The Australian Nordic Ski Instructor Manual

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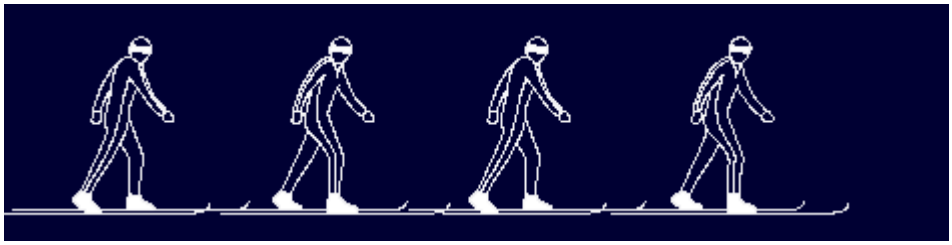
Diagonal striding (two phase)

Definition
The basic method of propulsion over undulating terrain, by using a striding action like shuffling in socks over a polished floor, with extra momentum provided by pushing with the poles diagonally opposite to the skis.

Teaching terrain
Initially flat and preferably in well-set tracks, eventually moving onto undulating terrain. The effectiveness of this lesson is generally determined by the quality of the tracks, and by how well in advance that they are prepared. Make the tracks firm, straight, and long, with a firm bed for solid pole plants.



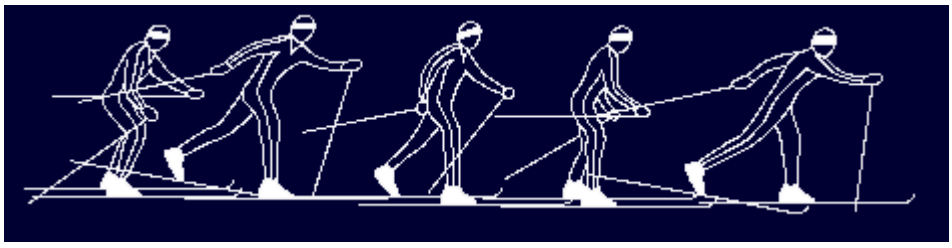
Diagonal striding: walking pace

Teaching approaches

- It is generally easier to begin by focussing on the feet and the lower body action - remove poles until later on, unless student requires poles for stability and security over rough terrain.
- Allow experimentation between stiff robot-like movements, and relaxed, gorilla-like movements. Which is more effective? Which is more comfortable?
- Alter the tempo, but not the stride length, and observe the effect. Conversely, does increasing the stride length affect the tempo? Try to avoid pausing between each stride, by likening the leg action to that of a cycling motion - legs always moving fore or aft. It is important at this stage to develop a good sense of timing in the student's movements, and not to be too concerned with the overall appearance.
- Push the knee well-forward and lock it in place throughout each stride to bring the weight onto the gliding ski in front. Does this reduce effort, or increase glide?
- 'Weight-transfer' is a common catch-phrase bandied around during these lessons. What does it really mean? What does it do? Without the ability to transfer mass (weight) from one foot to the other, in a cyclical fashion, the skier is doomed to standing still, unless they happen to be standing on a slope. The transfer of the body mass from one foot to the other is also moving the centre of mass from side to side - a lateral 'weight-transfer'. This is often mistaken as being the key to efficient diagonal striding, when it is in fact the simple act of 'weight-transfer' from foot to foot that holds the key. Warning: be extremely brief in

discussing 'weight-transfer'. It is a supreme example of 'instructor jargon', and often confusing to those who do not need or wish to know about it.

- The hips should be brought into play here. Mass transfer from foot to foot can be considerably enhanced if each hip is allowed to swing forward as the leg also swings forward. This assists the student in placing her/his mass over the ball of each foot, and thus increasing the power of the stride. Try encouraging the student to maintain striding without letting his/her heels come into contact with the ski: this exercise will bring her/his mass further forward, and enhance his/her glide. 'Doing The Time Warp Again' pelvic thrusts are a favourite crowd-pleaser, and loosens up students no end. Those misfortunate creatures who have not seen or experienced The Rocky Horror Show will doubtless ask *'Why?'* This manual will not attempt to provide an answer...
- Ever noticed a hefty slapping noise coming from the skis? This is created by one leg being longer than the other, which is sometimes a genetic problem, but usually more likely created by allowing the toes to point down towards the ground when swinging them backwards and forwards, creating (momentarily) one longer leg. The student is invariably all-too-keen to get that rear ski back into contact with the ground (probably because s/he thought that good diagonal striding involved lifting the back ski up high: this is actually hogwash!) so as to maintain balance. It is also a good sign of weak 'weight-transfer', and not maintaining a good glide on the front ski. Try this: take the skis off and swing one leg freely backwards and forwards, much like a ballerina practising by the bar. Note that it is possible to swing the leg freely only if the foot is kept flat (i.e. not pointing downwards) when it is swinging past the stationary foot. The same applies when wearing skis, and the slapping sound will go away, and the stride will be more powerful, when the skier learns to keep the foot 'flatter'.
- The overall body position needs little attention at this stage. Some skiers prefer a more upright stance than others - it is only really necessary to prevent some skiers from leaning too far forward, especially those who merely lean their upper body and leave their hips behind. Encourage the more upright to throw their hips into play (i.e. dropping their hips lower throughout the entire cycle), so that they can feel the extra power that can be gained from striding efficiently.



Diagonal striding: normal relaxed pace

- Arms need not be discussed until poles are re-introduced, and even then any technical explanation can hamper students' development. Many students stride better without poles, and in most cases they should be encouraged to spend as much time as possible diagonal striding without them, especially over varied terrain. Arms naturally swing in a regulatory fashion, to balance out the leg movement, and should continue to do so when poles are attached to the end of them. Clear up any misunderstandings the student may have about the role and function of the poles: many beginner skiers use them purely as walking sticks, and have no comprehension of the possibilities of their use as propulsion devices. This can be demonstrated quickly by getting the whole class to propel themselves (using a diagonal striding arm action) down a very slight incline without moving their legs. At what angle do the poles need to be placed into the ground? What swinging motion of the arms works best? Can this be further demonstrated by getting the class to do the same *up* the incline? What tempo works best? Is it the same for everyone? If you are unsure of an appropriate

answer, try it out with friends and be open-minded.

- The type of arm swing can be analysed in some detail. Some skiers are unable to swing their arms, but rather push and pull (much like a boxer boxing), heaving strenuously on their pole straps (make sure that they are adjusted properly). Short poles will encourage a good, but cut-off, swing, whereas long poles (esp. skating poles) most certainly encourage a push-pull movement, often with heaps of reaching forward and back, but with no 'relaxed penduluming' motion of the arm. The arm will work most effectively if it is allowed to flex slightly at the elbow throughout the swing, and swing naturally from the shoulder socket, rather like it would if the poles were replaced with 20 kg bar-bells - try it and see...
- Try 'aeroplaning' to discover where the arms work best - this is especially suited for those who ski predominantly with super-wide packs, and swing their arms in and out, reducing poling efficiency (look at each skier front-on to determine this - although they should see it themselves). 'Aeroplaning' is simply diagonal striding with the arms out as wide as they can be held for as long as possible, and then bringing them back in to a point that appears most comfortable.
- Finding that some students are unable to swing their arms behind and beyond their hips? This tends to halve the power that they might obtain from using the poles. First check that the pole straps are adjusted properly, and that they are able to hold the pole out behind them without losing control of it, and then proceed to get them to diagonal stride and yell 'push' every time the pole goes behind them.
- A good static exercise to encourage full and loose arm-swinging can be done be pairing up the group, and getting one student (the 'controller') to stand behind another (the 'demonstrator'). The demonstrator (using his/her own poles, held in the normal way) allows the controller to hold the sharp end of their poles, and they both swing the poles together, emulating diagonal striding. All that remains for you to do is move around and observe each couple and ensure that they are swinging nicely. The controller is able to apply pressure downwards (often required) on the poles to make the demonstrator pendulum more forcefully, and the controller is also able to dictate the length (arc) of the swing by either pulling at the end of a backswing, or pushing at the end of a forward swing. The instructor can act as the controller for those demonstrators that still have swinging difficulties.

Notes

Any comparison between walking and diagonal striding may lead to confusion. Walking involves a stepping action, whereas efficient diagonal stride involves a sliding action culminating in cyclic momentary glides. Slow, non-wax skis will always suffer a performance handicap (less glide), as well as altering the technique to the extent that the skier will not be encouraged to fully apply pressure onto the forward, gliding ski. This malady is often referred to as a 'late kick'. With confidence and the (learned) ability to balance on the front ski, this problem will gradually disappear. A quick solution is to encourage lots of skiing on icy snow with little non-wax ski grip, or to try out a pair of well (grip) waxed waxable skis.

Uphill diagonal-striding (uphill two phase)

Definition

To climb easy to moderate gradients with a variation of the diagonal stride, by shortening the stride, reducing the arm swing, increasing the tempo, and a more-aggressive shift of body mass from one ski to the other.

Teaching terrain

Slight to moderate uphill, preferably in well-set tracks. This technique is best demonstrated from a flat track that moves to a significantly steeper track, which then resumes to a flatter track. In this way the distinction between diagonal stride on the

flat versus diagonal stride on a slope can be clearly demonstrated and seen.

Teaching approaches

- Tempo change will have the most dramatic effect on diagonal stride grip - review diagonal stride on the flat with tempo change (faster) and observe the changes that skiers make (for example, arm swing must be reduced to keep up with foot swing).
- Reduced arm swing and leg stride will compensate for the increased tempo required, and therefore becomes an important component of uphill striding. Reinforce this with your students.
- What happens when you stand more upright climbing a short, steep hill? What happens when you crouch lower? Which allows you to throw more weight forward onto the leading ski? Most skiers can gain a little more grip by sinking lower on their skis, and by reaching a little further forward with their front foot to compensate for the reduced momentum.
- How much does bouncing up and down when climbing alter the effectiveness of the technique? It might increase the grip of the skis, but too much jumping may divert too much energy up and down, instead of along the track.
- Does leaning forward increase or reduce efficiency? Is it possible that the poles are used more than the skis to climb, and how would you resolve this? Removing the poles will highlight this function.

Notes
Terrain choice dictates the success of this lesson. The best choice is a short ramp of 20 metres or more, leading from one level area of track to another, thus allowing a clear demonstration of the change of technique from one gradient to the next.

Well-waxed and non-wax skis may well climb up virtually any slope of soft snow without any change in technique. It is important in these instances to choose a slope that cannot easily be climbed using ordinary diagonal stride, if you wish to teach the variation in technique required, otherwise it will be wasted as an exercise. A very firm and icy, but level track with even a slight ramp to a higher level will work well for those using non-wax skis.

Single-arm resting (three phase)

Definition
A variation of diagonal striding, by the rhythmical resting of one arm whilst striding, often used to alter diagonal stride tempo in difficult terrain. Also used to rest the torso whilst climbing a hill, and especially when cornering on a medium to large radius track, as the inside arm pole-plants less frequently.

Teaching terrain
Flat, or slight uphill, preferably in well-set tracks.

Teaching approaches

- Review diagonal stride first to ensure that all is in order.
- A slow demonstration will be required a number of times, of just one cycle (one arm rest), so that the movement is understood. A static exercise without skis and poles and just walking through the motions helps a good deal.
- Move onto skis and carry poles mid-shaft and swing them, skiing in the tracks and replicating the movements. Then, as the students are comfortable with the arm rest, the poles can be carried normally.
- Practise with both arms (one cycle only in a stretch of diagonal striding) a number of times, until it is possible for the students to rest one arm as the

instructor dictates.
- Counting the beats, or phases, reinforces the rhythmical nature of the technique, and will be helpful when trying to link a number of single-arm rests together. The exercise of resting one arm, and then the other, repeated many times, is one that takes a good deal of practice - demonstrations are essential.

Notes
This is also a wonderful exercise to develop good diagonal striding. However, if diagonal striding, or two phase, is still a little shaky, then single-arm resting, or three phase, is extremely difficult to pick up.

Double-arm resting (four phase)

Definition
A variation of diagonal striding, by the rhythmical resting of both arms whilst striding, often used to rest the torso whilst climbing a hill.

Teaching terrain
Flat, or slight uphill, preferably in well-set tracks.

Teaching approaches

- It is best to review diagonal striding (two phase) and single-arm resting (three phase) before moving on to double-arm resting (four phase).
- Practise (as for single-arm resting) the arm action alone, counting the beat loudly but slowly (with the following actions in brackets):

  'One [swing one arm forward and one arm back, but hold one forward - for example, the left one], ***two*** [swing the remaining arm forward and hold it forward], ***three*** [pause but get ready to swing the first arm back down again], ***four*** [swing the left arm normally, and prepare to swing the right arm normally]'

  Note that on the count of two, the left arm rests for a beat (phase), and on the count of three the right arm rests for a beat (phase).
- Follow on by introducing a striding action (no skis or poles yet) with every count, and repeat the counting until students have got the idea. The striding continues normally, without any slowing or stopping, and should therefore present no problem if done without too much thinking. Only when the timing is all in order should you introduce the skis and poles (together).
- If trouble is found in the co-ordination of the hands with the legs, it could well be that the diagonal striding is not yet well adapted. However, it may help to lead into the double-arm resting with a fair amount of ordinary diagonal stride before and after one 'set' of double-arm resting.
- If the student has no rhythm (it happens!) then it is best to avoid too much technical explanation of how to do it but rather give plenty of demonstrations. Slow it down as much as possible though without losing any sense of rhythm.
- Stress the need to hold both hands forward for a whole stride (watch the hands out in front), otherwise the skier will fall directly into passgang. It may seem like a very long time to keep one's hands poised out in front, but it is essential if the right arm is to follow the right (left) leg!

Notes
This is also a wonderful exercise to develop good diagonal striding. If diagonal striding, or two phase, is still a little shaky, then double-arm resting, or four phase, is extremely difficult to pick up. It helps to practise this on a slight uphill gradient to prevent the students' skis from running away from them too much. Many times this technique is considered a conceptual problem, when in fact it is relatively easy to perform if one is competent at all striding techniques. This technique is an excellent build-up to one of

the many forms of transition from one technique to another - in this case five phase (see below).

Transition (five phase)

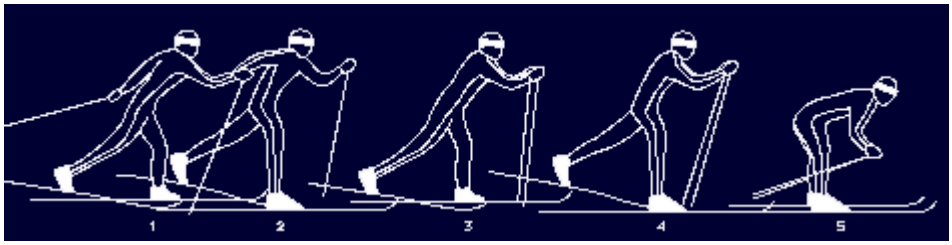
Definition
To move from diagonal striding, on the flat or uphill, to any double-pole variation, by a fluid, single transition of leg and arm movements, thus maintaining, or even increasing, momentum.

Teaching terrain
Undulating, preferably in well-set tracks and over the top of a slight hill.

Teaching approaches

- Review two phase, three phase, and four phase - especially four phase (see previous techniques or refer to the glossary for translation of these items).
- The natural tendency when double-arm resting (four phasing) is to do something with both of the hands just dangling out in front. For most people it is a very simple matter to double pole with the poles, and stride both feet together (finishing in a stride double-pole).
- If the students are still confused by all of this, count them through it as for double-arm resting:

  'One [swing one arm - the right one will correspond with the picture - forward and one arm back, as in diagonal stride], ***two*** [swing the left arm forward and the right one back - this is why diagonal stride is sometimes called *two phase*], ***three*** [swing the right arm forward again, but leave the left arm forward - hence the term *three phase*], ***four*** [rest the arms ready for pushing, but take another swing of the legs and fully extend the back - *four phase*], ***five*** [completion of a double-pole push - *five phase*]'
- Then move on to introducing the skis and poles, and walk them through slowly, remembering that from the count of one to the count of four, the legs stride normally, and on the count of five, they come together as per stride double-pole.



Transition from diagonal striding action to stride double-poling

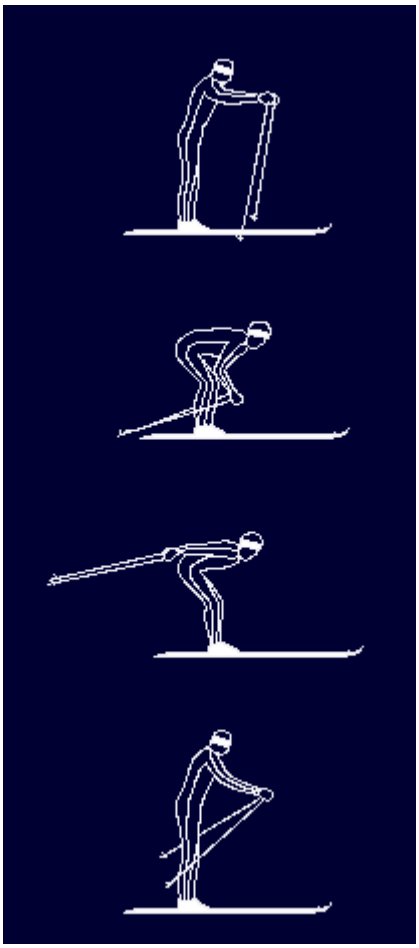
- Technically speaking, some would argue that it is best to rest the arms fully for two full strides before double-poling (five phase), rather than the more obvious one full stride (four phase with a double-pole push). Either way is just as effective - the latter is quicker, whilst the former develops a stronger stride and therefore more grip. Neither is more correct, and most people would probably make their own choice of which to use. It pays to be versatile here, especially if, for instance, you were to misjudge your stride and be slightly short of the lip of a hill when you are ready to double-pole off the side of it - an extra stride without the poling action would help out here, as it is pointless to double-pole off the 'wrong' side of a hill in terms of moving forwards rapidly or efficiently.

Notes

Find a slight rise over a well-defined hump, and diagonal stride up towards it, aiming to go over the top using stride double-pole. This is a very slick and effective way of using the terrain. The natural transition from one technique to the other will be exactly as described above - why bother to make it sound complicated?

All of the above 'phase' techniques are comparatively little-taught in this age of skating, and yet they are techniques that are probably used without thought a good deal more than people would first imagine. On the track, and especially in classical racing, these techniques can make all of the difference between a competent skier and some-one who is just very fit. The benefits for tourers is that these techniques will conserve precious energy, and allow the back muscles to recover from time to time, which is most important when wearing a pack on the back for *any* period of time.

Double-poling



Definition
To move the skier on undulating terrain, either in set tracks, or over ice, or reasonably-packed snow, by keeping skis parallel and slightly apart, and using the poles and upper torso to propel the skier along. Often used when other techniques become ineffective at increased speeds.

Teaching terrain
Undulating, preferably in set tracks.

Teaching approaches

- Best taught initially on a slight downhill track, so that momentum can easily be maintained. Get students to stand with skis parallel, and plant their poles well in front of their feet. Ask them to try to propel themselves along by merely pulling on the poles. Repeat the process with poles planted behind the feet. Which is easier?
- Having discovered the most comfortable position for the pole-plant (remembering that it will vary depending upon terrain and the speed of the skier), the efficiency of that pole-pull can be highlighted by asking students to lock their elbows to their rib-cage and repeating the forward movement. Bending at the waist is then mandatory for any movement at all!
- Emphasise the need to plant poles pointing rearwards (try it the other way if uncertain), and swing the arms in a long arc towards and beyond the thighs, pushing out to the rear.
- The relationship between the arms and the upper body is important to have an effective pull - the angle (in profile-view) between the upper body and the arms should remain around 90 degrees to work efficiently - look to see if the angle increases dramatically during the pull phase. It will naturally decrease as the push phase occurs.
- By pushing (not pulling) the pole grips away from the body, and down towards the ski tips, the skier should feel a levering action with the upper body and particularly the shoulders being projected forward. The end-result being that

less arm-strength is required for the same amount of propulsion.
- Tempo is important to maintain an efficient action. Try slowing the action right down, and compare it with a much faster action. If the answer isn't obvious, try it yourself and see, remembering that we are all have different 'natural' tempos.
- Encourage a continual movement of the arms back and forth in an arc. Watch for a delay as the poles are brought forward and swung into the air - it takes extra effort to hold the poles even momentarily above the snow. Perhaps the poles are too short? What if they are too long? How will long poles affect the arm-swing? A quick tempo will often reduce the 'time-delay' seen in a slower poling action.
- Rising up onto tip-toes as the arms swing forward allow an even greater compression of the upper body onto the poles, but is not always necessary for most skiers. Note also a slight fore and aft split of the feet enhances stability.
- Poles work most effectively when planted parallel to the body (viewed from the front or rear). Exaggerate the arm spread by pushing the arms out wide as they are brought forward to encourage this. Fast-tempo or sprint double-poling is easier with the arms held well out from the torso, using very different muscle groups altogether. Why is this so? Does it matter?

Notes
Alpine skiers will tend to sit back on the tails of the skis (a squat at the end of each pole-push) and negate any levering action the poles might have had. The focus should be placed on the shoulders and head providing the gravitational force over the top of the poles. Therefore, any compression of the legs will tend to reduce this effect.

Some skiers may observe that racers bend their backs over to an almost horizontal position, whilst tourers hardly move from a vertical upper body position. It all boils down to a matter of efficiency of action - neither is more 'correct'. A good number of tourers will compensate inefficient upper body action with a much stronger poling action, especially those with strong arms and/or shoulders, and when wearing a heavy pack.

Some upper body movement is desirable in demonstrations to show students the benefits and extra efficiency to be gained from using more muscle groups.

Stride double-poling

Definition
A method of increasing speed, or maintaining momentum, whilst double-poling, by the inclusion of a stride between each double-pole push, either by the same leg, or alternating from the left to the right legs.

Teaching terrain
Undulating, preferably in set tracks.

Teaching approaches

- Review double-poling to ensure that the basics are in place.
- The next logical step is to focus on the stride of the stride double-pole. You may wish to review diagonal striding particularly the striding and gliding - but not so much the arm movement.
- To focus on the stride alone, work on one single stride (from either foot), and follow through by bringing the feet back together, and then stride out again. Note that this action propels the skier forwards, and that the ski and leg left behind merely slides back to rejoin the other ski. It is therefore not necessary to encourage a rear leg lift (a waste of effort and balance) at all - this should only occur as a resultant reaction to a very powerful and energetic stride forwards, as in racing-speed diagonal stride.

- The poles should be brought into play now, and this is easily done by suggestion. Get the students to repeat with you *'stride - double-pole'* and perform the action that they describe. Repeat as often as possible, on either leg, or the same leg.

Stride double-poling

- Vary the tempo by getting everyone to stride double-pole together, with you calling the shots. Vary the stride length from very short *(stride double pole)* to very long *(stride - - double - - pole)* and discover the difference in power.
- A strong hip-thrust helps to develop efficient gliding over the lead ski - focus on striding with the foot and the hip, and not on kicking the leg back, to enhance this feeling. Reaching too far forward will only negate this feeling, so try to encourage a less powerful arm swing than used in double pole.

Notes
A number of strategies present themselves, some of which can lead to confusion. The name 'stride double-poling' alone causes a good deal of confusion - even amongst instructors. 'Step double-pole', 'double-pole kick', and 'one-push double-pole' are all terms used and recommended by people and ski instructor organisations that should know better.

Whilst it may be argued that these terms are appropriate if explained carefully, all of the latter lack consistency with the two techniques that they are drawn from. Otherwise we should call diagonal stride 'diagonal kick'!

Stride double-pole (or double-pole striding) is a technique that many will emulate without feeling its full effect and strength, purely because so much attention is placed on the rear leg lift. The rear leg need not lift at all at slow to medium speeds, as in slow diagonal striding, and any forced movement upwards takes effort, and moves the centre of balance upwards. At speed, however, momentum is gained from swinging the leg high, and can be applied when swinging it back down, so long as the swing down is halted as the rear foot joins the forward foot (as in diagonal stride) to convert the pendulum effect into an increased forward propulsion. This effect is negated if the foot is allowed to swing all of the way through and beyond the previously forward foot.

Advanced skiers will allow the foot to slide a little in front, which has the appearance of a 'double-shuffle', thus extending the glide. This is not an error, but merely a refinement.

Double-stride double-poling

Definition
A method of increasing speed whilst double-poling, by the inclusion of two strides between each double-pole push. Also useful for resting the upper body, and when skis begin to lose their grip.

Teaching terrain
Flat to slightly uphill to provide gliding resistance, preferably in set tracks.

Teaching approaches

- As for stride double-pole, but it is wise to begin by reviewing the leg movements in diagonal stride. Two strides followed by a bringing of the skis together for a period of glide will highlight the 'stride-stride-glide' tempo.
- Once this rhythm has been set, bring in the arm swing, perhaps with a review of double-poling alone. However, this should be superfluous if the timing of the 'stride-stride-glide' is well-ingrained.

Notes
This is identical to stride double-pole except that two strides take place for every one of the more normal stride double-pole, making it seem very much more powerful. The advantages of this is that it allows a more relaxed upper body movement - the arms have twice as much time to recover after each (half-speed) swing. It has also been said that this technique works well when using very stiff-cambered skis (as were skis of old), to obtain more grip. Note that it is possible to triple-stride double-pole, quadruple-stride double-pole, etc.

Skate turning

Definition
A method of changing direction and accelerating, usually from one track to another, or around a corner, by double-poling and skating off the outside ski into the new direction, followed by another double-pole to maintain momentum and balance. When using it to ski around a corner, the double-pole push may not always be required to assist in maintaining acceleration or balance.

Teaching terrain
Preferably a set tracks direction change, or around a well-packed corner, initially on flat terrain.

Teaching approaches

- A slalom on the flat will automatically introduce skate turning without the need to go into any great detail. Use the students as slalom poles, and get the student at the rear of the line to ski to the front by zig-zagging through the other students, using double-poling as much as possible. The next 'rear' student can follow on, and so on.
- Review double-poling technique and ensure that the upper body is effective, otherwise the skate turn may end up being less powerful. It is not always essential to use a double-pole push when skate turning, but it helps to maintain balance.
- The skate push off itself is important. How low a body position can you push off from? How tall (straight leg) can you push off from? Which is more effective?
- Edge the inside edge of the ski that you push off from, and skate out into a new direction onto a flat ski. Try it again with no edging of the push-off ski. What does this tell you? Focus on the ski that you glide onto. What happens when you let it land on an edge instead of flat? Will it reduce its glide? what happens when you land on the outside edge of that ski? What role do the knees play in all of this?
- As with all skating (divergent skis) techniques, minimal ski lift is required to change the direction of the ski. Excessive lifting will not only waste energy, but will also bring the skier's centre of mass higher at a time when it would be desirable to go lower. How do your students lift their skis? Ask them! Is it a heel-lift, or a toe-lift?
- All of the above exercises work best without the interference of poles and arms. The pole action can assist in pushing the skier into the new direction, and the arm-swing assists in providing further momentum. Timing of the pole push is

therefore important to watch.
- The arm action should follow the skis, and thus bring the body in line with everything else. Therefore, after a pole push, swing the arms across the body and towards the new direction of travel as soon as possible. This can be reinforced by practising a smooth double-pole - skate - double-pole single change of direction.

Notes
There is a difference in performing one skate turn, with a double-pole either side of the skate, and a series of skate turns. The former is generally used just to make a sudden change of direction, but basically maintaining a straight line. The latter is most often used to accelerate around a short or long radius corner, usually out of well-defined tracks.

Both are the same in that they accelerate the skier into a new direction. Step turning (often mentioned in this context) is different to both of these in that there is no acceleration in the execution of the change of direction. Simple!

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