OTTAWA DISTRICT HOCKEY ASSOCIATION
OTTAWA DISTRICT MINOR HOCKEY ASSOCIATION

1993

ADVANCED SEMINAR

OTTAWA, ONTARIO

SKILL ANALYSIS

Wally Kozak

900 Merivale Rd., Suite 204, Nepean, Ontario K2G 4N4  Telephone: (613) 224-7686  Fax: 224-6079
Skill analysis is an essential task of the modern coach. The coach analyzes the technical skills - detects errors and provides correction in terms of exercises and drill progressions. To carry out this task an understanding of Biomechanics is required. The science that describes the mechanical aspects of human performance provides six principles which assist in analyzing specific skills.

Upon completion of this presentation you will be better prepared to:

- Analyze hockey skills using six principles of movement.
  - The Stability Principle
  - The Maximum Force or All Joint Principle
  - The Maximum Velocity or Joints in Order Principle
  - The Straight and Strong or Impulse Principle
  - The Direction Principle
  - The "Torque" Principle
- Detect and correct using these principles.

1. INTRODUCTION

The modern hockey coach must be aware of tactical advances. The sophisticated nature of speciality teams and the speed or transition of the game today make awareness a necessity. The base for these developments in the game is the player's technical skills. The coach's ability to analyze individual technical and tactical skills, and to provide for their enhancement through sound practice techniques, will improve the level of team play. Technical and tactical skills need constant and correct repetition. Players must be challenged to overcome their weaknesses. They also must be motivated to reach new levels of performance. This is the coach's responsibility.

Team strategies depend upon individual tactics. Individual tactics depend upon individual technical skill. To illustrate this - a successful attack requires the individual tactical skill of drive skating. Drive skating requires the individual technical skills of skating speed, deceptive skating, and puck protection. Without these skills the attack would fail. Coaches must understand the scope of technical skills which go into each tactic and appreciate that skill development results in better tactical execution - this means superior team tactical play. The main link in the chain is technical skill (Figure 1).
TECHNICAL SKILLS: THE FOUNDATION OF PLAY

Figure 1.

2. SKILL ANALYSIS

The NCCP theory program suggests a pre-observation outline to help analyze skills:

- identify the purpose of the skill
- break the skill into phases
- identify the key elements of each phase
- develop an observation plan.

1. Purpose of the skill

Each technical skill has a specific purpose. The forward stride will enhance the race to free pucks, drive skating on the rush, and to help back checking. The backward stride will maintain gap control to play the rush. The tight turn will help in creating time and space with the puck to maintain puck control on a breakout.
2. Skill phase

Using shooting as an example, this skill can be analyzed by referring to the following phases:

- preliminary movement
- back swing
- force producing movement
- critical instant: the actual moment/the result/the shot!
- follow through: maintaining control - slowing the body parts.

It takes time to develop the focusing ability to see the movements during these phases. Analysis can be enhanced by the use of video tape, slides or still photographs. Sequential photographs are used extensively in Track and Field to aid in the performance analysis, this is now a tool that more coaches should consider using. At present, video tape is used to analyze strategies and team tactics. It can also be very helpful for players and coaches in terms of individual tactical and skill analysis.

Another important factor in analysis is the growth and development level of the athlete. There are some skills which younger players cannot perform. For instance, the adolescent player will often rely on the slap shot to compensate for a lack of strength when they should instead be learning to execute a "wrist" shot; they may not yet be able to attempt a "snap" shot either. The importance of teaching and learning a wrist shot can carry over into tactical skills; for example, passing and playing on a rush. Once again the importance of the base technical skills linked to tactical skills needs to be re-enforced.

3. Identify the key elements of each phase

To better understand how skills should be performed a working knowledge of biomechanics is useful. Biomechanics is the science that analyses and describes the mechanical aspects of human performance. Six biomechanical principles will now be described, each with reference to specific hockey skills.

**Principle 1: Stable balance requires a low centre of gravity, a wide base of support, a centre of gravity within the base and a large mass.**
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**THE STABILITY PRINCIPLE**

**Principle 1:** Stable balance requires a low centre of gravity, a wide base of support, a centre of gravity within the base and a large mass.
There are three states of motion to consider when analyzing stability. Stationary motion is illustrated in pinning when finishing a check. Linear motion is demonstrated when striding and gliding in skating. Angular motion is important in pivots and tight turns.

The stable balance principle is a key one for hockey. The player's balance is vital to the execution of skills. Poor execution in technical and tactical skills are often related to a poor stance (posture) or body position.

Hockey requires the player to be in balance. The height of their centre of gravity depends on the knee bend. The width of this stance and the knee bend will affect one's stability in different situations. Drive skating, puck protection and pinning skills are associated with this principle.

The hockey player is constantly adjusting their base to execute with stability and mobility. To move in any direction the player is in a state of "unstable equilibrium". The forward lean in the forward start moves the centre of gravity ahead of the base of support. You lose stability in the direction you want to go. To appreciate this, try and get up out of your seat without leaning forward. This vividly illustrates the importance of posture when playing hockey. Players are often in an unstable ready position to be able to react quickly in any direction.

The ready position of the shoulder over the knee which is over the foot is critical. This posture can be developed with a sound dryland exercise program as well as progressive on-ice exercises to develop the feel of a mobile and stable skater. The motivated player must utilize an off-season/in-season program to enhance the strength and balance specific to skating. These drills and exercises include plyometric (bounding) exercises, special ballet squats, skipping rope routines, Russian hop exercises and aerobic roller-blade skating. The International Centre of Excellence provides a video on "Dryland Exercises to Enhance Skating". Skating is the root of hockey skill and these special exercises and drills will be critical to success in any remedial program.

Principles 2 & 3: Production of maximum effort depends on two principles:

- principle 2, the production of maximum force requires the use of all joints that can be used
- principle 3, human movement requires the use of joints in the order from largest to smallest. (crack the whip)
Background information

Isaac Newton's three laws of motion have fundamental application in skill performance:

- *law 1*, everybody will remain in a state of constant motion unless acted upon by an outside force.

  In skating you would glide in a straight line if no forces acted upon you. The friction of the skate blade and position of the balance leg are important to an efficient glide. Think of good skaters (gliders) like Paul Coffey. The efficiency of his glide suggests that his edges are near perfect in terms of balance and getting the most out of each stride. Skaters who pound the ice or scrape the ice when returning their blades to a glide position inhibit their intended motion. The forward to backward pivot is retarded when the skater's blades scrape the ice while making the pivot. A teaching cue of "jump in your skates" helps make this pivot.

- *law 2*, force is proportional to acceleration. The greater the force applied by the skateblade, the greater the acceleration. The longer a force is applied the greater the force and greater the acceleration. The rocker of the skateblade affects the amount of blade in contact with the ice. This relates to the force, with the force/acceleration per stride being affected.

  Some skaters could develop more agility with less rocker and enhance their acceleration. This may be a factor in the speed and agility development of younger skaters. The speed of the contraction of the muscles of the knee joint affect stride power and acceleration. Some skaters accelerate better with a shorter stride because of the explosive contraction of their muscles at an optimal range of motion.

Use of all joints that can be used.

Hockey examples:

- a slap shot which uses all joints - knee, hip, shoulders, elbows, and wrist are more forceful than one which leaves out a joint

- a skater who fails to finish the stride with foot extension (toe bite) does not create maximum force/acceleration.
Short stick theory - for developing skaters/players

Primary power in skating comes from the extension of the bent knee. A beginning player who uses a long stick reaches the ice by bending at the waist and not at the knees. As a result they develop a short, jerky stride. A shorter stick will require a player to sit and bend the knees. The young player may complain about a sore back, however, the most important skill is skating. The learning skater will develop better stability and mobility and will use all the joints that can be used (principle #1) if they use a shorter stick.

On the other hand, a longer stick may help the player shoot by having more leverage (force), however, skating skill should precede shooting in the sequence of skill development.

Coaches must keep in mind the size - length, girth, and weight of the stick in terms of the growth and development level of their player. The ability of a player to control the stick and skate efficiently is a key complimentary consideration.

The longer the stick the more force and acceleration that can be created for shooting, however, this may be at the expense of agile and forceful skating.

Principle 4. The greater the applied impulse, the greater the increase in velocity.

Impulse is the application of force over a certain period of time. In skating, a greater impulse is achieved by applying force in an explosive stride. Highly skilled skaters perform knee extensions faster than less skilled ones. A quick explosive knee extension produces a greater impulse than a knee extension over a long period of time.

Good skaters have "quick feet", implying fast knee extension and foot replacement. Each skater must develop their optimal ready position (knee bend) to execute their maximal impulse.

Specific strength training will improve this force. The range of motion in the knee and hip joints along with appropriate strength training can increase the velocity of the skater.

Flexibility and strength enhance the force and time equation which maximizes the impulse and velocity of the performance.
Principle 5. Movement occurs in the direction opposite that of the applied force.

The ice pushes back as the skate pushes against it. In forward skating a push to the side is needed to set the angle of the blade, and the final thrust to the back to propel the skater in the desired direction. Hip flexibility and balance are essential to execute the proper stride.

Principle 6. Angular motion is produced by the application of force acting at some distance from an axis.

Angular motion refers to motion about an axis of rotation. The slapshot is rotation of the body to create force (torque). Pivoting also requires rotation of the body.

In executing a pivot, the skater keeps their arms close to the body to speed the body rotation rather than retard it.

When executing a tight turn with the puck, the puck is controlled by reducing the angular momentum. This is done by keeping the puck close to the body of the skater. The teaching cue is to keep the "elbow up" on the backhand turn or stop, and put the "top hand across" the body on a forehand turn or stop. The puck is often lost by the player who fails to keep it close to their body. Some players lower their one hand on the shaft of the stick and use a free arm/hand to help protect the puck.

Theoretical conclusion

Coaches can use these principles in their own analysis of skills. By breaking the skill down into phases they are easier to observe. By applying the biomechanical principles to the skill analysis, the coach can recognize what the athlete can do to improve their performance. A coach's ability to observe and apply these principles in a practical fashion will be an important part in their coaching approach.

4. Develop an observation plan

How, when, and where to observe requires careful consideration. If you try to see everything - you may see nothing. The viewing position may vary from drill to drill, as well as, from skill to skill. For example, in a 1 on 1 attack drill, the head coach might take a long view from centre ice, while the assistants might focus from the ends or corners. The side view could reveal the gap on the rush and the posture of the defender. The
end view could show the alignment on the rush and the pivot of the
defenceman in response to the drive skating of the forward.
The key task for the coach is to know what they wish to observe, and how
to look for it.

Keep in mind when isolating a specific skill it is ideal to view it from the
right angle and from far enough away to "see" movement in your field of
vision. To view a skating stride, positioning on the centre ice dot will
provide an ideal field of vision. You can also use the horizontal and
vertical lines of the boards as a reference line.

Avoid distractions! The coach has to "focus" - single-mindedly blocking
out people and sound. In viewing the skill, a long overall view provides
a good first impression. To analyze in detail, you must then focus on a
specific body part. This will greatly aid your analysis.

The coach's analysis should be preceded by an overview of the phases of
the skill that are being studied. This background information is critical
to an accurate analysis. It takes time and effort, but it is a worthwhile
investment for the coach and player. With this background information
and practice at observation, the coach can better:

• find out how the player actually performs the skill
• determine how they could perform the skill better
• use the knowledge gained to detect and correct errors to improve
  the skill.
3. PRACTICAL ANALYSIS

3.1. FORWARD SKATING ANALYSIS CHECKLIST

1. Side view
   Does the skater have proper:
   1-1. Body lean? □ □
   1-2. Bend at waist? □ □
   1-3. Bend at knees? □ □
   1-4. Alignment of shoulder over knee over foot? □ □
   1-5. Head position (eyes up - arch in neck)? □ □
   1-6. Lower back arched? □ □
   1-7. Rhythmic use of arms/stick? □ □
   1-8. Stride length? □ □
   1-9. Replace foot (quick - smooth)? □ □
   1-10. Height of foot after stride? □ □

2. Rear/front views
   Does the skater have proper:
   2-1. Position of balance leg during stance and glide phase? □ □
   2-2. Stride push (noting its direction: (side and back)? □ □
   2-3. Arm/leg co-ordination? □ □

3. Forward skating correction/remedial exercises
   1. Dryland exercise:
      - ballet squats
      - Russian hops
      - plyometrics
      - stair routines
      - skipping,
      - rollerblade-aerobic skates.
   2. On-ice exercise:
      - stationary hops/turns/squats
- skipping on ice - 1 foot/2 foot with turns
- moving squats\T-pot in straight line - on curve
- moving jump turns - 2 foot/1 foot
- power stride hops
- down & back - with verbal (mental) cues, 40 sec. to complete the skate, eg. 15 sec. of skating and 25 sec. of rest
- key is to focus and follow the cues such as:
  - arch the neck - eyes up
  - arch the lower back
  - roll the rear (balance leg under body)
  - quick feet - short stride
  - quick - slow - quick
  - reach with shoulders
  - build up speed
  - knee ahead of foot
  - "your best cue" - players will sense the "feel" of a cue which helps them the most.

3.2. BACKWARD SKATING ANALYSIS CHECKLIST

1. Side view
   Does the skater have proper:
   1-1. Backward stride? Yes No
   1-2. Body position ("sitting tall")? Yes No
   1-3. Shoulder position (behind knees and over heels - weight then helps pull the skater)? Yes No
   1-4. Knee position (over foot)? Yes No

2. Rear/front views
   Does the skater have the proper:
   2-1. Position of balance leg (under body) Yes No
   2-2. "C" cut (a full toe push)? Yes No
   2-3. A straight line direction of skating? Yes No
   2-4. Hip movement with good weight transfer? Yes No
3. **Backward stride correction/remedial exercises**

1. Backward squats.
2. Backward duck shoots.
5. Pull partner - "C" cut without resistance.
6. Pull partner with resistance - partner varies resistance by kneeling on:
   - 1 knee
   - 2 knees
   - on stomach.
7. Figure 8 - backwards with "C" cut (toe pushes).
8. Backward power stride/hops - pushing off drive leg and hopping laterally to the glide skate.

4. **Backward cross-over correction/remedial exercises**

1. Pull partner with resistance while skating backward:
   - full snowplow by partner
   - partner slides on stomach.
2. Step-cross-slide progression:
   - step - cross - and slide sideways (on outside skate) 6 repetitions each way
   - step - cross - step - cross - and slide on outside skate - both ways. 2 repetitions each way
   - step - cross - step - cross - step - cross - and slide sideways. 3 repetitions each way.
3.3. TIGHT TURN AND PUCK PROTECTION ANALYSIS

CHECKLIST

Does the skater have the proper:

1. Weight distribution on inside leg?  
2. Body position ("sit" - "bum" down)?  
3. Inside foot position (acts like a steering wheel)?  
4. Outside foot position (use of heel of blade for power as the motor)  
5. Puck control with the:
   - Forehand (wrist across)?  
   - Backhand (elbow up)?  
6. Quick footcrossover to accelerate. (Good timing with no lag so as to gain space/time. The skater accelerates out of the turn with a quick cross-over)?

1. Tight turns correction/remedial exercises

1. T-pot squats - straight line and on curve.
2. Flat foot skating - wide stance, close stance, scull (heel - push skating).
3. Scull the circles - balance leg on side.
4. Figure 8 skating flat footed inside circle.
5. Skating figure 8 - with a tight turn.
6. Keep away - use tight turns and puck protection.
3.4. BACKWARD TO FORWARD PIVOT ANALYSIS

CHECKLIST
Does the skater have the proper:

1. Stance with feet close at time of pivot
   - heel to heel?  
   - arch to heel? 
2. "C cut" before pivot (helps open skater up to pivot)?
3. Arm position (help pivot)?
4. Shoulder movement (bring shoulder around)?
5. Foot position (quick feet to accelerate after the pivot)?
6. Crossover - pivot stride?
   (cross square then pivot. Feet are in excellent position if defender crosses square)

1. Pivot correction/remedial exercises
   1. Repeated "C" cut preceding pivots. Work both pivots in random space.
   2. Repeated cross square and pivots in random space.
   3. Controlled 1 vs 1 along boards. 1 vs 1 where defender strides, pivots, pins, and repeats along boards. Go both ways to reinforce the pivot in each direction.
   4. Game like 1 vs 1 attack drills.

3.5. TRANSITIONAL SKATING FOR DEFENCE ANALYSIS

Transitional skating for defencemen means the change from offensive skating (forward to gain attack) to defensive skating (backward to defend attack). This is more evident in international hockey where teams tend to re-group often. European teams tend to make a quick transition and this requires special awareness and skill by the defence.

Canadian defence selected to play in international competitions have a major adjustment to make to cope with the transition game, as well as, the motion and the larger ice surface. These players seem to get trapped against the rush. When following up the ice in an attack situation or in a re-group, the defenders tend to lose their momentum either waiting too far back or getting caught too far up as the rush goes by. The ability to maintain momentum and position to play the transition and change
from forward skating to backward skating needs attention, instruction and remediation.

1. Skill description

As the defence follows the play they skate forward staying within 1 zone of the puck. When the defence sees the turnover, re-group by changing from forward skating to backward skating keeping the same speed as the attackers. The defence must maintain the momentum and read the rush being aware of motion in front, as well as, any player behind.

Skating forwards in one direction and accelerating backwards in the opposite direction requires the skater to shift the weight and transfer the momentum into backward acceleration. With a shift in weight and power, "C" cuts are made as the skater uses the skate edges to accelerate backwards and establish good gap, and have control against the attack. Players grasp the skill quickly and master it easily by practising it under control in an open space.

3.6. TRANSITIONAL SKATING ANALYSIS CHECKLIST

Does the skater have the proper:

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Movement up with the play?</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>2. Direction of momentum to change direction?</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>3. Position to use the skate edges aggressively - &quot;c&quot; cut and cross under?</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>4. Position to accelerate backwards to establish gap/lane control?</td>
<td>□</td>
<td>□</td>
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<tr>
<td>5. Body position (have a tall posture)?</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>6. Gap (play the rush with proper gap control)?</td>
<td>□</td>
<td>□</td>
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1. Transitional skating correction/remedial exercises

1. Demonstrate the "idea" of changing from forward to backward skating. The idea should suggest shifting weight to use the forward momentum to transfer the force through "C" cuts and crossovers into backward skating. (A video may be necessary to demonstrate this) The skater may turn their blades to 3:00 or 9:00 o’clock in forward skating and unweight into backward acceleration. Keep the eye on the puck at all times.
2. Have the players skate forward to top of circle and backward to the
bottom of the circle. Emphasize weight shift and acceleration back-
wards using a "C" cut and crossover. Repeat on all 5 circles, pivot at
the 12:00 and 6:00 o'clock positions.

3. Play Rushes vs Regroup
   - 1 vs 1; 2 vs 1; 3 vs 1,2, or 3 one way drill
   - Instruct the attackers to circle back a number of times before
     attacking. Defence must keep their momentum by maintaining
     their skating.

4. Coach instructs the attackers and backchecker(s). The defence will
develop the reading ability, as well as, their transitional skating skill.

3.7. 1 VS 1 ANALYSIS CHECKLIST
This means observing the defence's skating, gap and lane control, pivot-
ing and checking.

Does the skater have the proper:  

1. Transition from forward to backward skating?  Yes No

2. Movement up the ice with the play to establish position
   against the rush?  Yes No

3. Read of the rush and establish gap control?  Yes No

4. Alignment (properly using the stick for lane control)?  Yes No

5. Pivot movement?  Yes No

6. Angle (to finish the check and control the puck carrier)?  Yes No

1. Backward skating 1 vs 1 correction/remedial exercises

1. Defence 2 and forward 4 (in diagram 1) start from same end but
   opposite sides of ice surface. Defence must touch the far blue line with
   skates as the forward receives a pass from 5 with speed to counter the
   1 vs 1.
Diagram 1

Progression:

- defence use no stick, with hands joined behind the back. This develops the skating technique to maintain gap control and alignment
- no stick - hands free
- stick turned over
- normal - live 1 vs 1.

2. Backward acceleration from goal line to blue line
   - skater races alone at top speed
   - cues are "sit tall", or "pull heels straight back".

3. Backward races - 6 skaters at a time
   - Vary the distance goal to blue/red/far blue line.

4. "4 x 6" Drill - Players skate backward on whistle, then sprint 6 strides forward, 6 backward, 6 forward, 6 backward, then skate backward easily. Stress quick feet and acceleration.

5. 1 on 1 Acceleration Drill - for defence.
Diagram 2
- defence 2 and 3 start facing the puck carrier. Initially starting on the dot, but as skill is developed, they may move one half of the way between the dot and bottom of the circle. Eventually one of the defence could stand on the bottom of the circle.
- forwards 4 and 5 start on goal line in corner with a puck and attack the defence on coach's whistle.
- the defence cannot pivot until they cross the centre ice line.

Teaching points for the defence:
- "sit tall", "pull heels straight back"
- turn body sideways to start. Quick crossovers. Crossover no more than 2 times each way initially - 1 time is preferred.
- "c" cut, then undercut will achieve maximum acceleration
- the defender should stride when the gap is under control.
- the defender may or may not pivot. Keep the attacker on the outside.

6. 1 vs 1 weave drill:
- defence mirrors the forward
- forward begins at 1/2 speed, then 3/4 speed, finally full speed
- defence maintains gap control and speed by striding or using a crossover.
3.8. CONCLUSION

The coach's challenge is to provide attention to skill analysis and correction. Taking into account a seasonal plan, a major commitment is needed by the player in the off-season. In their dryland training, besides improving fitness variables, they must do the exercises appropriate to affecting skill execution. These hockey specific exercises must be incorporated into the training program.

The seasonal practices must challenge and develop the skill of the player. Some drills might need a "time out" to review the skills within them. Incorporate the skating drills which compliment your tactical drills in your skating warm-up. Use competitive drills with high tempo to enhance drill effectiveness. Know the purpose of your drills and the skills which are required for the drills.

These skills will enhance the individual tactics that develop team play. Spending too much time on team play may be less beneficial than high tempo/game-like skill drills which compliment team play. Look at some of your favourite drills and add a skill demand to them. For example, have:

- the defence keep their feet moving while executing a skating manoeuvre after they pass
- the goaltender initiate drills with a pass.

Good skills are a matter of good habits. Remember practice does not make perfect - it makes permanent. Hopefully, your practice reflects proper skill performance and tactics rather than poor technique. The ability to analyze skills is important. The ability to correct and improve these skills is a key role for the coach. Your skill at analysis and remediation will reflect the development of your players and the performance of your team.
4. **N.C.C.P. THEORY SUPPLEMENT**

1. Concepts of Biomechanics
2. Biomechanical Principles
3. Error Detection and Correction Techniques
THE ANALYSIS OF SKILLS (NCP THEOREM)

Principle #7: Angular momentum is constant when an athlete or object is free in the air.

Principle #4: The straight and strong principle: The greater the applied impulse, the greater the increase in velocity.

Principle #3: The production of maximum velocity requires the use of joints in order – from largest to smallest.

Principle #2: The production of maximum force requires the use of all the joints that can be used.

Principle #1: The stability principle: The closer the line of gravity to the center of the base of support, and the greater the mass, the more stability.

Observation: Biomechanical principles are invaluable to the analysis of skills. Above all, these principles help sharpen skills of...
When athletes want to spin more slowly, they should decrease their moment of inertia.

Angular Motion

- Apply a force in the opposite direction.
- Decrease their moment of inertia.
- Use as many joints as possible.
- Decrease muscle mass associated with beginning with those joints in sequence.

Linear Motion

- Decrease their moment of inertia outside the base.
- Narrow their base of support.
- Place their center of gravity in the middle of the base.
- Increase their mass.

Maximum Effort

- They should move quickly (become less stable).

Stability

- They should become stable.
### The Analysis of Skills

**Function:**
- Athletes learn to recognize correct kinesthetic feelings (by
  - Creating the proper mental "self" by retraining the focus,
  - Corractive training)
- Athletes are provided with familiar situations to attempt
- Provides athletes a visual sense of correct execution of technique
- Provides opportunities for athletes to see performance
- Critical feedback is specific and age-appropriate

**Purpose/Advantages:**

**Error-Correction Techniques**

- Athletes teach each other
- Athlete completes a self-assessment
- Use key points from technical charts to assess movement
- Assess athletes, looking specifically at results, "what happens?"
- Detect errors using biomechanics concepts as a basis for
  - Various subjects
  - Provides opportunities to view skills frequently and from
    - Focus on movement with a mental picture of correct execution

**Purpose/Advantages:**

**Error-Detection Techniques**