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Transmission by the Learner Develops Learning; And Advice for Peer Leaders

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Transmission by the Learner Develops Learning; And Advice for Peer Leaders

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Abstract

The act of transmission by the learner is very important to the process of learning and committing to permanent memory for future access. *Transmission* occurs through an action by the learner, for example, through oral *communication,* or through *writing*. In comparison, reception by the learner, for example, by reading, hearing, or watching, is a passive process. The reason why so many expert educators promote Active Learning Strategies comes from the successful results derived from *transmission* occurring during these active periods of learning. Current digital content platforms have lost much of this vital process. To achieve and then reinforce deep learning, the physical action, the process of transmitting by verbalizing and by writing, needs to be stressed and supported. All forms of education, including Peer-Led Team Learning (PLTL) Workshops, need to provide for, encourage, promote, and stress transmission from the students. They, in turn, need to practice the verbal or written *transmission* of the subject matter. Peer Leaders in PLTL workshop sessions must consistently encourage learners to communicate with each other and must themselves abstain from taking on the role of the *mini-professor* by giving explanations or pointing to screens or boards. Active engagement through transmission of content – whether talking through the process of solving a problem with another, comparing written methods through discussion in small groups, appreciating missed steps – forces the brain into active motion and into long-term memory. In order to achieve a quality education, students are often not presented with an essential opportunity to learn through transmission. Educators and administrators of educational institutions can enhance their approach to teaching and learning by using and promoting transmission techniques in small group settings such as PLTL workshop settings.

Keywords: Active Engagement, Peer Leaders, Deep Learning, Transmission, Passive Learning, Reception

Introduction

Learning requires *transmission* more than reception in order for the learning to 'stick' in memory. All Active Learning methods and strategies (Bonwell & Eison, 1991; Felder & Brent, 2009) involve and promote the *transmission* of the knowledge from the learner. Success in 'learning' is strengthened by the learner **transmitting** what they are trying to learn. *Transmission* cements the understanding. This occurs in several ways, including oral, written, or performative *transmission*. The reason why so many expert educators promote Active Learning Strategies comes from the successful results produced by the acts of *transmission* during the activities. When the learner repeatedly practices a physical skill, such as riding a bike, it is not surprising to realize that for the "riding a bike" skill to be truly learned, the learner must personally do it – they must demonstrate and practice the skill, they must transmit their new knowledge from their brain into the physical world. The same is true for conceptual skills. We posit that to grasp an understanding of knowledge, it must be personally transmitted from within the brain through the body to the outside for learning to be achieved. In true learning, one is modifying the brain. True learning benefits from the physical process and the exporting of that knowledge by transmission.

Why is transmission by the learner so important? Transmission requires the learner's brain to formulate the thoughts that will be transmitted. That formulation requires ownership, requires a command and organization of the parts, and requires an understanding of their relationship to one another. This act of willful unification of old and new concepts to generate the required transmitted output, is a necessary process for true learning to occur. Thoughts and intentions are sent outward to the fingers to write or for the mouth to speak. The more often the person doing the transmission, practicing that act of transmission, the more the transmitter places the content into permanent memory. It is commonly known that repetition helps people to remember, but it is the act of transmitting during this process that is so vital to the learning. This is true even if you are transmitting to yourself: that is the action of 'studying'! All forms of education should provide for, encourage, and promote transmission from the students trying to learn. In short, to be successful learners, students need to practice the *transmission* of the subject matter they are studying.

The fault of reception

Today's students appear to believe that "learning" involves the receiving of information, as in looking on phones, watching videos, reading silently, listening in class,

and hearing information coming from some learned source other than themselves. Generally, this reception of content is passive learning. Having heard or watched something, students will immediately conclude: "Yeah, I understand that" meaning: "I've got that; I can do that, I will remember that." The next day, students who have only received content from someone else will have difficulty remembering what they have received (Gotian, 2025). In reality, these students have not (necessarily) retained the content, nor understood what it means (Bloom, et al., 1956); They do not have command of the knowledge nor how the specific content is transferred to more permanent memory. We assert that students have not necessarily learned what they have read, seen, and heard – even if they think they have. Exposure to content through reading, hearing, watching and realizing the understanding of the written or spoken word is not true learning, it is only part of the process, and is only reception. A golfer does not become an athlete and great golfer by reading or hearing about golfing or by watching excellent performance via display.

Today's culture has normalized entertainment received via short video clips, and this content is usually consumed on phones passively. No transmission of the content – or reaction other than "like" – is required or involved on the part of the consumer, only the looking and the listening, the reception. The most entertaining content naturally captures the most time and attention, and the content's value is therefore ranked by its entertainment value. Unfortunately, using this criterion, content that is not entertaining is often perceived as not valuable or not worth one's time.

By contrast, a lecture in school takes a commitment to understanding the material, even if presented in a boring manner; its perceived value and importance may not be appreciated and little attention is paid. A reason that lectures are considered boring is because students are often excluded from transmitting in the class setting, as they are only expected to sit and listen, passively receiving information from the lecturer. This problem is exacerbated by large classes, where the chance of every student participating in a meaningful way is very low.

Cheating is another manifestation of reception and a lazy non-active approach to gaining answers (not knowledge). When a student cheats and looks up the answer that someone else has produced or someone else provides (or uses Artificial Intelligence or CHEGG (www.chegg.com), that is reception. Cheating rarely helps make information stick into memory, because the new knowledge is never "owned" knowledge. **Getting the answer from any source other than formulating (or re-formulating) it in one's own brain is *reception*.**

Transmission techniques

Doing one's best to provide one's own thoughts is transmission. Everyone must exercise a muscle in the toolbox of our very humanity. When anyone uses a blank sheet of paper or a blank screen (and maybe some form of data) to struggle with, develop, and write down the answer to a problem (like an end of chapter/module/unit question), that is transmission. One's own brain is struggling with the question and producing the result of one's own personal thought: *that is transmission*. The process of learning how to develop the answer to this kind of question is strengthened.

When one asks a teacher, tutor, or website to model how to proceed in solving problems, that is only the first step in the process of learning and is one of many perfectly reasonable approaches. It is what happens next that sets deep learning apart from shallow effort. *Students must be encouraged* to re-cite, re-transmit, and re-think what they have heard or read. This is fundamental to excellent education, and educators need to encourage this behavior in students.

However, a word of caution is needed. It may sound like using transmission is just a better memorization technique. But the true goal here is to provide students with a way to transcend the memorization of simple details and give them a unified understanding of the concepts and the interrelationships between the simple facts, and then to be able to integrate knowledge and synthesize their own high-level understanding of problems and solutions (Bloom et al., 1956). Without this transcendence, knowledge is just a bigger computer memory that stores facts without knowing or understanding why or the relationship among the facts.

Educators speak of "Time on Task" (Bloom, et al., 1956). To be effective, more time on task needs to involve more personal *transmission*, thus fostering more learning and retention into permanent memory. This is true, even if the time on task is only transmitting to oneself (actively, deliberately, outwardly) as one goes over the content one is trying to learn. Better learning takes place when the time on task involves actual, voiced transmission to others (as in PLTL Workshop). John Dewey's "Learning by Doing" (Dewey, 1916; Dewey, 1934) emphasizes experiential learning and active engagement. This is transmission by the learner. Essentially all of the levels of Bloom's Taxonomy (1956) represent active involvements of transmission by the learner/individual conducting the actions. Kolb (1984) defined learning as: "…the process whereby knowledge is created through the transformation of experience" (p. 38). The fourth quadrant of Kolb's Experiential Learning Cycle is "active experimentation: trying out what you have learned." That is transmission

from self. These educators did not explicitly state the importance of *transmission* in the process of cementing learned content into permanent memory, yet it is ***transmission*** that is important.

Socratic questioning (Russell, 1946) and the Socratic method (Conor, 2025) offer processes of setting up transmission after transmission from the learner. The 'teacher/mentor' asks a series of probing questions. The subsequent responses, transmissions by the students, guide them in critical thinking, critical understanding of the subject, critical intellectual growth. The more depth to the transmission required from the 'learner', the deeper the critical thinking is developed, and the deeper the content is placed into memory.

Writing is transmission. Why take notes? Why take **hand-written** notes? The Reason: brains use this action very well for learning how to remember. There is a strong evolutionary connection between the movement of a person's hands and their brain. Early childhood development experts teach children sweeping hand motions, fine motor skills, and arm movements to reinforce their will, their control, expressions, and their mastery of communication and language. This is especially useful for language development, specifically writing and memory (Andra, et al. 2020; Roberts, et al., 2022; Mathias & von Kriegstein, 2023; Cushing & Bodner, 2022; MacLeod, 2011). The act of writing is the process of transmission from one's own brain, onto a surface like a sheet of paper or a tablet, to support the process of learning. During class, the notes one takes should be just the first step. The speaker/teacher is talking fast; if the content is new and foreign, the student's brain struggles to understand. The student writes furiously, trying not to 'miss' the point.

The act of re-writing one's notes in one's own interpretation and language **soon after lecture,** or soon after reading or watching, is very good practice for effective learning. The simple act of *transmitting* the information again through the brain, fingers, or voice, is essential.

All of us speak or talk to ourselves. This is an act of interpreting and arranging the world around us and incorporating new experiences, which essentially is an effort to describe the world to ourselves. Though internal (and for some, external), this is also a form of transmission, and it is one kind of transmission we are describing here. Consider, for example, "Nomenclature," which is a topic generally difficult for most students of chemistry – and all of STEM (Science, Technology, Engineering, Mathematics). New nomenclature is repeatedly considered throughout STEM (and all) coursework. Here is a specific example. To help with learning the naming of chemical acids and the ions they

produce in aqueous solution, students in chemistry sometimes learn the mnemonic "-Ic I -ate that horrend-ous b-ite" (e.g., UTEP Peer Leaders: Workbooks). This mnemonic helps students associate the naming of the acid (such as "nitr-ic" acid) with the naming of the polyatomic oxoanion it contains and produces in aqueous solution, "nitr-ate". Furthermore, it also associates "nitr-ous" acid with its oxoanion "nitr-ite". Repeating the application of the mnemonic silently and deliberately, or better yet, out loud, is a form of transmission. Repeating (i.e., actively doing) this over and over to ourselves is transmission and helps us learn and remember.

When we say to ourselves, "Think of another example," we are asking ourselves to transmit and to *transform that knowledge into a more fundamental distilled understanding.* By coming up with a similar example and transmitting it, the student distills that one case understanding into a general, more encompassing knowledge. That greater perspective is an important goal of education.

The role of the Peer Leader or facilitator

Eric Mazur popularized the teaching/learning method *Peer Instruction* (1997) during lecture: "Turn to a neighbor and explain." Every student speaking during these "Please explain" instances is transmitting and asking the listener to transmit in reply. A student's reply (transmission) is cementing their understanding during that explanation. Typically, attendance during lecture classes dwindles during a semester because students are not challenged successfully, unless they are transmitting (participating!). The professor is transmitting; the students are passively receiving.

True understanding and true learning are enabled when using the brain to formulate and transmit the interpretation of what is seen or heard. This is enhanced by repeatedly reviewing and re-thinking to oneself, but especially in struggling to explain it (out loud is best) to a few others and peers, *You see it (or hear it), and now, **you** say it (transmit it)! Now do it again*. This seems so basic, and it is basic, it is fundamental! So do not forget how important it is, how fundamental to learning is transmission!

Peer-Led Team Learning (PLTL) (Gosser, et al., 2010; Gosser, et al., 2001; Wilson & Varma-Nelson, 2016) provides exactly the opportunity for this practiced, recreated transmission. The Peer Leader in a PLTL workshop can **cause** this and **facilitate** this and **promote** this, encouraging and developing students' abilities in transmission. Sometimes Peer Leaders think their job is "speaking the truth" to Workshop students (Christian, et al., 2023): "Despite these extensive training programs, some Peer Leaders still misinterpret the

purpose of PLTL, believing that they are required to teach, mimicking a 'standard' lecture format, rather than facilitating the learning of their near-peers" (p. 60). By facilitating their "near-peers" to actively speak up (transmit), Peer Leaders are promoting the magic of great learning. The old-fashioned lecture format has its place and its value in providing overviews of concepts; a good PLTL Workshop affords the opportunity to practice means of transmission, active doing in a small group session.

The task as Peer Leader is to help the learners in workshop sessions to respond by having them transmit the information in some fashion to fellow learners (Roth, et al., 2001). We exhort you: Don't wait. Help student learners to transmit soon after reception; find ways to transmit to one another. Make them speak out loud.

Use the practice of *Reporting Out*. This strategy is an essential component of PLTL, where small groups or individuals in workshop express out loud (transmit) their conclusions, answers, and process from the previous activity. Peer leaders need to be aware of the limits induced by cognitive load, and the diminishing results that occur when their students are asked to store too much information in short-term memory (Mathias & von Kriegstein, 2023). Furthermore, small learning groups, like PLTL Workshops provide the psychological safety (Edmondson & Lei, 2014; see also Psychsafety.com) for students to be able to make mistakes OUT LOUD (i.e., during transmission) and not be criticized or embarrassed for making them, understanding and learning what misconceptions they held.

Near the end of workshop sessions, Peer Leaders can guide student reflections to express the lessons learned via transmissions by the student participants. Peer Leaders support student learning by allowing and organizing the learning period to foster those reflections of content learned (e.g., Pinkhasik, 2015).

Develop these strategies and then do not keep them secret. Let students know that these techniques work! A useful guide for many such strategies developed by Peer Leaders is the "Facilitation Guide" (McWilliams, et al., 2019). Engagement with other students in a PLTL workshop helps to socialize learning, make connections with classmates, and share the human experience of struggling to master learning.

Although PLTL was created by STEM practitioners and initially for STEM courses, there is nothing science-specific, technology-specific, engineering-specific, or mathematics-specific about the essence of PLTL. PLTL is all about communication; all about transmission. Fortunately, PLTL practice is finding its way beyond traditional STEM disciplines, including nursing (Sherman, et al., 2023) and the humanities (Hendrickson, et al., 2024).

Conclusion

Peer Leaders: Find ways to get students to practice transmission so they accomplish lasting learning. Encourage students to learn to be transmitters, not receivers, by modeling and promoting active learning strategies. PLTL and workshop sessions provide the perfect setting for this to happen.

It is frustrating to be an educator and learn that the first thing students do, when they are assigned end-of-chapter problems, is to look up the answers and worked-out solutions via online cheater software like CHEGG and Yahoo Answers. Experienced educators are frustrated by this because they know that good learning does not happen this way. To be clear: having a book, a class lecture, or online tutoring source help explain and demonstrate how one might solve and answer questions is a reasonable, sometimes necessary, path for learning course content. The important issue is what happens next: Practice. To become proficient with the topics and skills taught in a course, one needs to do practice problems - "homework" - outside of class. Transmission by writing and working problems by hand and speaking out loud is essential for lasting learning to occur. For students to fully benefit from the exercise of doing homework problems, they must actually and actively work out each problem. When students copy their homework (*reception*) from someone or something, with the goal of "just get it done and turn it in," then learning is avoided and the exercise is a waste of time and money. Without effective learning, performance on exams will be poor. Avoiding learning is contrary to the goals of being in school and getting an education. The *struggle* to produce solid, lasting knowledge in the present becomes a tool that can be used later to solve very important, real-life, higher-level problems. This is intellectual growth.

To be effective, studying must involve transmission as discussed here. The best way to remember anything is to practice, to transmit over and over again. This is why it is said that teaching is the best way to learn something! The act of teaching is transmitting! Teachers, in order to facilitate learning for others, learn to formulate concepts in their own terms; they become transmitters, finding their way to be effective. When preparing and thinking in order then to express ideas out loud to an audience, that is transmitting. Telling a story, "hooking" one's audience, takes practice. Good communication relies on good storytelling (Patterson, 2023) and good stories (Becvar, 2023). When one practices one's speech in front of the mirror, when one re-writes notes, that is transmitting; that studious student is learning how to deliver the speech, how to work the problem, how to formulate understanding of something useful. Good learning requires no less.

In PLTL workshop in General Chemistry at the University of Texas El Paso, students write their own answers into workbooks (Becvar & Saupe, 2021): this is transmission and good learning practice. "Writing down what you learn in your own words boosts memory and understanding" (Gotian, 2025). Doing their own work – writing, applying new information, reflecting on connections to prior learning - the students are learning.

Administrators: Supporting opportunities for students to exercise the process of transmission is a strategic advantage. Workshop workbooks provide such transmission opportunities, where students can write and solve problems in class. PLTL programs use physical learning materials, and several use workbooks to provide these opportunities (e.g. through PLTLIS.org and PLTLbooks.org). With today's digital challenges, including AI, the in-class exercises, where students must generate, must transmit, and must actively cement their learning, all become essential complementary processes. Educators need to disclose their intentions with students, letting them know why it is so important to transmit, so students can take these transmission skills to other parts of their education and their lives.

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