to use sports drinks during extended aerobic training sessions.

**AGE RANGE (VARIES BASED ON BIOLOGICAL DEVELOPMENT)**
- Girls age: 12-16
- Boys age: 14-17

With the rapid improvement in endurance through phase 4, skiers in phase 5 can start making gains in anaerobic power and strength. The awkwardness that sometimes comes with the growth spurt that negatively effects coordination has passed, and athletes in this phase can make significant progress in their cross country skiing. There should be an increased focus on training that reaches up to the lactate threshold and eventually into peak lactate (Levels 3-5 from Table 3). Overall training hours continue to increase on a yearly basis, as cross country becomes the skier's primary athletic endeavor to meet the demands for peak performance.

As mentioned in phase 4, girls enter the sensitivity window for strength starting at PHV and boys enter twelve to eighteen months after PHV. Cross country skiers aim to improve endurance strength – the ability to apply strength over long periods of time. Resistance training must be balanced appropriately with endurance training so as to maintain the athlete's aerobic power. The cross country athlete is not looking to put on additional muscle mass that is not going to be part of a more efficient and powerful ski technique. Too much strength work can negatively affect aerobic power and can change the muscle fiber composition discussed earlier in this section. Ski-specific training, such as that based on double poling, helps ensure the strength gains will contribute to faster skiing. We will expand on strength training for cross country athletes in Level 200.
By this phase it is essential that athletes keep a training log to record their training sessions. Training logs can come in many forms, but should at a minimum include the time spent training, training type, intensity level, and any key takeaways. Athletes should also monitor their energy levels, sleep (length and quality), diet, and resting heart rate. This information will be useful for them to measure progress, identify good and bad tendencies, and to monitor training loads to avoid overtraining.

**ADAM'S NUTRITION TIPS:**
- Training and competition nutrition discussed.
- Proper timing of nutrients should be encouraged.
- Fluid balance should be individualized.
- Begin to periodize nutrition based on training. Differentiate nutritional needs based on intensity of training sessions and type of training (aerobic, anaerobic, skill development).

---

**PHASE 6 – FULL MATURATION**

**Age range (varies based on biological development)**

Girls age: 16 and older  
Boys age: 17 and older

Hopefully, the fundamentals have been addressed, but likely there are a couple fundamental items that still require mastery. These should be an integral part of the athlete's focused training sessions by addressing these weaknesses through drills. A good practice is to frequently start training session with drills that address these deficiencies to continually progress and make the athlete mindful of the goal.

The fundamentals that an athlete defines as "strengths" should occasionally be touched on in training as well. A motivating way to do this in training is progressive drills that start with the fundamentals and quickly shift gears into more advanced sport-specific challenges. This is a specific example of applying the principle of progression defined earlier.

**Coaches tip:**
*If your easy training is too hard, your hard training will be too easy.*

Recovery and general health require diligent observation due to the high volumes of training, travel and competition. It is also critical to maintain a balance between training and competition. There are often numerous opportunities for competition, but the goal is strong competitive results. This requires careful monitoring and a balanced effort of training.

The training of athletes in phase 6 is highly periodized and individualized. Higher levels of the USSA coach education system will help coaches understand how to build these individualized programs.
Drabik summarizes things well. He states, "taking into account the young athlete's stage of preparation, biological age, and the needs of [cross country skiing] and tailoring all this to the unique individual before you – these are the factors that make the difference between a good coach and a great one." There is much still for the coach to learn, but this section provides a good background and should help in looking at the right things to design, implement, and evaluate an effective training plan.

**KEY TAKEAWAYS**

- While physical fitness is the most significant factor in ultimate skiing success, technique plays an important role, and deficiencies from early in a skier's career could limit their long-term potential.
- Effective training design begins with a needs assessment based on the athlete's developmental phase and current strengths and weaknesses.
- Athletes need to listen to their bodies. Training harder is not necessarily better.
- Carbohydrates play a critical role in fueling the body in cross country skiing, but fats are also a key energy source.
- Muscle fiber composition can be influenced by training.
- Training must follow a progression that moves from simple to complex, easy to difficult, general to specific, and slow to fast.
- Trying to increase work capacity too quickly or skipping ahead to more advanced technical skills before mastering fundamentals is detrimental to the athlete's performance.
- Ensuring proper recovery in the training plan is essential for progression and is a critical aspect of training planning.
- Skiers need to have a well-rounded, broad athletic base through phase 3 to develop the essential ABC's – agility, balance, coordination, and speed.
- A proper sequence to develop endurance is to first increase the frequency of workouts, then increase the variation and duration of the workouts, and finally raise the intensity once increases in duration and variety start to decline.
- Proper nutrition, rest, and recovery are essential for athletes to manage the increased training demands they will face in the later phases.
"Technique is the tool you use to apply your fitness to the sport."

Pete Vordenberg
Technique is the tool you use to apply your fitness to the sport. Technique is the screwdriver, fitness is what you use to turn the screwdriver, and ski racing is the job you are trying to accomplish. Technique training helps skiers to use the physical skills they have the most efficiently. The purpose of technique training is to develop a superior tool to help you get the job done. Fitness comes first. If you are fit enough, you can drive the screw into the board without the best screwdriver. There are many examples of skiers with inefficient technique winning World Cup ski races. They are successful by working hard and developing their fitness and get the most out of their sub-standard screwdriver.

Technique work must be done in conjunction with and as an addition to preparation aimed at aerobic, anaerobic and/or strength-oriented training. Do not mistake having a nice tool chest with being a good carpenter.

While fitness may come first over technique in importance for overall success in ski racing, the foundations for good technique are best developed early. In the fitness domains, the preceding chapter on training explored ways to maximize the sensitivity windows in an athlete's development. In the motor skill window (CCTS phases 2-3), young athletes are physiologically predisposed to make rapid gains in motor skill learning. The skills and movements learned in this phase tend to make up the foundation of their technique, often throughout their career. This is great for the skier who acquires excellent skill and form in these phases, before their growth spurt, but it can create a challenge for the skier who learns improper movement patterns, or who specializes in one technique too early without practicing the fundamentals of all the cross country techniques. The goal of the coach is to teach skiers efficient technique when they are younger and engrain efficient movement patterns.

Ski specific technique is derived from fundamental movement patterns. The four basic steps of sport specific technique can be identified as:

1. Develop fundamental athletic body position (POSITION)
2. Develop the fundamental movements of the sport (MOVEMENT OR MOTION)
3. Develop rhythm and synchronization of the fundamental movements of the sport (TIMING)
4. Develop power through the increase in force applied and/or the increase in speed of movement (POWER)

Each step builds off the next and is supported by the previous one, as shown in the figure 1.

As with training principles, there are many methods and subtle intricacies in sport-specific technique. Our goal is to outline the fundamental movements of cross country skiing. Differing body types, terrain, snow type and ski disciplines require subtle technical tweaks. The goal of a coach is to outline and demonstrate the fundamental movements and

![Figure 1: Development of sport specific technique pyramid](image-url)
empower athletes with the knowledge to adapt their personal ski style to specific conditions.

FUNDAMENTAL ATHLETIC BODY POSITION

The fundamental body position for cross country skiing is virtually the same in both ski disciplines. It is also essentially the same as for all weight-bearing sports. Note the common characteristics.

CROSS COUNTRY BODY POSITION

- Active forward body position aimed directly down the trail
- Weight distributed over the ball of the foot
- Relaxed and supple knees and ankles
- Positive shin angle
- High and forward, yet neutral hip position
- Soft "C" shape formed in the upper body
- Relaxed and rounded shoulders
- Relaxed arms aimed directly down the trail (in direction of travel)
- Head aligned with the body instead of looking up

Photos: Pete Vordenberg  Athlete: Kris Freeman

With this foundation, we can address specific fundamental body positions for the cross country skiing disciplines.

CLASSIC

Classical skiing refers to the traditional style of skiing. The arms and legs move parallel to the direction of travel with the same synchronized rhythm as running. Imagine, when running, if every time you took a step your forward momentum carried you twice as far as your normal stride. That is classical skiing. Classical skiing depends on kicking and gliding. It is like a walking or running step that lands you on a slippery shoe. Each stride sends you gliding down the trail. As the name suggests, Classical is at the root of the sport – a sport born in the mountains of Norway thousands of years ago.

Body Position: Body position in all sports is important for enabling the athlete to apply power to each motion effectively and efficiently. For this reason, body position in classic is similar to other ski disciplines as well as to other sports.

Feet: Center the weight across the ball of the foot. If the weight is too far forward onto the toes, then it will be difficult to apply enough force through the kick. If the center of weight is too far back, then it will be hard to apply force quickly enough to be powerful. The skier’s weight will
shift toward the whole foot in the glide phase but will rapidly shift back to the ball of the foot to quickly initiate the downward kick. Body position drills should focus on keeping the weight aligned over the ball of the foot.

**Ankles:** The bend in the ankles is vital to directing power in such a way that the skier is propelled forward down the trail, not up in the air. The degree of the bend at the ankle is dependent primarily on terrain. The steeper the terrain the more acute the angle at the ankle. Also, the more force the skier is attempting to deliver the deeper the angle will be.

**Knees:** The angle at the ankle must be closely mimicked by the angle at the knee in order to keep the skier’s weight positioned over the feet, where the generated force can be directed through the ski and to the snow. Generally, skiers struggle to get the proper angle at the ankle rather than at the knee. The result is a knee angle greater than the ankle angle, which places the skier’s weight behind the feet. This slows the speed of the kick, loads a great deal of weight on the quadriceps, and diminishes the amount of force applied to the kick.

**Hips:** The hips must be high and forward. The region of the hips is the center of an athlete’s mass. Subtle shifts in position at the hips can make a significant difference on body position and the consequent transfer for power. Efficient body position is accomplished by having the skier’s weight over the balls of the feet, maintaining the proper ankle and knee angle, keeping the upper body in a “C” position. Look for the hips to remain high and forward through the entire classic kick cycle.

**Kinetic Chain of the Lower Body:** It is good to understand the body position a skier should be in joint by joint. However, it is more important to recognize that each joint affects one another. It’s most important to know that athletes learn through movements. Movements are made up of linking multiple joints together in a systematic way.

The kinetic chain of the lower body is extremely critical to cross country skiers, for the glide phase happens on one leg (except in the double pole or in a downhill tuck). Athletes don’t learn to move joint by joint. They learn by mastering general movements and adapt them to sport-specific situations. The alignment of the lower body is critical. The hip should be directly over the knee; the knee should be directly over the ankle and the ankle directly over the foot. This aligned position of the hip, knee, ankle and foot

---

**COACHING POINT**

Pay particular attention to Kikkan’s relaxed shoulders, active forward lean and full weight transfer onto the gliding ski in the photo above.

*Photo 1: Classic body position - Kikkan Randall (Pete Vordenberg photo)*
places the athlete in a position to apply power from the center of mass (hips) down the kinetic
chain and utilize ground reaction forces (from the foot upward). The lower body works together
to systematically synchronize the movements down and back up the chain. The most common
flaw in classic skiing is a failure to maintain body position through the full cycle.

Technique can be over-taught. As coaches, we need to understand efficient posture and joint
angle, but we need to recognize that teaching should be done in a format that looks at the whole
movement. The body has an amazing capacity to self-organize and learn efficient rhythm and
timing. Start by teaching full movements and coach subtle tweaks with subtle cues. Analogies
to other popular sports can “click” in the heads of athletes. Be cautious about continually
separating and dissecting the movements into pieces, for the end result may be an athlete that
has lost all sense of athletic rhythm and flow.

**Core/Back:** The upper-body, from tailbone to head, should form a soft “C” shape. Think
Neanderthal man, big foot, gunslinger. Do not think of the Queen of England or of the postural
advice of your parents. This “C” position will help keep the hips over the feet, relax the lower
back as well as position the muscles of the core to apply force to the poles. This “C” can be very
shallow leaving the skier quite upright or rather pronounced, putting the skier in an aggressive
forward position. The depth of the “C” is also dependent upon terrain, with most skiers adapting
a more upright shallow “C” position as the terrain becomes steeper. An “S” shape in the back is
the most common core body position mistake and puts a lot of pressure on the lower back. This
can also force the hips back. Another common mistake is to fold at the waist into an “r” position.
This forces the hips back and makes it hard to deliver power to the kicking ski.

**Shoulders:** Shoulders should be rounded, leaving the arms hanging free and loose at the
skier’s side and slightly in front of the body. Even skiers who ski in a very shallow, upright “C”
position should have a forward lean at the shoulder. This position allows for a smooth pendulum
swing of the arms as well as a good position from which to apply both body weight and force to the poles.

**Arms:** The arms should hang loose and relaxed from the shoulders at the start of the poling cycle. The angle of the arm at pole plant should enable the skier to apply maximal force with the core and back as well as the weight of the upper body to the poles. This means that the arm will be much closer to 90 degrees in steeper terrain and slightly straighter in more gradual terrain. At pole release, the hand should be low and relaxed. The follow through of the arm is dependent upon speed and terrain. The faster the skier is moving the longer the follow through. The shoulders and hands should reach forward down the track in front of the skier rather than across the skier’s body or out to the side. In other words, the arms should swing straight forward and back in a pendulum fashion.

Remember that the body synchronizes and connects movements together, so that they support the common goal of travelling down the track as fast and as efficiently as possible. The arms, core and lower body all work together. The swing of the arms supports the kick from the lower body and vice versa. Remember to teach relaxed, fluid and quick movements. Efficient skiing should look and feel graceful.

**SKATE**

Skating is the newer method of cross-country skiing. Just like a speed skater, skating on skis uses a lateral push with the legs to propel the skier forward. The arms, core, and back work together with the legs to aid in this forward propulsion. Skating is the fastest technique in cross country skiing and is very popular among those just getting into the sport. Skate skiing was first used to win World Cup races in the 1970s. It was brought to popularity by American Bill Koch and so this style has distinctly American roots.

A core element of skating is an active forward body position with widened stance and articulated feet, remaining relaxed at the ankles, knees, hips and shoulders.

**Body Position:** The major difference in body position from classic to skate skiing stems from the lateral skate push of the legs. Start in the same body position as classic then take a half step sideways and articulate your feet outward (turn outward).

**Feet:** Center the weight across the whole foot, with slightly more than half of the weight toward the ball of the foot. If the weight is too far forward onto the toes, then it will dig the front of the ski into the snow and plow. If it is too far back, then it will force the hips back and make the skier carry a lot of weight on the quadriceps. The skier’s weight will shift toward the forefoot as the ski is set down and will quickly shift back across the whole foot for the majority of the push phase of the skate. At the end of the push the weight will again tend toward the front of the foot, but most of the power comes from skating off the whole foot.

**Ankles:** The bend in the ankles is vital to positioning the skier in a powerful pushing position and into a position that prevents the ski from stalling out as it moves across the snow. As in classic, the angle at the ankle is dependent primarily on terrain. The steeper the terrain or the greater the force the skier is attempting to delivery to the ski, the more acute the angle at the ankle will be.
**Knees:** The angle at the ankle must be accompanied by an aggressive angle behind the knee in order to keep the skier’s weight positioned over the feet. The combination of the appropriate ankle and knee angle allows the forces to be directed through the ski to the snow for efficient gliding. Skiers tend to struggle to get the proper angle at the ankle rather than at the knee. What results is a knee angle greater than the ankle angle that places the skier’s weight behind the feet. This loads a great deal of weight on the quadriceps, and diminishes the amount of force applied to the push. The skier can think of driving the knee forward or pressing with the knee to accomplish this position.

**Hips:** The hips must be over the feet. When it comes to body position this is accomplished with knee drive, maintaining the proper ankle and knee angle, and keeping the upper body in a “C” position. High hips position the femur bone nearly vertical, thereby supporting body weight on bone structure instead of on the musculature.

**Kinetic Chain of the Lower Body:** As in classical skiing, the alignment of the lower body is critical. The hip should be directly over the knee; the knee should be directly over the ankle and the ankle directly over the foot. This aligned position of the hip, knee, ankle and foot places the athlete in a position to apply power from the center of mass (hips) down the kinetic chain and utilize ground reaction forces (from the foot upward). The lower body works together to systematically synchronize the movements down and back up the chain. The most common flaw in ski jumping is a failure to transfer weight laterally, so the hip of the gliding leg is aligned over the knee, ankle and foot. Again, remember that technique here can be over-taught. Coaches must understand efficient posture and joint angles, while recognizing that coaching should be done looking at the movement as a whole.

**Core/Back:** As in classic, the upper-body, from tailbone to head, should form a soft “C” shape. Remember Neanderthal man and not the Queen of England. The “C” position helps keep the hips over the feet, relaxes the lower back and positions the muscles of the core to apply force to the poles. The “C” can be either very shallow, leaving the skier upright, or rather pronounced putting the skier in an aggressive forward position. The depth of the “C” is dependent upon terrain, with a more up-right, shallow “C” position as the terrain becomes steeper. Folding at the waist into an “r” position is the most common error skate skiers make. This forces the hips back and generally increases the angle at the ankle.

---

**COACHING POINT**

In the photo above, note the following aspects of Liz’s body position:

- High hang arm
- High but neutral hip position
- Rounded shoulders
- Body constantly faces the direction of travel
- Kick to the side
- Positive shin angle

---

**Photo 3: Skating body position example - Liz Stephen (Pete Vordenberg photo)**
**Shoulders:** The same fundamentals apply as in classic.

**Arms:** We will discuss each skating technique in detail in the next section, but it is necessary to point out that the V1 skate has asymmetric poling while the remaining skate techniques are symmetric. The intent is to generate maximal forward power from the poles regardless of asymmetric (V1) or symmetric (V2) poling.

As in classic, the arms should hang loose and relaxed from the shoulders at the start of the poling cycle. The angle of the arms at pole plant should enable the skier to apply maximal force with the core and back as well as the weight of the upper body to the poles. This means that the arm will be much closer to 90 degrees in steeper terrain and slightly straighter in more gradual terrain. At pole release, the hands should be low. The follow through of the arms is dependent upon speed and terrain. The faster the skier is moving the longer the follow through.

The V1 technique uses an offset position of the hands. The high hand belongs to what’s called the “hang arm.” The hang arm delivers most the poling power. The hand should be close to the head at the initiation of the poling motion. The other hand, the push arm, is planted lower. Be watchful that this hand does not creep too far across the skier’s body causing unnecessary twist. The hang arm will be no greater than 90 degrees at pole plant. The push arm should be slightly lower and more forward. Because V1 is used in steep terrain it’s common that the follow through will be short and hand return immediate.

Remember that the body synchronizes and connects movements together, so that they support the common goal of travelling down the track as fast and as efficiently as possible. The arms, core and lower body all work together. The swing of the arms supports the skate push from the lower body and vice versa. Remember to teach relaxed, fluid and quick movements. Efficient skiing should look and feel graceful.

---

**FUNDAMENTAL MOVEMENT PATTERNS OF CROSS COUNTRY SKIING**

**CLASSIC**

- Active forward body position – remain relaxed at the ankles, knees, hips and shoulders
- Pendulum arm swing from the shoulder
- Core compression of the upper torso
- Impulse kick – initial downward loading of the leg (foot stops)
- Pendulum leg swing
- Extension – pole release and final kick off expressed downward and not back

Photo 4: Classic diagonal stride - Ida Sargent (Pete Vordenberg photo)
SKATE

- Active forward body position with widened stance and articulated feet – remain relaxed at the ankles, knees, hips and shoulders
- Pendulum arm swing from the shoulder
- Core compression of the upper torso
- Lateral loading of each leg – emphasis on loading from the ankle and not the knee
- Extension – pole release and final push off expressed downward and lateral rather than back

These fundamental movements are coordinated into cross country skiing technique through proper rhythm and timing.

RHYTHM AND TIMING

Here we will introduce the techniques used in each of the cross-country disciplines and the proper timing of movements within each.

CLASSIC

There are three gears in classic skiing. The diagonal stride is the first gear in the classical transmission, and is used in climbing steeper hills where double poling will only bog the engine, or on the flats when the goal is skiing slow and easy. Double pole is the second gear, and is referred to as the power and speed gear. It's used on flats at high speeds, on gradual climbs just before switching to diagonal stride, and is the dominant gear in sprinting. Kick double pole is the overdrive gear. It is used as the gear between double poling and diagonal striding that maintains speed well into a climb.

DIAGONAL STRIDE

In all techniques the whole body works together to transfer the skier's weight from ski to ski and down the track. Timing of the diagonal stride mimics that of a running stride. The skier's opposite arm and leg are forward together. In skiing, the upper-body contributes forward momentum by applying power through the pole as the skier glides, plants, compresses and explodes forward off the kicking ski, propelling the skier down the track. At the same time as the kicking ski and poling arm pass back behind the skier, the opposite arm and leg swing forward (just like running) adding forward momentum to the propulsion down the track. This technique uses the same timing as running but has the added power of the upper-body, and the speed and efficiency of the ski gliding on snow.
The term “kick” is used to describe the forward propulsion of the skier from one ski to the next (as in a runner striding from one foot to the next). This term is misleading, as the skier does not actually kick backwards any more than a runner kicks backwards. This “kick” could better be described as a bound or the propulsive component of the stride, but the term “kick” is utterly entrenched and will do fine.

The kick of the diagonal stride is better likened to the explosive bound of a long jumper than the foot strike of a runner. In either case imagine the jumper or runner attempting to kick the foot back at take-off. In actuality the foot and leg is left behind the athlete in the follow through after the jump or foot strike. The same is true for the skier. In fact, the skier’s “kick” is similar to the jumper’s bound in that the foot is planted on the ball of the foot. The athlete then compresses down on the planted foot, and explodes forward off the foot down the trail or, in the case of the jumper, through the air. The time the jumper spends in the air is the time the skier is gliding on the snow. The more powerful the jump the further the jumper sails through the air. The more powerful the “jump” for the skier the further the skier can glide. The major difference is the direction of this jump - the jumper must orient some power into the air while the skier is oriented entirely down the trail.

This jumping sequence is so linked as to be a single motion containing all the elements of glide, plant, compress, explode, glide.

**DOUBLE POLE**

In double pole, the upper body is used to apply power onto the poles to propel the skier down the trail. The key to double pole timing is in the application of power to the poles. With the arms and body in the proper position, the body weight falls on top of the poles as the core contracts, thus crunching down powerfully on top of the poles. The back and arms simultaneously push on the poles. This application of force must be quick and timing precise in order to maximize power output. The return of the upper body to a high start position is also important to this technique. The forward arm swing must be dynamic and in synchrony with the return of the upper body to a high position in order to gain forward momentum and in order to return to a high position quickly and smoothly. This forward arm swing is the same movement as the standing broad jump, discussed later in this chapter when exploring phase 2 of the CCTS.

**KICK DOUBLE POLE**

The kick double pole begins with a double pole. This leaves the arms slightly behind the skier, the upper body in a relatively low position and the skier’s weight spread evenly over both skis. The skier must then transfer all their weight to the kicking ski, plant, compress and explode forward off the kicking ski (as in diagonal stride) in absolute synchrony with the forward swing of the arms, the return of the upper body back to a high double pole position, and the forward swing of the back leg. The opposite leg becomes the kicking leg in the next cycle.

In kick double pole, the kick is very similar to that of the diagonal stride kick. In the same way the kick can be likened to the explosive bound of a long jumper’s jump in that the weight is planted on the ball of the foot, the athlete compresses down on the planted foot, and then explodes forward off the foot down the trail or, in the case of the jumper, through the air. In both diagonal stride and kick double pole the kick propels the skier down the track and onto the other ski and into an extended position. In kick double pole, the skier is now gliding on one ski with both arms forward in a double pole position. The skier applies a double pole similar to a normal double pole.
SKATE

As in classic skiing, there are three gears used in skating. These are defined as V1, V2, and V2 alternate. V1 is the first gear in skate skiing. It is used at the start of the race before switching to V2, and for climbing steeper hills where V2 will only bog the engine. V2 is the power and speed gear. It is used on flats at high speeds, on gradual climbs just before switching to V1, and as a dominant gear in sprinting. V2 alternate is the overdrive gear for skating. Skiers will use V2 alternate when the V2 tempo begins to redline on flats or gradual descents, as the gear between V2 and no-pole skating or tucking, as a cornering technique, or as a cruising gear.

V1

In all techniques the whole body works together to transfer the skier’s weight from ski to ski and down the track. The V1 technique is described in terms of the hang arm. If it is the skier’s left hand that is placed high and next to the head at the start of the poling motion, the hang side, also called poling side is the left side V1.

On the poling side the entire upper body and poling-side leg push simultaneously down and over laterally to transfer weight to the non-poling side. There is little to no time spent inactively gliding in the V1 technique. As soon as the skier’s weight is shifted onto the non-poling side the arms begin to swing back up and forward as the skier begins the push-skate back onto the poling side. When the skier transfers weight back to the poling side the poles and poling-side ski meet the snow simultaneously. While for some skiers the poles plant a little earlier than the ski, and for others the opposite is true, for most it is simultaneous. In all cases the push from each leg is as equal, smooth and powerful as possible and the use of the upper body is dynamic through a relatively shallow compression and short follow-through.

V2

In V2, the upper-body pushes in a double pole motion as the skier pushes simultaneously with the skating leg onto the gliding ski. The double pole and the skating push are completed as the gliding ski hits the snow and the skier’s weight is transferred laterally to that ski. While the skier is gliding, the arms and whole body return to the high position to initiate the double pole and skate-push that will take the skier back onto the initial ski. In this way the V2 technique is entirely symmetrical, with the upper and lower body working together and in the same way on both sides. The push from the upper-body must be dynamic and powerful and the depth of compression variable depending on terrain. The lateral skate push with the legs must also be dynamic and from a high to low position.

The biggest mistake in the V2 technique is usually a matter of timing. Often skiers will attempt to pole down the skating leg like a one-legged double pole, complete or nearly complete the poling motion and then begin the skating motion with the leg and weight shift to the other leg.
correct this, the skier must remember that the whole body works together at all times to transfer weight from ski to ski and down the track.

**V2 Alternate**

In V2 alternate, the method of propulsion on the poling-side is exactly the same as it is in V2. The upper-body and lower body compress together to transfer weight to the gliding ski. However, in V2 alternate the skier does not return to a high position on the gliding ski but stays in a relatively low position. The return to the poling-side is accomplished from this lower position with a skating push aided by the momentum of the arms swinging up, forward and back over to the poling-side ski. The synchronization of this forward arm swing and skate push is integral to the effectiveness of this technique.

V2 alternate and V1 are similar in that there is a poling side and a non-poling side. That is why it is called V2 alternate. Skiers use the V2 on the poling side but the advantage of this technique occurs on the non-poling side. While the skier is gliding on the non-poling side ski the arms are behind them. The skier rides that ski in a relatively low position. From this position the arms swing dynamically forward in synchrony with a powerful lateral skate push back onto the poling side ski. The synchrony of the dynamic arm swing and skate push is what makes this technique so fast. On the poling side the whole body returns to the high position to initiate the double pole and skate-push that will take the skier back to the non-poling side. The V2 alternate utilizes the double pole on only one side. The lower body should however be symmetric. Also, the upper and lower body should work together powerfully on both sides with active poling on one side and active return of the upper body on the other side.

As in V2, the push from the upper-body must be dynamic and powerful and the depth of compression variable depending on terrain. The skate push with the legs must also be dynamic and from a high to low position. On the non-poling side the arm swing is always a dynamic and non-stop motion.

The biggest mistake in the V2 alternate technique is a matter of timing. On the poling side, skiers will often attempt to pole down the skating leg, like a one-legged double pole, complete or nearly complete the poling motion and then begin the skating motion and weight shift to the other leg. To correct this, the skier must remember that the whole body works together at all times to transfer weight from ski to ski and down the track. On the non-poling side, skiers tend to make the same mistake they make in V1. They use the non-poling leg for recovery. This not only kills momentum in the glide but also does not allow the arms or leg to work together in shifting weight back to the poling side. The arms will not swing dynamically from the follow-through position, and the skier will simply fall back over to the poling side rather than slide back over to the poling side. This variation of the V2 alternate is very common and steals all power and speed from the technique.

**POWER**

At the top of the sport technique development is power. Power is the result of force being applied quickly. In skiing, power can only be developed effectively when the fundamental body positions, movements, and rhythm and timing have been mastered. Power is what keeps these techniques moving without bogging down.
Fundamental athletic body position allows for the use and engagement of the whole body to apply forces toward forward propulsion down the ski trail. Proper body position as described earlier allows the use of the large muscle groups of the core instead of relying only on the extremities. Proper position also places the skier in a position to rapidly apply force – generating power. Timing allows power development while maintaining the forward momentum of the skier.

The effective, efficient and repetitive application of power to the poles is the goal of learning proper technique. This includes body position and timing. Once the skier can grasp the idea of proper body position, it must be ingrained through repetition. This repetition will also develop the strength it takes to maintain this position over time and develop power from it. The practice of proper timing will help develop the speed of force application. Here’s how power applies for the various skiing techniques.

**CLASSIC**

**Double Pole**
A good mantra for double poling is “high hands.” The power position in double pole is with hands high, arms at 90 or less degrees, poles against or nearly parallel with the forearms, and body leaning from the ankles dramatically forward. From this start position, the body weight will crash down onto the poles, the core will crunch and the arms and back will contribute force simultaneously. The poles will connect with the snow delivering all this power directly to the snow. The arms and core work together, simultaneously generating power when the arms are held relatively close to the core. The forward movement of the skier will push the tips of the poles back and the handles down translating power to forward movement.

Hands that start low fail to take advantage of the body weight compressing down and forward and fail to allow the core muscles to do their job at the start of the poling motion. At the same time, the skier will not be able to seek as great a forward lean. Although, a pole that is angled back does translate immediately (baskets planted further back); there cannot be as much total force applied to the poles. This force is applied late in the cycle and leaves the skier in a very low finishing position.

It should be noted that the arms can be planted at straighter than 90 degrees. In this case, however, some of the applied force will be given away as the arms collapse to a structurally strong position. The force in this case cannot be applied as quickly, thereby resulting in less
power. Cycle time will also increase making it difficult to maintain momentum as the terrain goes uphill. Therefore, there is a range for proper pole placement in relation to the arms. Poles that are too far away from the forearms will not allow efficient engagement of the core, but poles that are too close to the forearms will result the arms collapsing until a structurally strong position is regained. This "optimal range" is dependent on many contributing factors including terrain, current speed of the athlete and the skier's strengths.

**Diagonal Stride**

The job of the kick in classic is two-fold. The first part is compressing the ski downward onto the snow, which is vital in gaining the platform from which forward propulsion is performed. The second part is making that forward propulsion powerful enough to propel the skier further and faster than the competition.

A large part of this power comes from weight transfer, which could have been covered in the body position section. The skier's entire weight must be over the gliding/kicking ski for the skier to both glide with relaxed balance and apply maximal power to the kick. In fact, the ski will carry 100 percent of the skier's body weight in the glide and the entire skier's weight plus the force added by the kick itself during the kick phase.

The speed of the kick is of primary importance to power development during the classic kick phase. This is because the skier must execute the kick fast enough in order to stop the ski in the snow without interrupting their forward momentum. In the short instant of time that the ski is stationary while the skier is still moving forward, that ski must be planted, flattened against the snow, and loaded with the force of the skier's weight plus muscular strength (compressed) until the skier can finally explode forward off that foot onto the other ski. This entire sequence must be split-second fast, and that speed is the primary contribution to power in diagonal stride.

The classic kick phase includes two movements that happen simultaneously. There is the active downward kick directly down onto the gliding ski, which sets the wax. There is also the concurrent forward drive from the opposite hip, which also generates forward propulsion. The timing and speed of these two movements happening simultaneously contributes to forward momentum and each movement contributes to the efficiency of the other. For example, a quick and explosive forward kick on the gliding ski will aid in a rapid and snappy return of the opposing leg and vice versa. Leg action in classic is distinctly different from skating. The lower body action in skating is only one movement – a loading of the leg to laterally shift the skier's weight over the gliding ski.

Power from the upper body is generated in a similarly quick application of force down onto the pole. The force is developed with a crunching motion of the core as well as the use of the lats and application of the upper body’s weight onto the poles. This motion actually takes place over a longer period of time than the kick as the poling motion begins before the initiation of the kick. Nevertheless, power is still developed by applying this force quickly. To enable this, the poling motion should not be overly drawn out. The forward swing of the other arm is simultaneous to the poling arm. It should be swung low, relaxed and directly down the track so its momentum can be best be utilized.

**SKATE**

Power is developed on the poles through the application of body weight to the poles. This happens through the dynamic use of core, back, and to a lesser degree the arms themselves. A lot of power comes from the upper body in skating. Some skiers rely more on the upper body
than others. A common mistake is to let the use of the legs suffer by focusing too much on using the upper body. Ideally, as is the case with all techniques, the whole body not only works together, but the work of one complements and aids the work of the other.

Power to the skis from the lower body is achieved through a push position similar to that used by speed skaters. Whereas in the classical diagonal stride, the ski must stop for the kick, in skating the skis must never stop. The biggest error in skate power application is a weak-side – strong-side approach. This means relying on the poling side to build momentum or power and using the non-poling side as a recovery side. This results in a loss of momentum on the recovery side. It is much more efficient to maintain momentum than to build it, lose it, and build it again. This is similar to what cyclists call "pedaling in squares" where you only apply force on the down stroke. The best cyclists apply force around the whole circle resulting in smooth continuous power and often, as in the example of Lance Armstrong, at a higher cadence.

The cyclist "pedaling in squares" can still rely on the downward-bound leg to apply force while the upward-bound leg rests. However, the skier has nothing to maintain momentum with while on the recovery side. Generally the weak-side approach means the skier will stand up or "peg-leg" on the recovery side leg. The weak-side ski decelerates as the skier stands up on it. To correct this, the skier must focus on driving the non-poling side knee and ankle as soon as that ski hits the snow and until weight is transferred back to the poling side. The skier may look at this concept as a volley of the body weight back and forth, like a tennis ball, in which the legs are the rackets. Being dynamic with the return of the arms to the poling side and synchronizing that arm swing with the skate will help maintain momentum on the non-poling side.

A large part of power development comes from weight transfer. Optimally the entire skier’s weight must be over the gliding/pushing ski for the skier to both glide with relaxed balance and apply maximal power to the skate. In skating, weight transfer is achieved through the shifting of the hips from side to side. Think about shifting your weight laterally, so that the hip aligns directly over the knees, ankles and foot of the gliding ski. Many focus exclusively on shifting the weight with the upper body. This can result in a tipping or twisting of the upper body but without real weight transfer. The body’s mass is best moved by shifting the hips.

In all skate techniques, complete weight shift, where the skier is actually directly on top of the ski at the beginning of the push phase, can compete with the need to shift weight more quickly to avoid bogging down on steeper terrain. This is especially true in the V1 technique because it is used almost exclusively in steep terrain. One way to accomplish both good weight transfer and maintain momentum is to keep the feet in a wide position, never letting the feet come close together. When this is the case, the skier’s body will stay inside the feet and the skier will never be directly on top of the ski. Weight shift will still be effective however, so long as the hips are shifting from side to side and pushing against one ski and then the other.
Technique variations – low and powerful versus light and quick

Power application needs to be appropriate for the particular situation. The distance of the competition, snow type, terrain and individual athlete aptitude are examples of variables that affect the "appropriate" amount of power from an athlete.

It is also important to remember that power can be increased by increasing output of force, by increasing the speed of the movement, or by any varying degree of the combination of force and speed of the movement. Give athletes ample opportunity to internalize this and "play" with these variables. For example, take an athlete that is cruising down a long gradual descent with long and forceful pushes. They are taking full advantage of each strong and forceful push, but they need to adjust their push as they ski up into a steep ascent. Their glide shortens and will be less forceful, but quicker pushes are necessary to optimize power output. This is analogous to shifting a gear on a bike through a transition from downhill to uphill.

For more information on cross country technique, and drills and exercises coaches can use to teach these techniques, refer to the U.S. Ski Team Cross Country Technique Fundamentals CD available at the USSA Education Shop http://educationshop.ussa.org.

With the understanding of techniques for cross country skiing, following is important advice for coaches in teaching these techniques and tactics to skiers in the developmental phases of the CCTS. Read through all phases, even if you don't coach in some of the phases, to help you understand the foundation leading up to long-term success.

PHASE 1 – AGES 2-6 – PRE-PUBERTY

Here the emphasis is on fun. The young skiers should be encouraged to play on their skis. Simple games can encourage young skiers to develop their balance and comfort level over the slippery footing underneath. Competitive games and terrain obstacle courses engage our active youth. Technical and tactical coaching do not occur here, except to the extent required to get kids standing and sliding on their skis.

PHASE 2 – AGES 6-10 – PRE-PUBERTY

The emphasis continues to be on play and having fun on snow. Any technical coaching is done primarily through games and self discovery. Visual demonstrations are often most effective. Recruit the top technical skiers in your area to ski with your athletes at this age to set an excellent visual example. When using verbal descriptions, the coach should relate positions and movements to other sports, animals, or games in which these children will be familiar. To bring the concepts to life for children in this phase requires great creativity by the coach. Overly technical instruction at this phase is not conducive to learning or fun. Skiers at this age and level have limited stamina and short attention spans, so brief sessions that keep the kids moving are keys for maximal learning. Skill oriented obstacle courses both on and off skis are an excellent way to develop fundamental skills in a fun format. Another good
practice is having multiple stations and rotating skiers through to keep them engaged and provide variety.

The athletes in this phase are poised to make rapid gains in technique, particularly from around age 8 as they enter the sensitivity window for development of motor skills. Training sessions should help young skiers in this phase learn an essential skiing skill: dynamic balance.

**Dynamic balance** on skis is a fundamental skill that is specific to sliding sports. It is not a skill that is inherently developed in one's gait (walking or running). A high degree of balance and coordination is necessary to develop dynamic balance on skis, and the motor skills sensitivity window is an optimal time to teach it. The best method to learn this skill is through active play on skis. Coaches should allow and encourage their skiers to challenge themselves on a variety of terrain. Encourage them to challenge their skiing boundaries. Allow them to be adventurous, guiding activities such as taking jumps on their skis, blasting downhill, and skiing backwards. It may seem like mere child's play, but this play is vital in the long term development of a skier's technical skills.

Coaches should also encourage a wide variety of sports at this age to develop a broad base of balance and coordination. This helps young skiers create a broad foundation of movement patterns, so that they can call upon these patterns in a sport specific manner in later development. Research shows evidence that children in the motor skills sensitivity window in phases 2 and 3 are the most able to transfer skills learned in other sports and activities to their current activity than at any other time in their athletic development.

Technique training for this age can occur off snow. An example is the **PAL progression** (Gambetta, 2010). PAL is an acronym for Posture, Arms and Legs. PAL progression is a common method to teach efficient running gait. The foundation of most sports is running. Cross country skiing stems from "running" on skis. PAL progressions are an effective starting point for those that have not developed efficient balance and coordination to glide easily on one ski. In addition, many fundamental technique flaws can be corrected with basic instruction of PAL progressions.

PAL progressions can be taught in a game-like setting with kinesthetic aids such as hurdles, cones and running ladders. These tools can help show an athlete efficient body position, stride and application of power.
Technique drills should be done at the beginning of a training session when the mind and body are fresh. The Level 100 technique clinics start each skiing progression with a form of PAL progression, which is then progressed to more ski-specific drills. It is common to incorporate PAL at the start of ski-specific technique drill progressions to reinforce efficient body position, motion and power. PAL drills and PAL progressions are a very effective tool for athletes at every age and skill, from novice to elite athlete. Coaches need to be able to effectively demonstrate and coach an efficient gait. For hands-on education on the use of PAL drills and progressions, coaches should attend a Level 100 technique clinic.

This phase is also an appropriate time to introduce jump mechanics. Jumping, bounding and hopping are often grouped together as one. The mechanics of jumping, bounding and hopping are very similar, but they are each unique. Jumping is springing from two-feet and landing on two feet. Bounding is a take-off from one leg and landing on the opposite leg. Hopping is springing off one leg and landing on the same single leg. There is an increase in both coordination and physical effort as one advances from jumping to bounding to hopping. Drill progressions are often built with this in mind.

Cross country skiing directly uses two (jumping and bounding) of the three mechanics. The jump mechanic is used in the double pole. The common broad jump has the same fundamental movements, synchronization, timing and rhythm as the double pole. The bound is used in some form for all cross country skiing strokes that include a kick or push phase from the lower body. The simplest example is the common bound and the kick phase in the diagonal stride. These two movements are identical. The only difference is the glide phase in the diagonal stride is generated on the snow.

Photo 11: Tad Elliott and Simi Hamilton display efficient ski-specific bounding form. Running, bounding and the diagonal stride in cross country skiing have the same fundamental mechanics. (Bryan Fish photo)
We will consider and reference the general mechanics of "jump", "bound" and "hop" collectively as "jump mechanics" for purposes of simplicity. We will use the term jump, bound or hop when we are specifically discussing one of these movement patterns.

Why jump, bound & hop? Jump mechanics stem from running or gait. The bound is nothing more than a run with an increase in coordination (weight transfer) and power application. Jump mechanics directly build on the gait. They require and engrain improvement and increased efficiency of all four stages of the technique pyramid (fundamental athletic body position, fundamental movement, rhythm/timing and power).

Jump mechanics can be directly included into general and specific cross country ski technique drill progressions. They can be done on foot or on skis just like PAL progression drills. Many ski-specific drill progressions, like a popular diagonal stride progression, starts with walking or shuffling on skis. Then it progresses to a run on skis and then progresses to bounding on skis. Athletes with a high proficiency of coordination and rhythm on skis can even skip on skis. Skipping is a variation of the fundamental bound. The same is true with jumping. The most fundamental jump is the broad jump. The double pole has the exact same fundamental movements, rhythm and timing as a broad jump. Popular double pole drill progressions include the broad jump directly on dry land and on skis into the double pole drill progression.

Age range (varies based on biological development)
Girls age: 10-13  Boys age: 11-14

This is an important phase for the development of technique. Skiers may have more experience, have further developed cognitive skills, and are still in the sensitivity window for motor skills. Successful coaching at this phase involves teaching athletes the fundamental athletic body position for skiing and the fundamental movements for each technique. Athletes should understand the difference between running, classic skiing, and skating. Skiers at this phase should be able to herringbone and snowplow. They should also be able to balance on one ski while skiing on gradual downhills. Most importantly, the skiers exhibit natural body mechanics on skis and are eager to explore different types of terrain and snow conditions.

Specificity was discussed in SECTION 2 – Training. Recall that specificity requires that we have a strong fundamental athletic background as a solid foundation and then our scope narrows toward more sport specific activities as the athlete moves up the athletic pipeline. These fundamental activities need to be revisited and engrained throughout an athlete's career to ensure their athletic foundation remains solid. A good method of revisiting these fundamentals is to add them to an athlete's warm-up or at the first stages of a technique drill progression. These habits are established in this phase. In later phases the athlete may breeze right through without a glitch, yet it is a very valuable habit to ensure the foundation remains strong.

Unfortunately, it is often a fundamental movement that is not acquired in this phase that results in an athlete not making it all the way up to the tip of the athletic pipeline. It is something "trivial" that was skipped over as a younger skier. But these lacking fundamental skills, or bad technical habits that were not corrected in this phase, lead to inefficiencies throughout the rest of the phases. Compensations are made but they are less efficient.
There are a lot of subtle sport-specific technical variations that many coaches may debate. Most, however, have only subtle implications and only affect the top of the technique pyramid. In this phase, the athletes need only to master the fundamentals – athletic body position, fundamental motion and rhythm/timing. These set skiers up to take advantage of power applications that will come in later phases. It is also important that our athletes learn to be adaptable and malleable. This also happens through the fundamental movements. Learning numerous activities, sports and being placed in a wide spectrum of sport-specific situations cultivates the mastery of fundamental movements and encourages adaptability of an athlete as they apply fundamental movements in a variety of ways. This is why it is important for our young skiers to do multiple sporting activities and "play" on their skis up to and through this phase. Variety is essential. A broad base will set the technical foundation for long term athletic development of a skier.

**PHASE 4 – DURING THE GROWTH SPURT**

*Age range (varies based on biological development)*

Girls age: 11-14    Boys age: 12-15

This phase is a difficult time for athletes to work on their technique. The best approach for the coach in this phase is to maintain and refine the skills the athletes have learned in the previous phases. Due to coordination challenges associated with the rapid growth and biological changes occurring in athletes through puberty, the expectation from both coach and athlete should change with regards to rate of improvement in technique. Instead, from a training perspective, this is a very important time for the cross country skier to work on their endurance. Therefore, continuing to promote the fundamentals through the skier’s warm up as discussed in phase 3, and working on maintaining efficient technique throughout longer duration training sessions should be the focus. In other words, through this phase, work on techniques already developed by the skier and add length to their training, rather than trying to teach new techniques and potentially limiting skiing time and sustained aerobic effort. You can see now why the focus on fundamentals, broad base, and variety were emphasized again and again during the earlier phases.

Targets for skiers in this phase are good body position, balance, and weight shift. Skiers should demonstrate the ability to maintain appropriate balance and stance while skiing in all terrain and under a variety of conditions. They understand the concept of changing tempo to suit conditions and terrain (“changing gears”). From a tactical standpoint, now is the time to start having discussions on racing strategy and pacing with your athletes.

**PHASE 5 – AFTER THE GROWTH SPURT**

*Age range (varies based on biological development)*

Girls age: 12-16    Boys age: 14-17

In the development of technique, skiers in this phase have moved through the difficulties in phase 4 and now are adapting and refining their technique to their strengthening bodies. The athletes should effectively use different techniques to correspond to changing terrain and conditions, and be able to change techniques smoothly and quickly. Remember the four level
The goal of technique training is to help skiers use their physical skills in the most efficient way. The foundation for technique often comes from training and habits learned early in development, or prior to the athlete's growth spurt.

There are four basic steps in the development of sport technique: 1) fundamental athletic body position, 2) fundamental movement, 3) rhythm & timing, 4) power. Development of each cross country technique should follow this progression.

Fundamental body position for cross country is virtually the same in both classic and skate skiing and has much in common with most other weight bearing sports. Shared attributes include:
- Active forward body position aimed directly down the trail
- Weight distributed over the ball of the foot
- Relaxed and supple knees and ankles
- Positive shin angle
- High and forward, yet neutral hip position
- Soft "C" shape formed in the upper body
- Relaxed and rounded shoulders
- Relaxed arms aimed directly down the trail (in direction of travel)
- Head aligned with the body instead of looking up

Dynamic balance is a fundamental skill that is unique to skiing, and requires that coaches use a great variety of games, exercises, terrain, and conditions for training young skiers.

The technique emphasis for skiers varies based on their biological development and their previous training experience.

While physical fitness is the most significant factor in ultimate skiing success, technique plays an important role, and deficiencies from early in a skier's career could limit their long-term potential.
“Equipment becomes an extension of the athlete, as the car is to a formula one driver, or the camera was to Ansel Adams.”

Bryan Fish
When it comes to equipment, parents and athletes will look to the coach for advice and support. Improper gear or missing the wax can impede a skier’s chances to meet their goals in a race, in training, or in play. Proper selection and maintenance of equipment is an important factor in the enjoyment of cross country skiing.

At the introductory levels of sport, the coach must be mindful of the primary focus of skiing, which includes the athlete’s conditioning, technical skill development, and love for skiing. Equipment can present one of the biggest challenges, and in some cases barriers, for parents of young skiers. In a recent survey of USSA cross country parents, equipment costs, along with costs associated with travel for events and training, ranked well ahead of all other categories as posing the greatest participation challenges. Keeping long-term athlete development in perspective, the coach should help families make smart equipment decisions that will allow them to develop and perform at their level without overbuying. It is important to strike a balance between high end performance for race results versus basic equipment needs that will allow the athlete to learn and progress in the sport. Less is more at the beginning. Improved equipment and an introduction to waxing are important to both coach and athlete as their level of proficiency increases. As an athlete transcends the stages of development, the reward of getting new equipment opens up renewed motivation, and new technical challenges and possibilities, where having the best racing equipment at every stage can cause burnout.

Proper equipment fit and appropriate attire is particularly important when introducing athletes to the sport. The variables of equipment are endless. While costs escalate when an athlete steers toward elite status, it is still recommended to own only the necessary equipment. For the Level 100 coach it is important to understand the equipment basics as outlined in the CCTS and discussed below. In subsequent certification levels we’ll address advanced equipment selection and preparation.

PHASE 1 – AGES 2-6 – PRE-PUBERTY

A coach who works with skiers in phase 1 should make the following recommendations to help catalyze a positive experience:

**Skis:** Skis on one pair of waxless skis, soft flex and between nose and forehead in height.
**Boots**: Uses boots that are comfortable and warm.
**Poles**: Uses one pair of poles for all techniques, or skis without poles. Poles should fit snugly under the armpit.
**Ancillary Equipment**: Clothing should provide appropriate protection from the elements and keep children comfortable for extended periods of skiing to ensure enjoyment of sport. Eye protection should be worn at all times when skiing. Athlete uses sunscreen.

---

**PHASE 2 – AGES 6-10 – PRE-PUBERTY**

The right gear in this phase makes skiing much more enjoyable and is essential for children if they are to continue in the sport. The coach should guide parents to help them find the right equipment for their children.

**Skis**: Uses waxable skis that are to be properly waxed by the athlete, parent or club leader for every day of skiing. Skis that glide properly are more fun.
**Boots**: Uses combi boots that allow for natural ankle movement and are comfortable for classic and skate technique.
**Poles**: Uses one pair of poles for all techniques at the beginning of the phase. Athlete moves to specific classic and skate poles by the middle of the phase.

---

**PHASE 3 – BEFORE GROWTH SPURT**

**Age range (varies based on biological development)**
Girls age: 10-13
Boys age: 11-14

Equipment that allows the athletes to perform efficient technique is very important at this stage. Remembering that this is the motor skills sensitivity window for development, and knowing that habits ingrained during this phase stay with the athletes throughout their skiing career, the coach must not allow their skiers to use equipment that may result in long-term technical problems. For example, incorrect pole length that the athlete compensates for by moving the elbows out can create poor movement patterns. Stress proper fit.

**Skis**: May be using classic and freestyle skis for racing and training. Skis should be selected to fit the skier’s weight and height. Skis are to be properly waxed by the athlete and coach for every day of skiing. The coach should be teaching the athletes waxing and maintenance skills through clinics and oversight of waxing sessions.
**Boots**: Uses combi boots that allow for natural ankle movement and are comfortable for classic and skate technique. Athlete may be using separate boots for skate and classic by the end of the phase.
**Poles**: Athlete uses separate poles for classic and skate techniques. Classic poles are between armpit and top of shoulder, and skate poles are between chin and nose, depending on age and strength of the athlete.
PHASE 4 – DURING THE GROWTH SPURT

Age range (varies based on biological development)
Girls age: 11-14
Boys age: 12-15

During the growth spurt, athletes may quickly outgrow their equipment. Improperly sized equipment makes it even more difficult for the athlete to cope with the coordination challenges brought about by the growth spurt. The coach should watch out for equipment as a possible cause for technical deficiencies that might occur during this phase and make sure the athletes have access to the right equipment. Equipment selection will adhere to USSA and FIS rules. The coach should begin guiding the athletes in taking responsibility for their own equipment.

**Skis:** Uses classic and freestyle skis for racing. Skis should be selected to fit the skiers’ weight and height. Fit is critical. No more than two or three pair for each technique should be owned by athlete. The athlete is responsible for maintaining skis at all times.

**Boots:** Classic and freestyle.

**Poles:** Classic and freestyle.

**Ancillary Equipment:** Hill-bounding poles. Appropriate footwear and clothing are worn during all physical activities. Athlete has a backpack for extra clothing, water bottle, water bottle carrier, waxing equipment, etc.

PHASE 5 – AFTER THE GROWTH SPURT

Age range (varies based on biological development)
Girls age: 12-16
Boys age: 14-17

As the athletes make gains in strength and size during this phase, they are transitioning to equipment that can help them generate more power and speed in their skiing. They are now responsible for maintaining several skis, keeping each in excellent condition.

**Skis:** Uses classical and skate skis. Fit is essential and quality over quantity is emphasized. Skis are properly waxed and maintained at all times by athlete. The athlete carries appropriate supplies for training.

**Ancillary Equipment:** Both classic and skate roller-skis. Helmet and bright, reflective clothing for roller-skiing is mandatory. Athlete uses road-tips on poles when roller-skiing.

PHASE 6 – FULL MATURATION

Age range (varies based on biological development)
Girls age: 16 and older
Boys age: 17 and older
By this phase, equipment maintenance and waxing become a progressively more important skill to master. Athletes are educated and responsible to wax their own skis, and should treat this part of preparation in the same way that their distance training improves their aerobic efficiency or intervals improve aerobic power. Poor equipment and maintenance habits can erase months of training gains. Like any skill, it takes time and practice to perfect. Encourage athletes to wax and test their equipment in many different snow conditions and temperatures. They can explore lengthening and shortening their kick wax pocket or adding more layers of wax for classic skiing. Learning and testing their equipment is an integral part of preparation. At this level, athletes should also be logging their ski preparation and related performance in their training logs. We will spend more time in the area of equipment selection and preparation in the next coaching levels.

**KEY TAKEAWAYS**

- Equipment costs for skiing is an intimidating hurdle for families. This hurts participation numbers. It is the coaches' role to ease families into the sport with the most cost-effective, functional setup, and to encourage an athlete to acquire new equipment as development progresses.
- The coach should approach equipment selection and preparation with a long-term perspective.
- Equipment costs can pose a significant challenge for many skiing families. The coach should help ensure the athletes have what they need based on their development phase while discouraging overbuying. Sometimes less is more at the introductory level.
- Proper fit is critical through the motor skills sensitivity window (second half of phase 2 through phase 3) to ensure poor movement patterns are not ingrained.
- Coaches should help athletes take responsibility for their equipment as, like skiing skills, it is something that requires time and practice to master.
"Achieving mental excellence is the key to successful performance in every human endeavor."

Jon Hammermeister
The mind controls the body. The mind also controls the choices we make, the habits we develop and the goals we set. The mind needs training just like the body. Mental skills must perpetually grow as the athlete gains experience and moves to higher levels in cross country skiing.

A coach must acknowledge their role as a teacher of mental skills, and should always be mindful of their influence on the psyche of the athletes they coach. In the example you set as a coach, in the words that you use to give feedback, in your body language, and in your day-to-day actions you are impacting mental skills. There are many specific areas of mental strength training that should be taught and practiced, but it is important to understand that in the mental game, the coach is constantly playing a role. How you interact with your athletes can impact their confidence, anxiety, focus, stress, and motivation. Work to understand what kind of impact you are having with each athlete, and find ways to make it the most positive.

Goal setting and performance planning are critical aspects of the CCTS performance psychology domain. Goal setting helps to organize and plan, so forward momentum is optimized. Identification of short-term and long-term goals and achievement of those goals cultivates confidence and motivates the skier to continue to set further goals, perpetuating the journey. In this manual, we will primarily focus on the relationship between goal setting and planning.

The coach should look at goal setting as an integral element in the task of cultivating athlete motivation. Ultimately it is the athlete's internal motivation that will drive the effort they put forth. If the athlete is giving their full effort, effective coaching will bring about positive change. Without full effort and motivation, no matter how good the coaching, the athlete will not find great success. The coach must be mindful of their skier's motivation and use strategies that will maximize that motivation.

To successfully introduce performance psychology on your team, coaches might consider this specific strategy. It consists of three parts:

"If you're going to repair a motorcycle, an adequate supply of gumption is the first and most important tool. If you haven't got that you might as well gather up all the other tools and put them away, because they won't do you any good. Gumption is the psychic gasoline that keeps the whole thing going. If you haven't got it there's no way the motorcycle can possibly be fixed. But if you have got it and know how to keep it there's absolutely no way in this whole world that motorcycle can keep from getting fixed. It's bound to happen. Therefore the thing that must be monitored at all times and preserved before anything else is the gumption."

Robert Pirsig – Zen and the Art of Motorcycle Maintenance
PART 1: GOALS

Start with goals. Identify long-term goals. This is where we are going – the destination. Also identify short-term goals. These are black and white, achievable goals that support the long-term goals.

Emotion drives motivation. Long-term goals give us an image of ourselves at the destination. Short-term goals give us benchmarks to mark progress and gain confidence. For goals to be effective they must be clear, specific, measurable, have a timeline and they must raise the hair on the back of your neck. Finally, they must be written down.

Goal setting is an important action for both coach and athlete. Athlete goal setting is covered at the end of this section, with a feature from U.S. Ski Team athlete Andy Newell. For the coach, goal setting should include both team and personal elements, using long-term and short-term goals. The following example shows the wide variety of areas that should be considered when planning and establishing goals for the coach.

LONG-TERM TEAM GOALS:
Where do you want to see the team in five years?
- Results for the team
  - 2 top 5 results at Junior Nationals
  - An athlete qualifies for Junior Worlds or J1 trip
- Outcomes for alumni
  - Half of skiers have the option to ski in college
  - Two athletes move on to U.S. Ski Team
  - All athletes continue to ski as part of their lifestyle
- Size of team
  - Increase from 17 to 30 athletes
- Level of funding for the team
  - Raise funds for new team van ($25,000)
  - Raise funds for a scholarship program for skiers with financial need ($10,000)

Where do you want to see the team at the end of this season?
- Results for the team
  - Achieve seasonal goal of each individual athlete
  - At least 75% of team travels with the team to all the races
- Successful training
  - Minimum 75% attendance at all conditioning sessions
  - Recruit an upperclassman to lead one workout a week
  - Training volume meets CCTS recommendation for each individual athlete
  - All athletes complete training logs
  - Educate all athletes to be able to wax their own skis with glide wax, kick wax, and klister
  - Ensure each athlete carries a wax kit in their drink belt each day that they carry with them

In this example, notice how the goals are specific and measurable. As a coach, you may only work with athletes a couple of years before they move on to another coach, but to be fully invested in each of your athletes you should view their development in terms of how well they
will do long-term, not just how good they can be at the end of their time with you. Tracking how good your athletes are doing even after they have moved on to another coach can give you good feedback on the fundamental skills you’ve taught them.

In the season goals, you notice that the coach goals are based on the goals of the athletes. This implies that the coach must be aware of the goals of each skier, and must take shared responsibility of these goals with the athlete. The training goals identify important things you will focus on. To be successful, these goals must be shared with the athletes, as well as their parents and supporters. Involve the athletes and parents in the team goal setting process as part of a pre-season meeting. For the goals to be achieved, there must be mutual buy in and ownership.

Based on the goals set, the coach must outline the actions that will lead to team goal achievement. For example, getting 75% attendance at a race may require that you assist an athlete to get an excused absence by writing a short letter to the school explaining the event. Achieving individual athlete goals will require designing training plans that are individualized within a team training structure.

With the long-term goals in mind, the coach must set short-term goals that are the basis of the training plan. These can be monthly, weekly, or daily. An example of weekly goals follows.

**WEEKLY TEAM GOALS:**
- Five training sessions
  - One L3 interval session (will share inspirational quote prior to training)
  - One L4 interval session (will show a video beforehand for motivation)
  - Speed games session (design a fun new game the group has not done before)
  - All athletes have one rest day (factoring in other activities they may be involved in)
- Each athlete given one specific feedback per session on technique
- Identify a specific goal for each session and make sure everyone knows the task and how to accomplish it

Finally, to support your personal development as a coach, you should identify your own personal goals that will benefit your athletes and your coaching. Some examples:

**Long-term personal development goals:**
Complete Level 200 education and certification
Attend National Coaches Symposium
Seek out mentor coach relationship with a top level coach in area

**Short-term goals:**
Talk to two businesses this week about sponsorship of team scholarship program
Read *Mindset* by Carol Dweck
Complete Level 100 exam

We come back to the fact that goals play a huge role in team environment. Clear goals, a clear path, clear expectations and a timeline all contribute to the team environment. Create specific habits through simple and specific actions. For example, a training goal for the group may be to recover faster after training. To do this the coach suggests that the athletes drink a carton of chocolate milk after every practice. To introduce the idea, for the first two weeks the coach brings chocolate milk or soymilk for everyone. She then requests that everyone begins to bring their own, every time, and drink it within twenty minutes of the end of practice. The coach praises those who bring a carton chocolate milk for taking their recovery seriously and being professional in pursuit of their own and their team's goals. The coach defines a trigger for the drinking of milk after training by tying it to a specific situation. Every time the athletes get back in the van or back to the parking lot at the end of practice it is milk time. Create the habit by tying it to a specific time and place.

To build on this, perhaps the team struggles to fill in their training logs. Have the athletes all bring their training logs to practice and fill them in on the way home or while they drink their chocolate milk.

Use techniques that make sense to you, and techniques that are likely to fit with your current team chemistry. Try, fail, learn, and then try again.

Another method of building motivation is defining goal events. These are events that an athlete has targeted as high performance events. A goal event can provide focus and purpose to training.

PART 2: FEELING

Engage the emotions. Emotions drive motivation, use all tools available. Enable flow.

Goals give concrete guidance on how to evoke emotion: The athlete can see the Olympic podium, picture themself on its highest step. That is a goal. That gives goose bumps. That enlivens motivation. But the Olympic podium is a long way away. That is where short term goals come in. The athlete must be able to picture themself bounding up "Iron Lung Hill" four times at level 4. That is a short term goal and being able to accomplish it will yield confidence and renewed motivation. Now add another dimension. Ask the athletes to picture themselves bounding, but have them imitate the cadence and power of Kikkan Randall. They should see themselves bounding like Kikkan skis, as Kikkan Randall. Touch the ground and fly.

A great coach helps their athletes feel their goals. Use video of ski races, running, cycling and swimming races. Use the most inspiring events you can find. Your team might respond to a great boxing match, movie scenes, or famous speeches. Surprise them. Catch their attention. If it is in your nature, use your own motivational talks. Be mindful of duration, it may be easy to go too long. Dose it out in small batches and frequently. Since cross country skiing doesn't have the celebrity status and media presence of many other sports in our country, coaches need to be proactive in bringing the sport to life for their athletes.

Flow is a natural term for the height of performance or an experience. It is the feeling one has when doing something right at the edge of their abilities, where utter focus and attention are demanded, and with that focus they can answer the demand. They are completely engaged. It
is a joyful sensation. In his book *Flow: The Psychology of Optimal Experience*, Mihaly Csikszentmihalyi writes:

"… a sense that one's skills are adequate to cope with the challenges at hand, in a goal-directed, rule bound action system that provides clear clues as to how well one is performing. Concentration is so intense that there is no attention left over to think about anything irrelevant, or to worry about problems. Self-consciousness disappears, and the sense of time becomes distorted. An activity that produces such experiences is so gratifying that people are willing to do it for its own sake, with little concern for what they will get out of it, even when it is difficult, or dangerous."

Flow is the feeling we love about sport. Coaches have the opportunity to help athletes experience flow. Flow can be encouraged by offering positive feedback and stepping back from constant critique and comparison. Let the athletes find the answers themselves by working free from doubt. Confidence is vital to flow. While sometimes we as coaches must critique and interject thoughts and corrections, sometimes we shouldn't. This leads to the most important aspect of flow practice and a guiding principle of training. The workout or activity must balance the challenge with the athlete's skills. To continually elicit physiological adaptations, challenge the athletes, keep their attention, keep them motivated and elicit flow experiences, training must progress along with the athletes' skills and fitness. What was fun, challenging and motivating last year or last week may not be any more. This ties in with short-term goal setting. Short-term goals must be a challenge but also attainable through the appropriate level of work.

Related to flow is the idea of working on strengths. Building on strengths is often an overlooked path to improvement. One way to address this is to consider the things you do well. Identify those things an athlete does well. Do workouts aimed at building on an athlete's strengths. This enables them to build on the assets that will help them gain time and win ski races whereas working on their weaknesses may only help them keep from losing time in ski races. Strength-building workouts build confidence and confidence cannot be underestimated in creating and maintaining motivated athletes. Strength building workouts can be great flow workouts. They are also particularly valuable leading up to an important competition.

In *Sacred Hoops*, basketball coach Phil Jackson shares:

"In basketball – as in life – true joy comes from being fully present in each and every moment, not just when things are going our way. Of course, it is no accident that things are more likely to go your way when you stop worrying about whether you're going to win or lose and focus your full attention on what's happening right this moment."

**PART 3: CULTURE**

What kind of environment do you have in place, and is it conducive to achieving your goals? In looking at your environment, have a people focus. Work with your team – athletes, staff and parents – to define a culture. *This is who we are. This is how we train. This is how we race. This is how we act as a team.* Use this strategy to create effective habits. Behavior is contagious, so align the behavior norm with the goal. For each stakeholder in the group help them answer the questions:
"Who am I?"
"What is this situation?"
"How does someone like me act in this situation?"

Culture enables motivation and achievement by creating and enforcing norms that direct daily behavior toward the goal. When an individual or a group start toward a goal they are no longer tethered to the start and they are not at the destination. What is often forgotten is that while the arrow is not at the target, it's not at the bow either. You are en route. Failure may be a result of trying to do something challenging, but it is not the end result until you stop trying. You are en route until you stop trying or get there. This is the process. Dream, try, fail, learn, try again and step-by-step move toward the goal. **Culture determines how failure en route is perceived and how that perception effects action.**

According to the **identity model of decision making** discussed in the book *Switch: How to Change Things When Change Is Hard* by Chip and Dan Heath, our perception of the kind of person we see ourselves as determines how we respond to certain situations.

Our identity is something we create every day. We were not born skiers. We became skiers and though the process of being coached, experiencing team, observing our teammates and role models we define what it means to be a skier, what it means to be a skier on a specific team, on a specific path to specific goals. Our identities help direct our actions and they can be a great source of pride, inner-strength and motivation.

A huge contributor to our identity is our **mindset.** According to Carol Dweck (*Mindset, 2008*), you can either see every failure or struggle as evidence of a personal identity made up of fixed qualities and shortcomings or you can see struggle and setback as opportunities to grow, learn and improve. This is an important concept in its simplicity and truth. Regardless of where we are in the process or how good we are at something we are always capable of improvement, of growing, and learning. Teaching this growth mindset is paramount to coaching and in creating an environment where struggle and setback is part of the process not just of sport but of life.

To teach this mindset, emphasize effort rather than outcome as the true test. Praise work, improvement and process over outcome, skill or talent. Think of mindset literally. Just like a set in volleyball puts you in position to spike and score, mindset puts you in position to learn, grow, to accomplish something great. This is not a new idea.

"Men often become what they believe themselves to be. If I believe I cannot do something, it makes me incapable of doing it. But when I believe I can, then I acquire the ability to do it even if I didn't have it in the beginning." – Mahatma Gandhi

To summarize the strategies to create a motivational environment:

- Use long term goals to point to a motivating destination
- Use clear, achievable short term goals to build confidence and motivation
- Engage the emotions
- Create flow workouts
- Define the team's identity
- Teach a growth mindset
- Align the team's habits toward the goal with simple, easily triggered actions
- Keep it simple and specific
- Practice what you preach
Like the other areas of emphasis in the CCTS we've explored, the performance psychology domain has specific periods where skiers should pay particular attention in their development. These are outlined next.

**PHASE 1 – AGES 2-6 – PRE-PUBERTY**

The parent and coach role in this phase is to help cultivate a passion for skiing and outdoor winter recreation in the athlete. Young skiers must be motivated and enthusiastic about cross country skiing if they are to pursue it in the long-term. Sessions should include lots of activity and lots of positive reinforcement from the coach and parents.

**PHASE 2 – AGES 6-10 – PRE-PUBERTY**

The focus continues to be on the underlying passion for skiing and exercise. Continue to use plenty of positive reinforcement. Athletes that have long-term success in sport often recall that their first coaches were very nurturing. Fun is at the forefront of training and competition. Emphasize and model teamwork and sportsmanship. Set team goals, use team rewards, and encourage an inclusive team environment. Involve parents and families so that the athletes and your group develop strong support systems.

Athletes in this phase generally view their ability as somewhat of a fixed trait, and typically do not associate the effort put in with results. They tend to get reward from succeeding in an effort they found challenging, beating their peers, or by receiving positive feedback from their coach. By providing a variety of activities at this age that are stimulating, at the appropriate challenge level, and are backed with plenty of positive reinforcement from the coach, athletes will shine.

**Age range (varies based on biological development)**

Girls age: 10-13  
Boys age: 11-14

It is important for the coach in this phase to help athletes focus on the process and not on results. A focus on effort and work ethic in your approach to training sessions and competition is key. Recognize the good results of your athletes, but emphasize the things that all of them are doing well regardless of their performances. Since athletes of the same age may be biologically ahead and into phase 4 or 5, you must help those skiers in phase 3 understand that they are still on track and doing well if they are struggling at races to keep up with the now stronger and more aerobically fit peers. Athletes at this phase should start setting goals, and as a coach you need to help them to set process goals based on their desired outcomes.

Good mental strength habits at this age include a focus on positive self-talk. When asking athletes about their skiing or results, require that they state things as a positive – they tell you
what they will do rather than what they won't do. Likewise, when providing feedback, tell them what they should do, not what they shouldn't do.

Athletes at this phase can also start using imagery by rehearsing good technique in their mind, seeing and feeling proper execution. Imagery, like other skills in skiing, must be practiced and can be improved upon.

**PHASE 4 – DURING THE GROWTH SPURT**

*Age range (varies based on biological development)*
Girls age: 11-14
Boys age: 12-15

Perseverance is a mental skill that starts to become quite important in phase 4. It is required for the longer and harder workouts phase 4 athletes should be exposed to taking advantage of the endurance window of sensitivity. Perseverance is needed to help the athlete through potential coordination and technical challenges they may face during the growth spurt. It can also help athletes get through what can be a socially challenging time in their lives.

One of the best ways to help athletes is through developmental phase appropriate goal setting. Athletes at this age need help defining appropriate benchmarks to track their progress toward their goals. They need to see progress. This requires understanding an athlete’s current baseline and setting short term goals that can be demonstrated that successfully achieving these goals will progress an athlete toward their long term goal. As we mentioned in earlier sections, this is a good time to help athletes build on their strengths and focus on skills they’ve worked on in earlier phases.

This phase may also trigger questions by the athletes about performance enhancing drugs and supplements as they look for answers to the challenges they face. Discuss ethics, fair play, and the rules regarding performance enhancers. Good nutritional habits and, again, perseverance are the answer. Maintain the emphasis on positive self-talk, work ethic, and motivation.

**PHASE 5 – AFTER THE GROWTH SPURT**

*Age range (varies based on biological development)*
Girls age: 12-16
Boys age: 14-17

By now the performance-oriented athletes should start to see a clear vision of the step-by-step path to be a top-level cross country skier. They will begin to see where they are directly at in the development pipeline. By this phase athletes will start to have a more adult approach to preparation and competition. They typically understand that they can improve their performance through increased effort. They start to be more attuned to their personal progress and more naturally adopt process goals. As a result, goal setting becomes more refined (see example of Andy Newell’s goal setting pyramids that follow).
This is the phase to work with athletes to develop and refine a consistent race day routine. They take greater responsibility for their preparation from a physical, mental, and equipment standpoint. They document what works and what doesn't in their logs. The coach should help skiers in this phase to develop an "athletic plan" to approach training sessions and life. The work they do in training and lessons learned through sport are viewed as an integral part of their identity – fit for life.

The coach must continue to emphasize that performance enhancing drugs are unethical and have no place in cross country skiing. Emphasize proper nutrition, health, sleep, and recovery along with training to maximize performance.

**PHASE 6 – FULL MATURATION**

**Age range (varies based on biological development)**
Girls age: 16 and older
Boys age: 17 and older

By phase six, top level athletes start to find themselves among highly talented fields whose physical, technical, and tactical skills are closely matched. The separating factor on race day is often a skier's mental strength. Coaches need to work with athletes to identify their ideal performance state and find ways to achieve it during competitions. Athletes use all of their available performance psychology skills including imagery, goal setting, attentional focus, self regulatory talk, self confidence, and performance planning. It is recommended for athletes to have a mental strength coach working with them on a regular basis. The development of these performance psychology skills will be expanded upon in Level 200 and 300.

**Andy Newell's discussion on athlete goal setting follows on page 83.**

**RECOMMENDED READINGS**
- *Switch: How to Change Things When Change is Hard*, Chip and Dan Heath
- *The Happiness Hypothesis*, Jonathan Haidt
- *Cornerstones of Coaching*, Jon J. Hammermeister
- *Sacred Hoops*, Phil Jackson
Some athletes spend a lot of time meticulously planning ahead, while others just let things happen as they fly by the seat of their pants. No matter which approach you have as your day-to-day routine, people have aspirations. It is human nature. It might be a thought of what you want to accomplish in your lifetime. Or, something you would like to get done this week. It might be an idea of something you would like to tackle today, or even in the morning. People who can recognize these ideas and aspirations and then transform them into simple goals are those who tend to be the most successful.

Why I Set Goals for Skiing
There are a number of reasons why it’s important to set goals for cross country skiing. One of the most important reasons pertains to specific goals and how they keep an athlete motivated and on track throughout the training process. To make it to the top of our sport it takes many, many years. We also have a long off-season away from competitive on-snow racing, which can make it difficult for athletes to gauge their progress against other skiers and keep interest in their skiing ambitions. Setting training goals for hours, technique, strength, testing, etc. can provide an athlete positive feedback throughout the off-season. This can provide the athlete with a sense of accomplishment while they’re away from snow and racing. As athletes, we thrive on reaching such positive benchmarks and maintain motivation when we know we’re heading in the right direction.

2001 Example
This was a thought process I used as a junior skier during the summer of 2001: Train hard in August, break 9:30 in the 3,000 meter running test, set a personal best in the Ball Mountain Dam double pole test, and I’ll make Junior World Championships. This was what I thought about every day throughout the summer as a 17 year-old skier. It was an effective way for me to simplify training and stay focused on my goals every session.

Another valuable reason for setting ski-specific goals is how it can affect the way skiers deal with the pressures of big races. It’s not a mystery that athletes who use imagery and visualization perform better in clutch situations. The same can be said for those who set challenging short and long-term goals for their skiing careers. It is important for young athletes to know that it’s not the end of the world if they do not achieve their specific goals. If there are certain season goals that they do not reach, then simply adjust them and try again next year. It can be a nerve-racking experience for an athlete to go out in the open and say “this is what I want to accomplish”. It takes a lot of courage to stand up and say this because there is a chance this athlete may not achieve their goals. The chance for failure is created. But the reality is, if an athlete has taken the time to recognize their goals, when they do make it to their big race day, they will perform better as an athlete that skis with the confidence of preparation.

We see examples of this regularly with junior athletes racing in Junior Nationals, J1 Scandinavian Championships, and World Junior Championships. A young skier that has taken the time to write down their goals at the beginning of the year will be much more effective in the big race than a skier who has not. An athlete who has not taken the time to recognize their goals for the season will find them self unprepared on the start line. The athlete is often in awe of the magnitude of their situation. Yes, a great experience will unfold, but quite possibly without the accompaniment of a strong result. An athlete who has recognized their goals will know that they belong on the start line.
of this big race. They will have set and achieved specific training and racing goals for their season. They will believe that they belong there. They’ve had this race in the back of their mind all summer and have visualized themselves racing in it many times. In this way, they’ve already been to the event many times. What it comes down to is an athlete taking a chance that they can perform well in comparison to an athlete that is well prepared to perform well.

How to Organize Goals for Skiing
There are a number of ways an athlete can organize their goals to get them down on paper. It comes down to personal preference, but there are three general guidelines that I like to follow.

1. Goals should be broken into two categories: short-term, or goals for the season or calendar year; and long-term, or goals for a career or lifetime.
2. Goals should be structured as the appropriate checkpoint required to meet the next goals. That is, a career result goal is backed by many smaller result and process-oriented goals. These goals are the progressive steps to the top of the podium.
3. There should be a balance between outcome goals (results) and process goals (training, technique, health, etc.)

I use a goal pyramid because it clearly shows me the steps involved in reaching my goals. It is basic enough to glance at every single day to help guide my training. It can be looked at like a ladder - as I accomplish each step of the pyramid, I become much closer to my big goals for the year and a tiny step closer to the big goals of my career.
It is a good idea to make two pyramids - one for short-term goals and one for long-term goals. It’s easiest to plan out the short-term goals first, and then place the top step of your short-term pyramid as the bottom of your long-term pyramid. Goals placed on the bottom of the pyramid should be more general than the ones toward the top. This should plainly depict the steps it takes to reach the top.

It makes me feel confident when looking at the pyramid because in reaching one step I then know that I am prepared to achieve the next; then the next, and so on. The most important part about the pyramids is how easily the athlete can see the path between career, yearly, monthly, daily, and session goals.

Included are copies of two sets of goal pyramids I created. The first two are from when I was heading into my first year as a J1 in 1999. You can see from these that my knowledge of the sport was rather limited but I still knew certain steps were needed to achieve certain goals. For example, I planned out how well I needed to perform in the NENSA qualifiers if I wanted a chance to podium at Junior Nationals. I also knew that I wanted to make World Juniors so learning to race well at Senior Nationals was a priority. You can also see where I wrote “don’t get sick” and Sverre Caldwell, my Stratton Mountain School coach, changed it to “stay healthy”. **Goals in the pyramid should always be written in a positive tone.** These two pyramids are probably too simple and there should be more specific process goals involved. Have a look.

Now look at two more recent goal pyramids I made for the 2005 season leading up to the Olympics. It’s interesting to take a look at these and see how goals can change over the years. When I wrote...
my goal pyramids in 1999 I thought I was going to ski for a college, as compared to 2005 when I was more focused on skiing full-time. It’s also interesting to see how much more specific and process-orientated my goals became as I learned more about the sport and the demands of World Cup racing. One thing that stayed consistent over the years, however, was my long-term goal of racing well in the Olympics.

Short term goals - 2006
Andy Newell, Age 21
Editor’s Note: Goal setting is appropriate for all stages of the pipeline. As coaches, it is our responsibility to not only help mold great cross country skiers, but to simultaneously teach these athletes how to achieve efficiently, and how to approach their training with John Henry’s effort. In this manner, a career of cross country skiing will be its own education. Regardless of the goal setting method, the process will be invaluable.

Check the appendix for another form of goal setting sheet that can be used.
KEY TAKEAWAYS

- The coach plays a major role in the mental skills training of an athlete simply by how he or she sets an example, creates the training environment, provides feedback and encouragement, and rewards effort or results.
- The coach should set team goals and personal goals that support their athletes' individual goals.
- Goal setting is a major driver of motivation.
- For goals to be effective they must be clear, specific, measurable, have a timeline and they must stir emotion. They must be written down.
- An important aspect of flow practice and a guiding principle of training is that the activity must balance the challenge with the athlete's skills.
- During the initial stages of skiing participation, the coach should provide ample positive reinforcement.
- Goal setting must include a balance of process (actions to achieve results) and outcome (results) goals.
"Somebody may beat me, but they are going to have to bleed to do it."

Steve Prefontaine
The challenge of a coach is to find the appropriate balance between the development of skills and training versus the frequency of competition. The coach should set athletes up for competition that will challenge them as well as demonstrate forward progress. This perpetuates confidence and motivates the skier to continue. Competitions are an opportunity for skiers to test out present fitness and gauge how well they are executing the skills of the sport. Competition, in itself, also provides opportunity for learning and growth by teaching pacing and tactics.

"The root word of competition is 'competere', which is Latin for strive together. And that is the greatest value of competition – to push yourself and others to be become better. Even in the hardest and most painful effort competition isn’t about working against, but working with."

Pete Vordenberg

The coach should bring long-term perspective into the competition plan since competition is taxing on the body and requires significant recovery. Added recovery means less time to develop the skills of the sport. The body requires rest and recovery to elicit a positive training response. A high percentage of competition will diminish the amount of time for athletic development and result in inefficient recovery.

Outlined below is the type and average competition volume appropriate at different ages and levels. Competition planning is often taken for granted and based on tradition, but the quantity and level of competitions chosen can make or break an athlete. There is a sliding scale as to what particular athletes can handle. Typically, it is better for an athlete to prepare more and compete less. This is as true with the athlete that prefers camaraderie as it is with the most competitive athlete on the team. Long term athletic development emphasizes mastery of fundamental skills and fitness through proper training. Through phase 4, the development of technical abilities and physical fitness takes precedence over competition. Then the pendulum swings and by phase 6, the athlete’s ability to compete becomes the focus. This long term athlete development based approach must be shared and explained with athlete and parent prior to the season and should support the goals identified by athlete and coach in the previous section.

Competition only exists in the form of games on skis. Look to challenge the child’s balance and increase his or her overall range of motion and coordination. Obstacle courses are a fun way for children to learn basic balance and coordination. Coaches can provide activities like skiing through a bamboo forest, skiing over and under obstacles, skiing through a slalom course,
skiing over uneven bumps and rollers, etc. Skiing in uneven terrain or away from groomed surfaces is also a good way to foster the development of basic motor skills.

**PHASE 2 – AGES 6-10 – PRE-PUBERTY**

Coaches should allow and foster competition for those athletes that enjoy and thrive on it, but don't push it on those who do not. Competition in a game and skill development setting should continue to exist at this level. Formal competition should be close to home, featuring innovative formats with a fun focus for interclub competition. Race distances may range from 0.5 – 2km, depending on age.

As in Phase 1, including many fun games and obstacle courses in daily practices will help the child develop the correct skills at this age. By Phase 2, more interactive games on skis should be incorporated into the daily lesson plan. These activities should challenge the child to move on skis in a number of ways (forwards, backwards, and laterally). Various activities should also challenge youth to ski as fast as they can at times. Rewards can be given for various elements within a race. For example, the fastest start gets a prize. Games like capture the flag, soccer, flag-tag, red rover, etc. are all examples of games that can be played on skis and help to develop raw speed. Be sure to use games in which the children are almost always moving. Keep standing-around-time to a minimum. Short team relay races are also great ways to develop speed and agility during phase 2. Be creative with the design of such relays. Challenge athletes to ski with no poles, two poles and one ski, or two skis and one pole. Competition does not need to be held in a traditional adult format to be relevant. These types of challenge events that force skiers to try many different maneuvers are essential additions to develop the foundational skills skiers will draw upon later in their career.

**PHASE 3 – BEFORE GROWTH SPURT**

**Age range (varies based on biological development)**
Girls age: 10-13
Boys age: 11-14

Local racing leads to state and divisional championships which may lead to regional events. Race distances should be between 1 and 5 km, depending on age. Skill-oriented challenges as outlined in phase 2 are still productive in this phase and should be included as part of competition. The competition season shouldn't begin until January to allow ample preparation time for fitness and technique development. Between five and fifteen race starts are appropriate, with the competition season lasting into April where conditions allow. Athletes in this phase can also maintain volume of training with a focus on skill development leading up to and sometimes through competitions due to the athlete's ability at this age to recover quickly from training efforts. Adult models of tapering generally only serve to sacrifice needed training and play time working on technique.
Competition results are often inconsistent at this age. Parents and coach should focus on the effort put into races and technical aspects of performance over results.

**PHASE 4 – DURING THE GROWTH SPURT**

*Age range (varies based on biological development)*
Girls age: 11-14
Boys age: 12-15

Local racing leads to state and divisional championships which may lead to regional events and Junior Nationals. International experience may be initiated in Canada at the end of the phase. Race distances between 1 and 10 km, depending on age. The competition period is December through April. Between ten and twenty race starts are appropriate. Competition results may be reflective of different rates of maturity among athletes the same age, so coaches and parents continue to focus on effort and technical factors, and performance relative to the individual athlete versus peer comparison at this phase.

**PHASE 5 – AFTER THE GROWTH SPURT**

*Age range (varies based on biological development)*
Girls age: 12-16
Boys age: 14-17

The competition season may start as early as November and runs to April. The number of race starts can range from 20 to 30 including local to national and international competition. Race distances should be between 1 and 20 km, depending on age. Key events are identified and training is planned such that the athlete will arrive at these events with high energy having adjusted training loads. Other competitions are used as rehearsals, with athletes refining their race day routines.

**PHASE 6 – FULL MATURATION**

*Age range (varies based on biological development)*
Girls age: 16 and older
Boys age: 17 and older

Athlete seeks to compete at the highest appropriate level including regional FIS and local USSA club races, Continental Cups, European FIS races, World Junior Championships, U23 Championships, World Cups, World Championships, and the Olympics. Race distances are between 1 and 50 km, depending on age and experience. The competition period runs from November to April, with between 20 and 40 race starts.

Each coach has a responsibility to prepare their athletes and aid them in having a great performance on race day. Following is a competition day checklist for the athlete used by U.S.
Ski Team coach Bryan Fish. Coaches should work with their athletes to develop their own routines. Remember to start by testing your race day routine in training.

1. Proper fueling: Eat familiar foods on competition day that sit well. Eat a complete meal approximately three hours before the event, with additional hydration and a light snack 75 minutes before the start.

2. Test skis well in advance (usually about 90 minutes before the start). Select the skis of the day and effectively communicate with the coach what changes are necessary (more kick, less kick, etc.)

3. Begin with an easy warm-up. Add some intensity after approximately 15-30 minutes or once the body is warmed up. A popular method is 10-30 second pick-ups or "speeds". These short and quick bursts recruit the fast twitch motor units and warm them up. Skiing at an easy level will focus warm up on the slow twitch motor units, yet the athlete will be recruiting nearly all his/her motor units once the race begins. Short bursts recruit a full spectrum of motor units without expending a great deal of energy. These pick-ups should be done with efficient and relaxed technique. It is best to do these on the race course to feel the course. The athlete should think about how to navigate and pace the race course.

4. Thirty minutes prior to the start, hone in on the wax, particularly if it is a classic event. Double check to make sure all equipment is ready. Keep skis cold unless a coach specifically states otherwise. A common mistake is to keep classic skis indoors and the kick wax doesn't cool properly. Skiing immediately on warm kick wax can smear the kick wax to the glide zone, or, in a worst case scenario, can completely remove the kick. One is left with little kick and poor glide. Therefore have the skis honed, let them cool, double check they are good for competition and keep them outdoors in an easily accessible place.

5. Further warm-up can be conducted through jogging and running pick-ups.

6. Keep warm-ups on, but make sure they are easily removable in order to step up to the start line relaxed and confident.

7. Ten minutes prior to the start be near the start in case there is a need to go through equipment check or if a timing chip is required. Stay warm and mentally and physically relaxed at the start line. Being tense reduces blood flow to the working muscles and expends more energy. Be confident and think clearly and calmly how you are going to execute at your best.

8. On the race course use positive self-talk to reach an optimal state. Racing is physically and mentally demanding. Stay tough. Focus on the race.

9. Leave it all on the course.

10. Immediately after the race, get warm clothes on quickly. It is good practice to change base layers on the upper body. Get warm-ups on and start to cool down with light skiing. Bring fluids and replenishment, which should include a recovery drink with carbohydrate and protein. There are many special drinks that can be used. Milk and honey or chocolate milk or are excellent sources of natural carbohydrate and protein. Find replenishment drinks that are easy on the stomach. NOTE: Sprinters may need to have a special cool down procedure to flush lactate.

11. Assess the race. Races test one’s preparation status. What went well in the process? What could have been better? What steps might change? Remember these are excellent educational opportunities to improve upon the next time. The more one competes and analyzes in this fashion – the more one learns, progresses and improves.

12. Enjoy competing. Enjoy the process.
KEY TAKEAWAYS

- The coach must find the appropriate balance between development of skills and training versus the frequency and volume of competition.
- For long-term performance, it is generally better for an athlete to prepare more and compete less, particularly at the lower developmental phases.
- Competition can take many forms, particularly at the younger ages.
- Competition routines should be rehearsed in training.
- Identify the purpose for each race and how it fits within the athlete's overall goals and development.
REFERENCES

Balyi, I. Canadian Sport For Life. www.ltad.ca


Hammermeister, J. 2010. Cornerstones of coaching: the building blocks of success for sport coaches and teams. Cooper Publishing Group, Traverse City, MI.


APPENDIX - A
Cross Country Contacts

**Entering the Development Pipeline**
While cross country ski racing is an individual sport, it is also a team effort. The club is the support and social home of the individual. It is also the starting point of the pipeline. Becoming involved is as simple as making contact with your local club. Begin with this list of USSA representatives who can help point you or an athlete you know in the appropriate direction.

**East Contact**
Janice Sibilia
NENSA Competitive Program Director; East USSA Representative
Email: janice@nensa.net
Phone: 914.475.5494

**Central Contact**
Yuriy Gusev
CXC Executive and Athletic Director, Central USSA Representative
Email: yuriy.gusev@cxcskiing.org
Phone: 608.385.8864

**Rocky Mountain Contact**
Mike Elliott
Rocky Mountain Executive Director, Rocky Mountain USSA Representative
Email: teamelliott@frontier.net
Phone: 970.769.8655

**Intermountain Contact**
Rick Kapala
SVSEF Program Director, Intermountain USSA Representative
Email: rick@svsef.org
Phone: 208.720.7981

**Far West/PNSA Contact**
Ben Grasseschi
Far West Nordic & Auburn Ski Club Head, Far West/ PNSA USSA Representative
Email: coach@farwestnordic.org
Phone: 530.388.8110

**Alaska Contact**
Joey Caterinichio
CCAK Chair, Alaska USSA Representative
Email: joeycat@pobox.alaska.net
Phone: 907.229.6427

**USSA Sport Education**
Email: education@ussa.org
Phone: 435.647.2050
Fax: 435.940.2790
Mailing address: PO Box 100, Park City, UT 84068
APPENDIX – B
Goal Setting Template
See following page
### Goal Setting Worksheet

Updated the week of: ________________________

If you view goal setting as a staircase, each individual step should represent a short-term goal. The bottom step can be seen as today and the very top step of the staircase will be some specific point in time in the distant future. To effectively use this worksheet, start at the bottom and identify short-term goals.

<table>
<thead>
<tr>
<th>Long-term goals</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intermediate goals</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Short-term goals</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Having achieved a series of short-term and intermediate-term goals, the long-term goals will be in sight and will be seen as achievable and realistic.

Intermediate goals build upon the short-term goals identified earlier. This is where adjustments can be made in order to help the athlete focus on how they will achieve their long-term goals.

The bottom step is today, a starting point from which students may begin to identify a series of short-term goals that will eventually lead to a long-term goal.

<table>
<thead>
<tr>
<th>Target</th>
<th>Date</th>
</tr>
</thead>
</table>