

Auxiliary Teaching

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In consideration for

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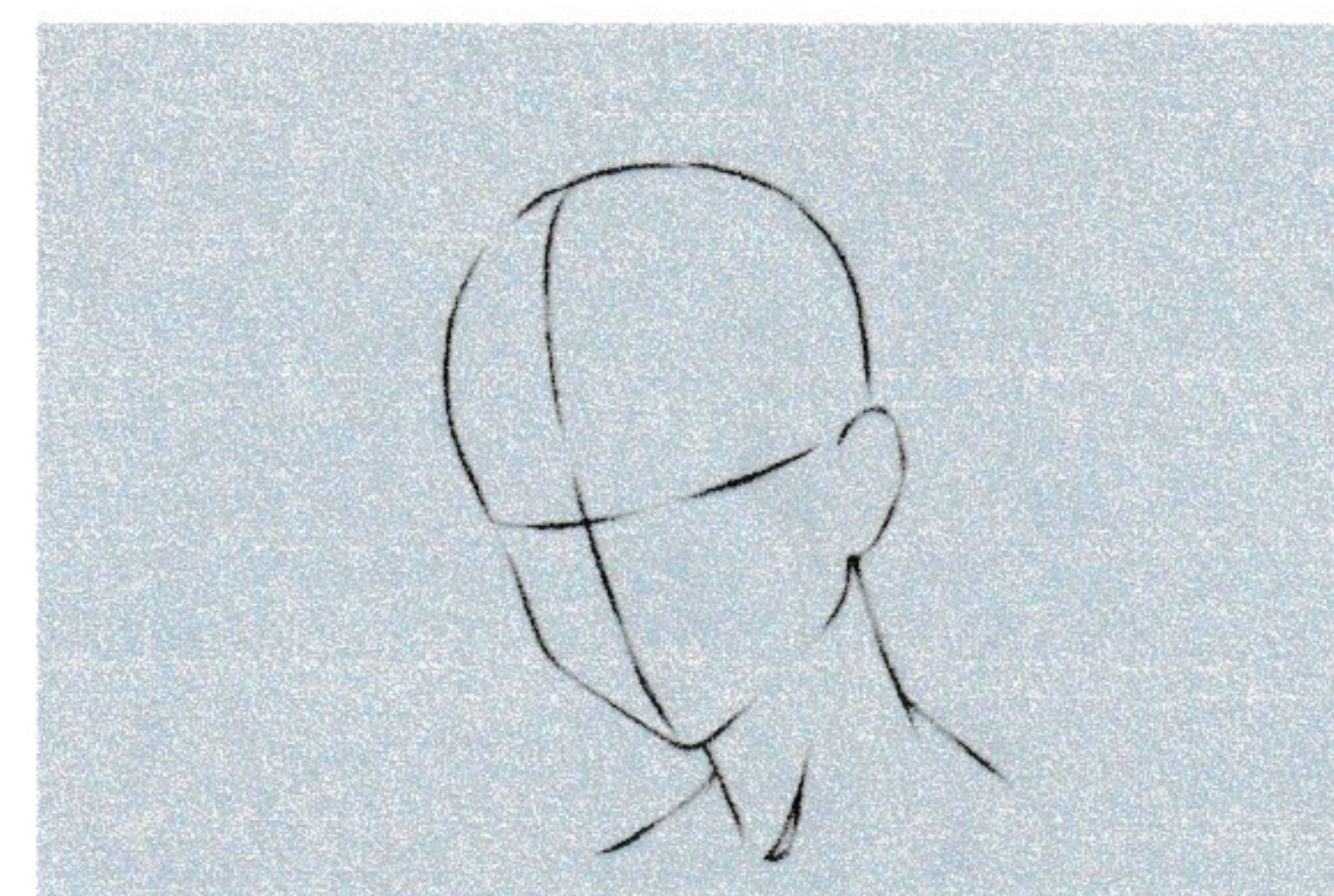
A new student tightens a white belt around their waist. They've never practiced martial arts before, and little do they know the world of technique, etiquette, and adversity ahead of them. During their first night, a Sensei pulls them aside to walk them through the basic stances and blocks. Only, the student is having trouble; they swing their arms and reach down, up, around, struggling to figure out the technique. The Sensei is a bit surprised, everyone else they've taught this move has understood it the first time. Perhaps what this Sensei does not know is that this particular student does not know right from left, or that the student is a visual learner who could benefit most from seeing the movement performed by another person. In order to be best equipped to teach, Senseis need to be both aware of their student's mental load and familiar with their student's learning style.

First and foremost, prospective teachers need to be aware of their student's mind and its limitations. Learning places great stress on a student's mental resources, and once a point of overload is reached, their ability to take in new information is sharply reduced.^[1] Sometimes there is too much going on in the mind. Sometimes learning is not a pleasant experience. Learning can be tough. We often underestimate the amount of time and practice it takes to master a new skill. Luckily, the sources of mental stress can be identified and there are plenty of ways to alleviate that stress.

Cognitive load theory was developed out of the study of problem solving by John Sweller in the late 1980s.^[2] He maintained that when a student receives too much information or is called upon to complete too many tasks, they cannot process the information and it inhibits their learning. Sweller put the types of cognitive load into three main categories: intrinsic load, extraneous load, and germane load. By instructional design, he argued, the mental load a student faces can be kept at a manageable level.

Intrinsic cognitive load comes from the inherent difficulty of the task.^[3] Each task is considered to have a different intrinsic weight to it based on what needs to be done. Some tasks are light, such as adding one plus one and finding the sum is two. Some tasks are heavy, like using algebra to solve multiple systems for a single unknown, or using calculus to find the surface area of the underside of a bridge. There is nothing a teacher can do that will change the intrinsic load of the problem. At some point they simply cannot eliminate any more steps. Nevertheless, there is a way around this. Chandler says that if the individual steps are taught in isolation and brought together as a larger scheme, the load born by the student is drastically reduced. This is why we teach the same kata differently to a student who knows it than to a student learning it for the first time. Correct form requires low stances, careful arm, hand, and leg placement, shifting of weight, and synchronization between hands and feet. The full sequence of events is too intrinsically complex for beginners to learn; only by piecing together a little bit at a time can the order be internalized. After the student has memorized the sequence and proven that they can do it on their own regularly, they can be taught to refine their technique. With this approach, no matter the intrinsic cognitive load of the task, anyone can learn it.

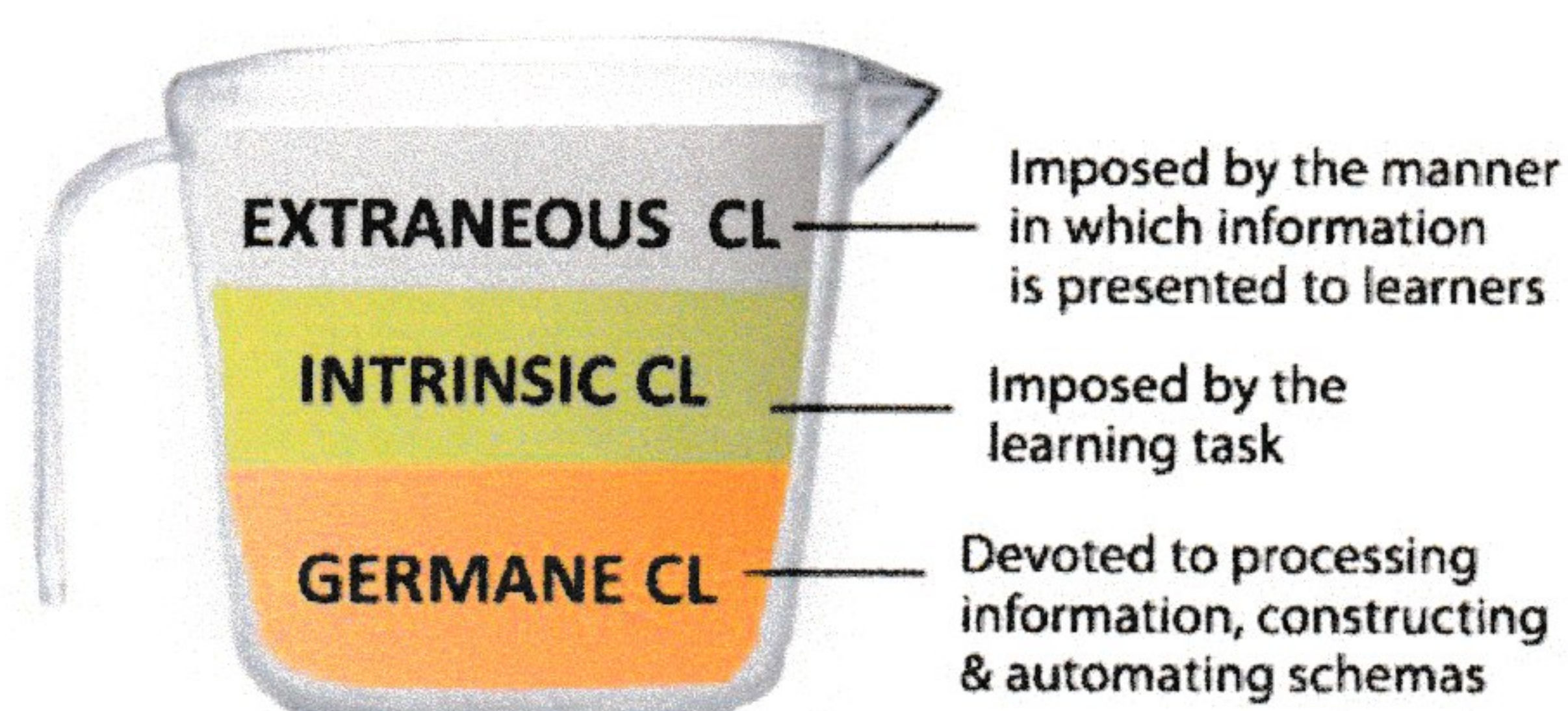
Extraneous Cognitive load is a bit different. Cognitive load study shows that when excess information is presented, especially through unnecessary words, the learner suffers. This is extraneous load. The term refers to the manner in which information is presented to the learner, which is wholly determined by the instructor.^[4] The best illustration of how extraneous load works is to consider two methods used to teach a young child what a square is. The first method involves asking the child to close their eyes and picture a bounded shape with four sides, all fixed perfectly straight, with two pairs of lines parallel



to each other, one vertical and the other horizontal. This method uses words to help the child construct a square in their head. Eventually, with enough discussion, they could perhaps draw one. The second method is to simply show the child any square. Since a square is not a verbal concept but a physical, artistic one, teaching it through a physical medium is better than through the more abstract route. In this case, it is less taxing on the mind and also more time efficient. Simply put, extraneous cognitive load is found anywhere the task has been made unnecessarily difficult.^[5] In karate class, it is preferable to teach concepts in the medium in which they are performed or best understood. Hence we teach kata best by performing kata, history best by reciting history, and save verbal instruction for more abstract concepts like stretching.

The third source of cognitive load is germane load. Germane load is tied to the processing and construction of schemas.^[6] Essentially, the brain reserves some of its processing power to make pathways that will process faster next time. It is important to note that each student's brain has limited resources available to bear the weight of the intrinsic, extraneous and germane loads. If the learning is moving too fast, or unnecessary information is being conveyed, students may have difficulty making any lasting schema changes because they don't have enough capacity for germane cognitive load. Germane load is the ideal source of mental strain while learning, since it creates lasting results. Given that intrinsic weight is irreducible, it is best to minimize extraneous load and maximize germane load.

These three categories, intrinsic, extraneous, and germane, account for the cognitive load faced by the student. Since the mental stress of learning can be mitigated by the teacher, it is in the teacher's best interests to keep an eye on



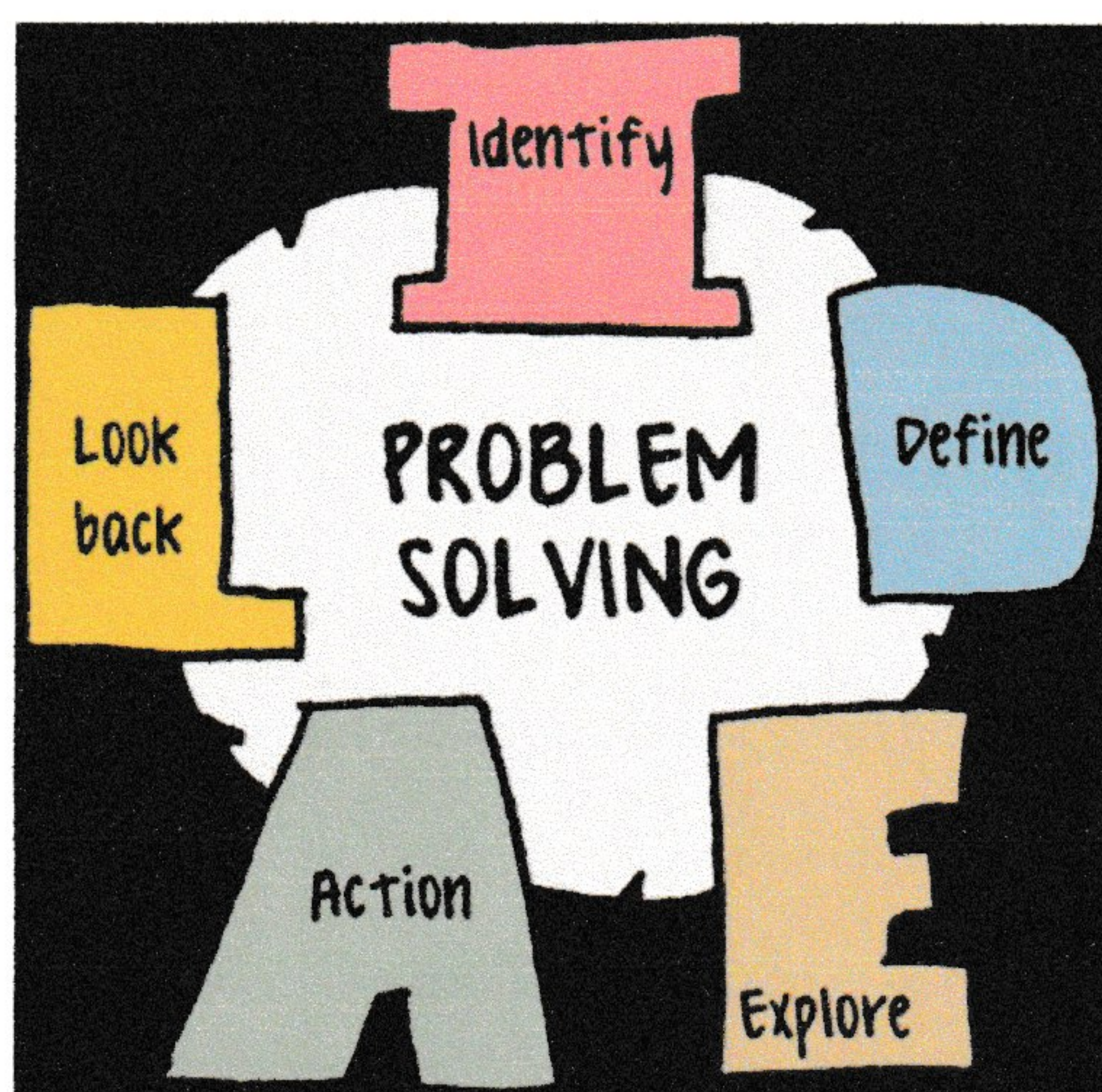
the students and adjust instruction so that they have the greatest capacity to learn.

With the research available today, it is clear which practices help and hurt the learning process by increasing and reducing the cognitive load. The three things that teachers can do for their students in this area are to discourage multitasking, make problem solving simple, and activate student's prior knowledge.

Many people believe that they can accomplish more, faster, by multitasking. The idea here is to work on one primary goal but allow a secondary goal to assume priority in the brain, consciously dividing your time between multiple non-demanding tasks. For example, reading email while watching TV. People compare our human brains to a computer brain with parallel processing. However, multitasking is a myth; humans do not have the ability to parallel process. Earl Miller, a professor of neuroscience at MIT, says we simply can't focus on more than one thing at a time.^[7] Though we appear to, the brain is actually switching from focusing on one thing to another at incredibly high speeds. While we can perform tasks simultaneously in unrelated parts of the brain, such as recognizing music and walking, when it comes to actual learning situations, multitasking does not exist. Remember that a single line of processing bears the full weight of the intrinsic, extraneous, and germane cognitive load. Switching focus back and forth rapidly is possible, but at high cost. When switching, it can take learners up to four times as long to recognize something new and it lowers their rate of retention even if they do.^[8] What's best is if the student is focused for a period of time and only switches tasks occasionally. This limits the extraneous load associated with digging up relevant information that was in storage during the last task. It's not bad to change your focus every once in a while; in fact, it relieves boredom. However, multitasking while learning slows the task and inhibits learning heavily, since there is less room for germane load. In the dojo, one example of multitasking is practicing kata while maintaining a conversation. No one can expect to improve their kata in the midst of answering

questions. Our ability to multitask is widely exaggerated, even into myth and hyperbole. Since it produces too much cognitive strain, students should be led away from multitasking and encouraged to focus on one task at a time.

Much like multitasking, there are misunderstandings surrounding the role of problem



solving in learning. Problem solving can impose a heavy cognitive load.^[9] Many educators favor problem solving and assert that it is one of the best ways to learn new material. They believe that when students create a solution for themselves, the resulting retention is greater than if it was presented by someone else. In some cases, where the student has a grasp of the basics and the actual problem scenario

poses a simple difficulty, problem solving is feasible and produces little mental burden. Partially worked problems are a good example. Some Senseis make great use of problem solving to teach strategy in kumite. Once the match is over or paused, they step in and work with the student one on one, simplifying the whole situation and creating one central problem for the student to solve. This allows the student to learn a new solution or strategy, this backfist or that timing, etc. without having their focus divided between fending off an opponent, trying to make a plan of attack, and listening to advice or instruction from outside of the ring all at once. To be clear, this only works because the situation is oversimplified; implementing problem solving to teach kata is not a good idea. Imagine how long it would take a student to learn the first kata if they learned the sequence as a response to an attacker who was performing the traditional bunkai. As each attack was presented, they would attempt other steps, other blocks, other attacks, and perhaps never arrive at the intended sequence of moves. Although it is tradition,

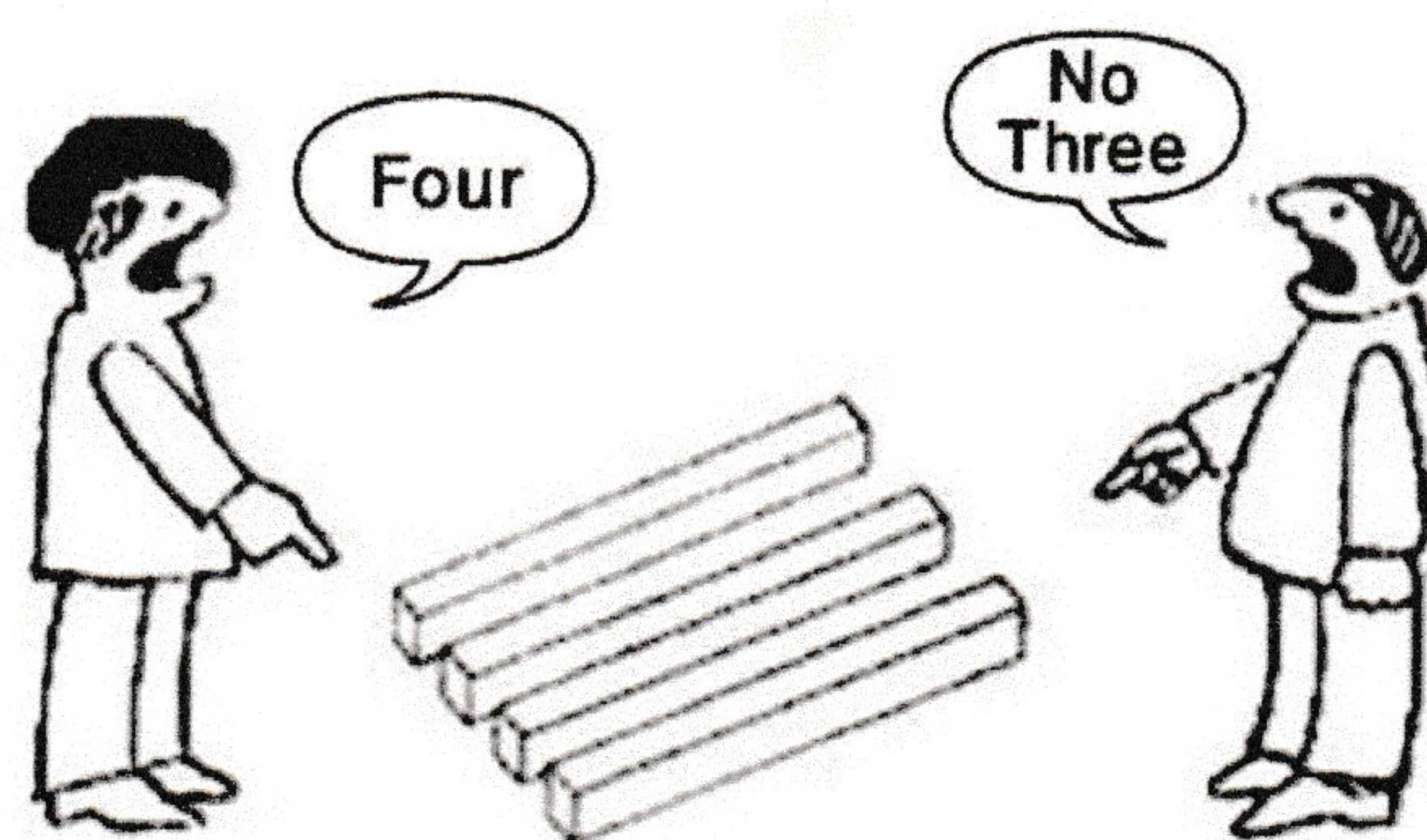
problem solving cannot be relied on: everyone is subject to overload, it's not true that we can learn more than one thing at a time. Teachers need to be careful when and how they educate students through problem solving.

The third way teachers can keep mental strain under control is by activating students' prior knowledge. Research shows that teaching is more effective when it assesses and uses prior learning so that the teaching may be adapted to the needs of students, affirming accuracy and correcting flawed knowledge.^[10]

The National Research Council, in their book "How People Learn," wrote, "All learning involves transfer from previous experiences. Even initial learning involves transfer that is based on previous experiences and prior knowledge."^[11] Prior knowledge is like a peg on which to hang new concepts; our brains use this information to make sense of new ideas and experiences by connecting outward from known to unknown. According to John Hattie, Director of the Melbourne Educational Research Institute in Australia, "New information that cannot be related to existing knowledge is quickly shed."^[12] Hattie also maintains that "Prior knowledge effects readily outweigh the effects due to IQ or so-called 'learning styles.'" When teachers take the opportunity to announce the lesson topic and ask questions that resurface the students' prior knowledge, it prepares the class to

connect new ideas to old ones and enables them to do so in a way that is less taxing on their mental resources. Often, students will be eager to express that 'yes, they have heard of 'X' before,' or that they know some relevant details and facts. These short moments, set

It is really confusing!!!



aside for retrieval, pay dividends throughout the learning process. There is, however, a caveat to this great tool, it can also be a hindrance.

Some prior knowledge is wrong or inaccurate, based on misinformation. The technical term for this obstacle to learning is called 'interference.'^[13] For example, when some karateka hear that kata needs to be powerful, they clench up their muscles and force their way through. This is exhausting and makes the finer movements of the kata near impossible. Sensei will see them struggling and tell them to relax for better technique, but inside this creates conflict. They may ask "How can I have a powerful kata and relaxed kata at the same time?" These people experience interference; they try to learn correct form, but they are held back by what they know. The best way to combat this interference is through something called "bridging." Bridging is where a series of steps or objects the student is familiar with are brought together to explain a particular phenomenon.^[14] In this case, Sensei can overcome the interference by showing a student how to tense up to fire a punch so that they can experience powerful technique. Then the Sensei would have them hold position and relax their muscles. By explaining that kata comes in a series of clenched strikes and relaxing pauses, the Sensei can improve the student's rhythm in their kata. They can create a bridge from what the student understands clearly to something they misunderstand due to interference. Otherwise, misconception can be a significant obstacle to improvement. Some interference to learning technique is simply due to muscle memory that students have carried over from former styles. In any case, it is important to be aware that difficulty learning a new technique could come from misconceptions that the student stored away in the past.

Before beginning instruction, teachers have a brief opportunity to check the students prior knowledge. This can be as simple as asking them to express what they already know of a

technique and has the twofold benefit of activating the student's prior knowledge and revealing potentially interfering information.

Many teachers know to avoid confusing their students by asking them to do too much all at once, but when they avoid multitasking and carefully encourage problem solving, and combine it all with a regular discipline to activate prior knowledge before a lesson begins, they will have little to worry about when it comes to the classes' mental fatigue.

As stated above, learning places great stress on a student's mental resources. The last thing an instructor wants is for their student to reach cognitive overload and give up, burn out, or continue practicing without learning. Instead, the teacher can counter intrinsic load by spreading out the content into a series of tasks, they can present the information in the most accessible mode to reduce extraneous load, and they can activate prior knowledge and avoid stressors that create unwanted mental strain in the learning process.

Knowing that each student shares some cognitive limitations is handy. Knowing how to teach so that students don't suffer under those limitations is even handier. Sometimes teaching a student is as simple as repeating the material the way the teacher learned it themselves. However, sometimes it takes a bit more. Even a capable teacher finds from time to time that their student does not understand a concept the way it was explained. In addition to being aware of student's mental capabilities, teachers who can identify and teach to their student's learning style are well equipped to help students who are having trouble grasping difficult concepts.

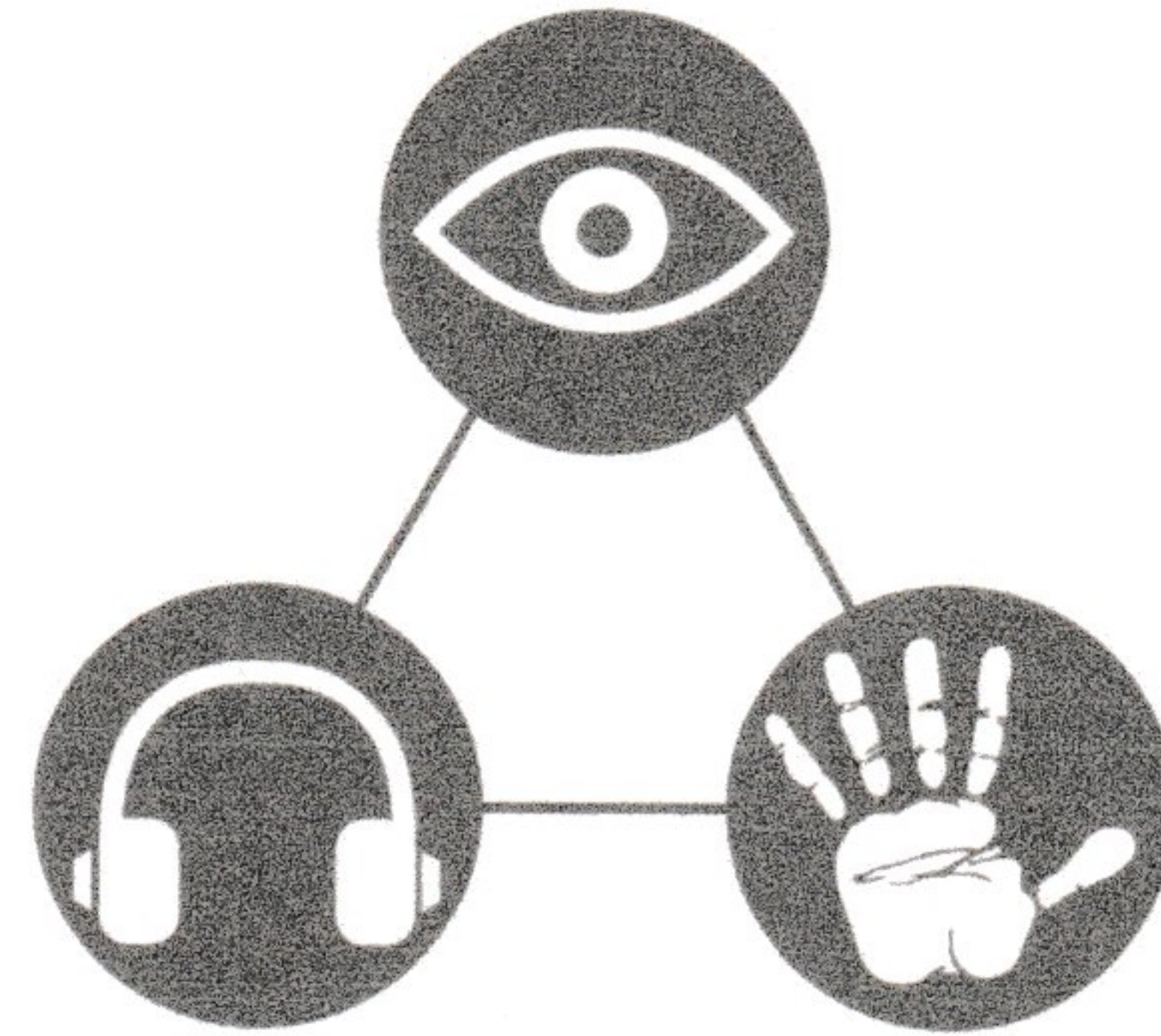
Learning styles are the modes through which the brain identifies and interprets outside information. They influence how individuals approach tasks such as reading a map or cooking a meal. For instance, different people go about figuring out how to use a new piece of technology in different ways. Some read the instruction book cover to cover. Some ask a friend to show

them the ropes. Some prefer to simply experiment and push all the buttons. In the 1970's,

Doctors Rita and Kenneth Dunn started researching how

students' learning styles could be identified and taught to.^[15]

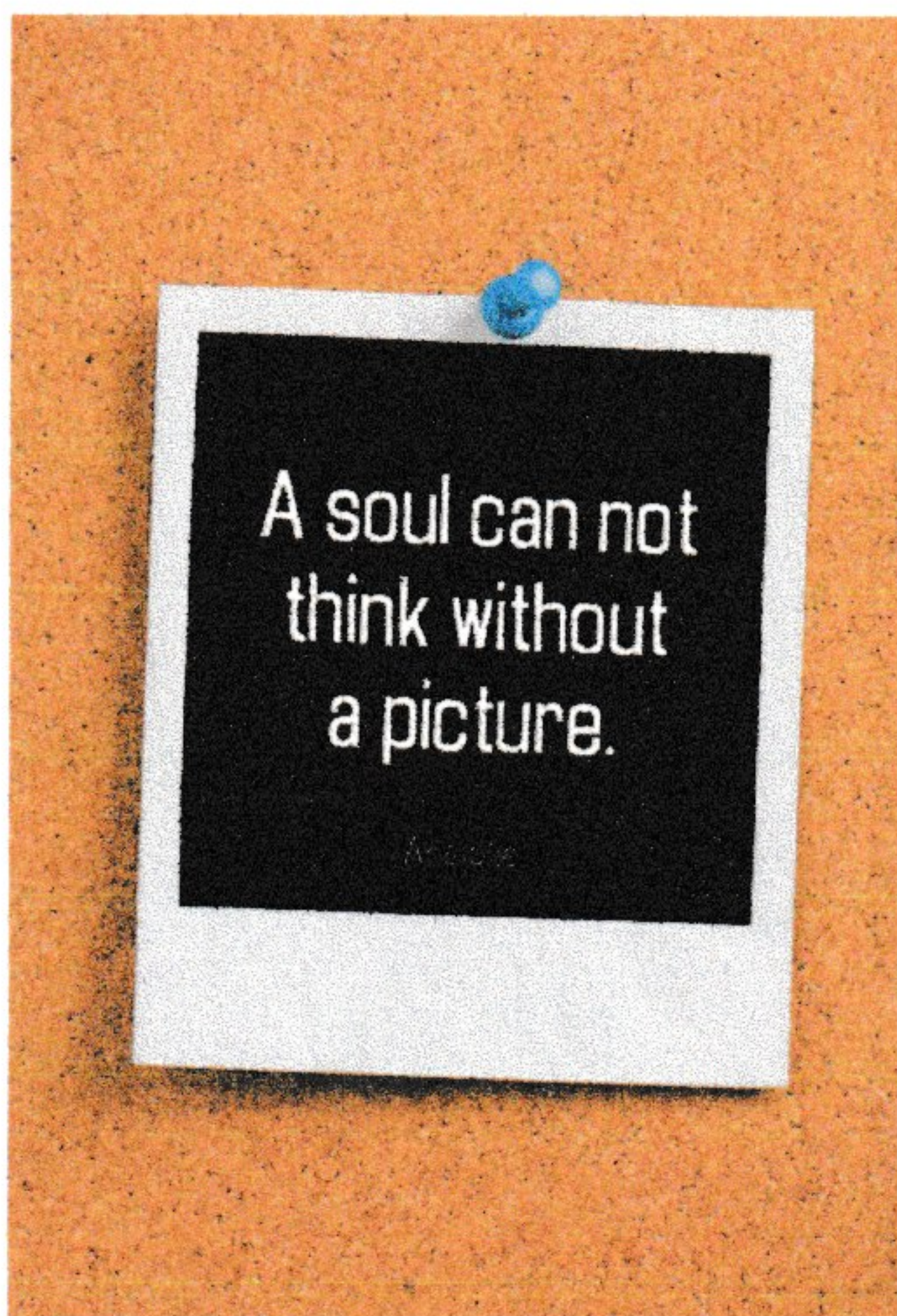
They claim that not only can students identify their preferred learning styles, but that students also score higher on tests, have better attitudes, and are more efficient if they are taught in ways to which they can more easily relate. Therefore, it is to the educator's advantage to teach and test students in their preferred styles.



The term 'learning styles' can be fairly broad: Dunn and Dunn go so far as to suggest that there may be as many learning styles as there are learners,^[16] since each learner's style has twenty one different determinants including environmental, emotional, sociological, physiological and psychological factors.^[17] In general, students fall into three categories as visual, auditory, and/or kinesthetic learners. Much of the research and study surrounding this field is gathered through self-reporting, and as such many education experts argue that learning styles are more likely learning preferences.^[18] These preferences are as follows. Some people learn by seeing or envisioning a concept. Some people learn by hearing instructions or discussing the ideas at play. Some people learn by trial and error or interaction with the problem. People tend to teach according to how they learned, so identifying a person's learning style is helpful for teachers as much as students.

The theme of the visual learner is that they absorb and recall information best by seeing. Visual learners are most common, making up about 60-65% of the American population according to Dunn and Dunn.^[19] They write that these individuals have an inclination to see a concept as whole rather than individual parts. They benefit from seeing the aims and objectives

of learning sessions or from understanding the purpose of the session. It's easy to spot a visual



learner when they are working with predominantly auditory or kinesthetic information because they create visual representations of the information to make it more accessible. They tend to prefer taking their own notes, and reading off notes for themselves. Some visual learners go straight to videos when they need to learn something new because it just "makes sense" when they can see the process involved. These individuals rely heavily on their sense of non-verbal cues from their instructors and other students when

there are no other visual aids available. Because of this, they may prefer working in groups or practicing through role play, which maximizes their opportunities to watch and learn a demonstrated skill. When they can, visual learners tend to favor sitting in the front of the classroom.^[20] In the dojo, it is reasonable to assume that these students will gain a deeper understanding of their kata by working on bunkai and observing their interaction with physical attackers than by hearing the applications described aloud. Similarly, in order to make improvements to their kata they may need to see someone better than them perform it correctly.

Aforementioned John Hattie, education researcher, has several suggestions for visual learners. He recommends that they sit or stand where they can see the instructor, and that when they learn something new they should definitely write it down.^[21] He also recommends that the visual learner make use of mind mapping to store large pieces of information. Mind mapping is where a student pictures an image associated with one central idea and visualizes that concept branching out to related ideas. Hattie's last piece of advice is to use flashcards for memorization. In order to teach according to these students' strengths, physically demonstrate all technique to begin the learning process.

Auditory learning is a learning style in which an individual learns through listening. Auditory learners make up roughly 30% of the population.^[21] Dunn and Dunn write that an auditory learner depends on hearing and speaking as the primary mode of learning. These individuals discover information by interpreting pitch, emphasis and speed. They gain knowledge from repeating aloud after an instructor or reading instructions out loud. Auditory learners must be able to hear what is being said in order to understand and may have difficulty with instructions that are written. They also use their listening and repeating skills to sort through the information that is sent to them. Auditory learners tend to have a theoretical style of learning that builds part to whole. First they need to understand small parts of the overall picture and then they move on to understand the relationships between those parts so that they can create a bigger picture. An auditory learner is skill oriented, memorizes tasks well and benefits from traditional styles of teaching such as lecturing and question and answer sessions.^[23] They may be reluctant to make their own notes. Auditory learners tend to have a knack for ascertaining the true meaning of someone's words by listening to audible signals like changes in tone. When memorizing a phone number, an auditory learner will say it out loud and then remember how it sounded to recall it. They tend to recall accurately what has been spoken, but may gain little benefit from additional reading or writing out facts. They enjoy explaining their learning to others in the group and learn from discussion.

To appeal to an auditory learners' strengths, encourage them to ask questions. When giving them a series of facts or a large batch of information it is highly effective to have them sort it into rhythmic patterns, a song they already know or an easy poem. They may find it helpful to repeat facts with their eyes closed. A quiet, reserved teacher who prefers to demonstrate motions and not talk about the ideas behind them is going to cause some difficulty for the auditory learner. As one Sensei put it, "I have found that it helps certain students to

explain why they must move into a certain position: i.e. 'Do not let your front knee go too far forward because your knee will become injured if you repeatedly do that.'"^[24] He also recommended providing a simile when something is difficult to explain, such as Kyoshi's favorite, "Shoot your shuto hand downwards as if lightning bolts come out of it." Once a teacher has identified a particular student as an auditory learner, they can rely more heavily on asking questions to check the student's understanding; remember that discussion may improve their technique more than demonstration.

Individuals that are kinesthetic learn best with an active "hands-on" approach. Price, Dunn, and Sanders (1980) found that very young children are all tactile/kinesthetic learners.^[25] "There is a gradual development of visual strengths through the elementary grades, and only by fifth or sixth grade can most youngsters learn and retain information through the auditory sense." Kinesthetic learners only make up about 5% of the adult population. With this style, learning takes place by the student actually carrying out a physical activity, rather than listening to a lecture or merely watching a demonstration. These learners favor interaction with the physical world. Because of this, their visual and auditory senses are not necessarily engaged in the learning process and they have a difficult time staying on target.^[26] They absorb information best by doing, experiencing, touching, moving or being active in some way, and prefer learning by doing as opposed to having thought it through before initiating action. They may not benefit from reading or listening. Moreover, such students need few verbal or written instructions and are confident in participating in hands on activities. It is common for



them to try to focus on two different things at the same time. As opposed to the auditory learner, the tactile learner will try to remember things by going back in their minds and visualizing their own body's movements.

Teaching a tactile learner is as simple as demonstrating a principle and then immediately having them try it. Since visual and auditory learners are far more common, it is typically best to have some sort of explanation or demonstration first, as opposed to having the student 'discover' the technique. In kids class, however, almost all of the students will be kinesthetic learners and this sort of teaching may satisfy their constant need to move. It is not unusual for kinesthetic learners to have high levels of energy which may cause them to be agitated, restless and/or impatient, but they may not be aware of this and are not distracted by their own 'fidgeting.'^[27] When they can't figure out a particular stance or motion, one of the most effective ways to help them is to move their body into the correct position. A kinesthetic learner can often

'feel it' when their technique is right or wrong. For Tactile learners, Hattie recommends having them participate in simulations of the task or technique.

These three learning modes, visual, auditory, and tactile/kinesthetic are not highly exclusive. Obviously, everyone receives information through all three modes and learns according to the information they receive, people often find they have overlapping traits from multiple styles. Still, people tend to express a preference. When a student gets stuck and seemingly cannot figure out how to learn a technique, this theory might explain why. In summary, every student tends to have a preferred way of learning, and some instructors feel that knowing the student's learning style helps them to come up with alternative teaching methods when they get a blank look. Teachers who are aware of the theory behind students' learning styles have an extra tool in their toolbelt for figuring out the problem. Nevertheless,

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