A PERSONAL VIEW

Effort and trust: the underpinnings of active learning

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Adams S, Bilimoria K, Malhotra N, Rangachari PK. Effort and trust: the underpinnings of active learning. Adv Physiol Educ 41: 332–337, 2017; doi:10.1152/advan.00036.2017.—Three undergraduate students and their teacher discuss two crucial issues that form the implicit basis of active learning: effort and trust. They use a single course in a Health Sciences Program to anchor their comments.

To provide some structure to the discussions, the instructor (PKR) sets the stage with brief remarks before the students enter the conversation.

P. K. Rangachari (PKR): “Seana, Krish, Neha—thank you for joining me in this discussion on active learning. Although much can be written, I want to focus on just two issues—the efforts you put in and the implicit trust that I placed in you for you to work to your greatest potential.

“T will briefly comment on the overall objectives of the course and my expectations to set the stage for your comments. I wanted a broad-based course that emphasized the complexities of health care.

“The course was designed to give you an opportunity to explore the emergence of patient care in a historical context. The model proposed was that any individual patient was at the intersection of two worlds—the world of cells, molecules, organs, and systems, and the social world of families, communities, societies. So, a proper appreciation requires consideration of information gleaned from a variety of disciplines (physiology, pharmacology, biochemistry on the one hand) and sociology, anthropology, epidemiology, and economics on the other. People differ in personalities, resources, and resilience and so react differently to the same condition. Diseases do not affect every individual equally. Ziegelstein has termed the unique circumstances of an individual the ‘personome’ and ‘personomics’ as the combination of psychological, social, cultural, behavioral, and economic factors that affect an individual’s susceptibility to disease and treatment (8). A considerable emphasis was placed on having you appreciate the complex nature of modern medical technology and the role played by multiple professions in the delivery of health care. These include not just the members of the obvious health care professions (nurses, doctors, pharmacists, physiotherapists, paramedics, etc.), but also manufacturers, economists, lawyers, journalists, consumer groups, and regulatory agents. I attempted to give you all an awareness of these complexities. There was no attempt to make you content experts in all of these domains, but rather to give you all a sense of the complexities of care.

“I also wanted to encourage you to foster your information-retrieving skills by considering not just scientific articles, but also material from other domains and gray literature as well. A particularly valuable part of this learning came from honing the ability to effectively share information and teach each other. In addition, I gave you license to explore issues that were of particular relevance to you, particularly expressive outcomes, mentioned by Eisner (2). Principally, I envisioned my role as a provocateur to ask questions, provide information when needed, and suggest avenues for exploration.
Given the broad objectives, I chose a delivery option that offered you considerable flexibility and fostered self-directed, problem-based learning. The first term of the course was modeled on a standard problem-based approach with a focus on two infectious diseases, TB [tuberculosis] and polio. The second term was considerably more open-ended and gave you greater license. In that term, there were several projects that again required active engagement.

In both terms, there were a number of assessments that provided you an opportunity to demonstrate that you had met the course objectives. These included problem summaries, oral exams, and several written exercises. I gave you a set of criteria that formed the basis of grading each of them. Although each assignment had specific criteria, there were some common elements that were included to varying degrees in each of them. These were content (the specific items of information provided in the answer), clarity, and corroboration (annotated references). I placed a good deal of emphasis on the last component so that you had to not only cite a reference, but also explain clearly what exactly you gleaned from that particular work. For the group projects in the second term, I allowed you to form your own groups, set your own meeting times, and gave you a single group mark. For the problem-based component, I expected you to ‘teach’ each other about the content you had acquired. Thus those of you who were in the polio group taught those in the TB group, and vice versa. Each of you then took an oral exam, where the polio group answered questions on TB and the polio students were questioned about their knowledge of TB. I emphasized that, although content was important, clarity of expression was also important, so that clear, concise answers got you higher marks.

“I want you all to take it from here. Comment primarily on how you dealt with the expectations. Remember to tailor your remarks in the first instance to the issue of the effort required to meet the objectives. We will discuss the issue of trust later. I would suggest that you start with the PBL component and the ways in which you tried to meet the expectations I have mentioned above.”

Neha Malhotra (NM): “Thank you Dr. Rangachari. I will start off the discussion by detailing the problem-based format of the course. The class was randomly divided, with one-half assigned to explore polio and the other, tuberculosis. Within these two groups of 10, we were offered biweekly problem prompts that prompted exploration of various subtopics, ranging from the ethics of scientific study design to the impact of tort laws on science innovation. Each prompt was different, as some were patient narratives, newspaper articles, and excerpts from scientific literature. Alongside our teaching assistants (TAs) and yourself, we engaged in open-ended discussions about the nature of the prompt. With your guidance, we outlined a set of questions as a group and further divided within our groups of 10 into clusters of 3–4 students to examine our developed questions.”

PKR: “Can I interject for a moment? Could you comment on the role of the TAs? Alex (the TA for the TB group) and Sharon (polio group) were seniors in the same program and previously took this course. They were selected based on a written submission explaining their reasons for wanting to be involved in this course.”

Krish Bilimoria (KB): “The TAs helped to maintain the relationship of effort and trust, as they served as a resource for further clarification and help. I viewed them as mediators between the professor’s level of trust and the students’ effort, as they continuously encouraged students to reach their fullest potential. Personally, I found both TAs to be a useful resource for both course material and academic advice. Their advice was in accordance with the course objectives, which allowed me to take initiative in my work and rely less on the feedback from you, the instructor. Ultimately, I was encouraged to think critically about the nature of my own work, which allowed for my academic growth.”

Seana Adams (SA): “This is an apt overview. Shall we begin exploring how we each tackled the pathophysiology of the diseases discussed? If I remember correctly, myself and Krish worked on polio while you, Neha, were a part of the TB cluster.”

NM: “Yes, that is correct.”

KB: “Researching the pathophysiology of polio came with a few issues. Most troublesome was the fact that the polio subgroup assigned to this section did not initially go into the adequate depth required to understand the disease. The group was given another week to delve further into the literature and ensure that they could clearly explain the mechanisms at place that lead to the contraction of polio.”

SA: “Yes, that was my group, Krish. The main issue here was being unable to clearly understand and explain to the class the process of retrograde axonal transport. After spending more time exploring the fundamental scientific literature, we illustrated the process on the board and could explain it to the rest of the class.”

KB: “That makes sense. What do you think the issue was during the first week in attempting to understand the pathophysiology of poliovirus?”

SA: “Much of it had to do with our response to uncertain course expectations. This was one of our first assignments, and we were given little explicit direction or scope; these were up to us to decide. We initially lacked the motivation to invest significant effort toward research tasks. I think this was due to a lack of an immediate evaluation or assessment following our research process. It took several moments of dedicated reflection to overcome the belief that a grade was the primary end to learning processes.”

PKR: “Can you tell us a bit more about the knowledge you gained and the process of researching the pathophysiology of poliomyelitis?”

SA: “Absolutely. In classifying poliovirus as an enterovirus, and exploring the pathway of infection, we made consistent comparisons with tuberculosis as a bacterial infection, exacerbated by macrophage caseation and necrosis. We noted similarities and differences at a biological level between the pathogenesis of polio and tuberculosis, exploring host-pathogen immune interactions, as well as the gross anatomical and physiological features of both conditions. In following the pathogen throughout the body, we explored knowledge relating to both diseases in a way that cut across biomedical disciplines. We had a chance to explore basic concepts in immunology, virology, bacteriology, anatomy, and physiology in an integrated manner that centered around the pathogen and its subsequent clinical condition.”

NM: “Agreed completely. I found that, in my group, specific individuals with past research interests or experiences in specific scientific disciplines, such as immunology or anatomy,
championed their disciplines in our interdisciplinary research. While this process wasn’t necessarily expansive in the depth of topics explored, we noted the interesting organization of knowledge across disciplines and the epistemic boundaries segmenting scientific discovery.”

SA: “Interesting points on the epistemic boundaries. Something I noticed as well were the challenges in balancing an understanding of the pathophysiology to the social determinants of both infectious diseases—did you experience similar challenges?”

NM: “Seana, I certainly agree. Many of us entered this course comfortable with our backgrounds in biology and physiology. We approached the project through a focused biological lens. As you and I have described, our focus was on the pathogens’ method of entry and the subsequent features of infection. However, rarely did we question why the pathogen manifested in the way it did, and what characteristics allowed it to be so deadly to the human body. In the case of TB, we found that mycobacterium tuberculosis often manifests itself in the apex of the lungs; however, beyond this fact, we could not explain why this location was special to the bacterium’s pathophysiology. Upon further investigation, connection of knowledge from anatomy, and instructor facilitation, we learned that the apex of the lungs has a lower ventilation-perfusion ratio, leading to a higher oxygen tension environment for the bacterium to thrive. This intersection of anatomy, physiology, and pathophysiology allowed us to understand not only tuberculosis’ resilience as an aerobe, but also the social conditions for its growth.”

KB: “I think this lends an important lesson to students learning physiology—although the primary focus is on bodily processes, there are other factors that impact disease in an individual that must be acknowledged to garner a coherent understanding of the pathophysiology of a disease. One step further is realizing that, while we could eventually appreciate the pathology of the disease, there was still a missing link as to why patients contracted it in the first place. Looking into sanitation, hygiene, and poverty on a global scale allowed for a more comprehensive understanding of the disease. As such, although we started our investigation with mycobacterium tuberculosis and its infection, we ended with an appreciation of it as a social disease.”

SA: “I found that our information sharing sessions at the end of each class allowed me to build consistent links between our findings in TB and polio. The various perspectives offered in the reading of a single prompt were also relevant. Our TAs also noted that the perspectives within our discussions differed from years past. I think this points to the exceptional flexibility, diversity, and self-directedness of our learning. Each of us seemed to pursue our respective topics by continuously questioning, and revisiting these questions in our search for answers. One thing I noticed, however, in our self-directed preparation for discussions was that, in tutorial sessions during academically demanding times, discussions were less engaging. This could be attributed to decreased effort toward the course when other courses began to take precedence. I noticed how students’ efforts waxed and waned as other courses preoccupied their time. Given the self-directed nature of the course, it is possible for students to feel comfortable reducing their commitment to this course in lieu of more rigid and fixed course workload.”

KB: “I agree that balancing the openness of expectations in the PBL style of HTH SCI 2Q06 and inflexibility in traditional courses, such as Epidemiology, Biostatistics, and Anatomy, was difficult. I would assume that the instructor’s trust in students is vital during these times of apparent decreased involvement.”

SA: “I even found that students who pursued the memorization and content-heavy Anatomy elective course often reduced their effort toward this course.”

PKR: “Why is that?”

SA: “I feel the reasons for this could be varied: either a discrepancy in student interests, or, more likely, an evident prioritization of time in a ‘riskier’ course. In many instances, I felt that effort put forth in HTH SCI 2Q06 did not directly associate with an increased grade. While I understood why this was the case, I found myself and many others relentlessly focusing our effort toward courses like Anatomy, which demanded continued effort to secure satisfactory grades. In this case, I believe grade outcomes drove many of my peers to cope by reducing their contributions in more flexible work, such as the projects in HTH SCI 2Q06.”

KB: “I think my time management in HTH SCI 2Q06 relied upon several factors: clear and concise delineation of research tasks, concise communication, and a shift in course expectations. HTH SCI 2Q06 learning task research had the potential to become a black hole for time and commitment. I instead viewed this scenario as one where barriers to learning were virtually nonexistent, and students could conduct minimal or excessive work toward the course without the impact of grades as a motivator. I felt that this unique class situation closely mimicked the flexibility offered in more independent academic programs, such as Masters or Doctoral studies, and allowed us to delve deeper into topics of personal interest. The effort put forth in projects was, therefore, more authentic in nature.”

PKR: “For this precise reason, it is imperative that the instructor interprets this struggle and acts as a provocateur. Also, teachers should be aware of the multiple demands made on students. Good students are often strategic learners who carefully balance their time to maximize their grades, and so will shift their attentions to meet course demands. It is important that tutors be prepared to be tolerant of this. This is really not easy and could become quite frustrating for a teacher to sit through a tutorial where students appear to be dragging their feet. But this is made up with tutorials where students are active, engaged, and exuberant. This “patchiness” does create problems for novice tutors, who find it difficult to trust students to carry on learning. In a sense, I think of an individual student’s contribution to a tutorial process as an area under a curve and am willing to be tolerant of patchy contributions on a day-to-day basis. It is important though that students hone their skills steadily through the course, and these of course include one of the key elements of any such course, namely information retrieval. Do you three have any comments?”

SA: “We certainly honed our information retrieval skills over the term. This process was often unrestricted, allowing us to explore a range of primary and gray literature to ensure that we included a variety of perspectives. We accessed newspapers, historical books, old photos, online databases, and primary studies.

“By doing this in groups, we were responsible for distributing the workload among our members. Nonetheless I think we
still had differences in contribution and participation between members. Some peers were highly involved and engaged, while others shockingly reviewed notes to study for other courses during our PBL discussion sessions."

KB: “I think the patchiness in contribution was starkly evident in the written one-page summaries we had to complete before class. We needed to distribute our workload, which was composed of retrieving and organizing research, leading to a final summary. This required trust among group members. When some group members wavered from their expected commitment, I felt the class expected that the individual would self-correct by modifying their contributions for the following week’s research.”

NM: “Those are some great points, Seana and Krish. I think the greatest aspect of dividing tasks is that there is a shared responsibility—not only are you learning yourself, but you are also being trusted to teach your peers. Moreover, we also place trust in our instructor to carry out the promise of exposing us to aspects related to the course content that would be practical and useful for our academic growth.”

KB: “Adding on to that point, Neha, the information we shared in our disease subgroups was a crucial component of the course. We could share research insights within our research groups to limit inconsistencies and knowledge gaps. Through this process, we quickly realized that, while we were expected to collect and synthesize information, it was an entirely different skill to translate and share that knowledge with our peers. I found that my trust in the instructor was not in vain, as just when the polio group lacked significant content on the pathology of disease, they were given another week to return with more solidified information.”

SA: “Agreed. Tuberculosis and polio are both infectious diseases that have left their mark on Canadian health care and share similar themes of power, privilege, and politics in disease management. In our sharing sessions, I recognized the politics and privilege of research, development, and patient care. I also found that I could hone in on my understanding of these domains when we carried out our projects second term.”

KB: “Regarding the projects carried out second term, I think the oral exam led us to a peculiar contrast in the standard trust relationship. In past research sessions, PKR, the instructor, had to trust that we, the students, would put forth a satisfactory magnitude of effort toward the exploration of our open research questions. However, for the oral exam, we, the students, had to trust PKR to appropriately explore and understand the research that our entire class conducted and judge us with an expectation that a ‘reasonable,’ but not perfect, exchange of knowledge was completed between the polio and TB groups.”

PKR: “I want to pick up on that issue of trust from another angle. So far we have been discussing the efforts you made and the trust I had in your capacities. However, there is another level of trust, and that is in the trust you all had that you would gain something from this course. In a standard didactic course, that trust is implicit, as students expect the lecturer to provide them the significant items that they are expected to learn. On the other hand, here, there appears to be an outsourcing of that requirement to the students. Reluctantly, students should trust that their teacher will ensure that they meet their learning objectives and will not pass them off raw and untrained. What do you three say to that?”

KB: “I think the relationship between instructor and student is very interesting. Over the course of my 3 years in this program, in some PBL courses I’ve taken, I feel as though there are times where I sincerely doubt or question the direction the instructor might be taking in the course. To this extent, I think students, including myself, place a certain trust in the instructor to sufficiently challenge the class.”

NM: “I’ve seen the opposite as well—some students, most often the strategic learners, take advantage of PBL courses where the instructors are not directly involved in training students. Considering the previously mentioned freedom that these courses offer students, unfortunately some will leverage this opportunity to cater to their workloads. As such, these strategic learners purposefully seek out particular courses in which students are trusted to direct their learning, and decrease their workloads by reducing their effort in PBL courses. These actions are often in an attempt to assume other co-curricular activities to ‘pad their resumes,’ a reality which, regrettably, is a result of a culture that often places a precedent on quantity rather than quality. Students of this sort are often those who pursue a numerical grade above potential skills and training and have unfortunately been incentivized to do so.”

SA: “I agree with both Krish and Neha—I think students can often fall between both extremes. However, irrespective of the outcome, I think most students are unable to directly communicate their challenges with a course, or instructor, and so are left in a delicate position where they are stranded pursuing a course that may not satisfy their personal workload and expectations. These standards are of course, personal and subjective, and so it is difficult to really assess ‘competency’ of specific skill sets in this manner. Even beyond the oral exam, I felt as though the learning summary required a fair bit of trust as well. This assignment required us to demonstrate all that we had learned in a concise manner—we had to take what had been given to us and compile it in a way that was meaningful to us and demonstrated our own academic growth. I feel, however, as though this broad method of learning has made my peers and I the jacks of all trades, but the kings of none. Would you both agree?”

KB: “Agreed.”

NM: “Although, I hope I can defend the value in being a jack of all trades, our course did not intend for us to be complete global health experts, whatever that may be. Instead, we have gained clarity into the tool sets required to solve problems in both a local and global sense. I feel that the broad background gave me the opportunity to cast a wide net and explore issues of personal interest in greater depth. In this manner, I think many people in our class could find a niche interest that they will further pursue in their global health explorations. Beyond this though, with the extensive amount of group work that we participated in, I believe that we are better prepared to listen to differing perspectives and form a consensus to guide our own decision-making. The skills that have been developed in this course can be extrapolated and applied to all areas of academia and beyond, as this course has been a journey of inquiry, as opposed to a mundane repetition of information. I would argue that multidisciplinary teams are not enough. We must have the capacity to relate our personal areas of expertise with others to make collaboration more effective. The emphasis placed on learning with and from our peers reinforced our intrinsic desire to learn for the sake of learning...
understanding resource allocation in low-income countries, that are not within the domain of a single discipline, like perspectives. This prepares me well to pursue research interests principles that may be unlike, or challenge, our own. As such, world, as the reality is that almost all of our personal tensions on. This is incredibly important, especially at this time in our analyst, bioethicists, nurse, lawyer, historian, and the list goes on. I find that this multisectoral approach even demanded us to step outside of our biases and value the unique perspective each stakeholder contributes to develop a holistic understanding of an issue.”

KB: “I find that this inter-disciplinary approach even demanded us to step outside of our biases and value the unique perspective each stakeholder contributes to develop a holistic understanding of an issue.”

SA: “I definitely agree with you, Krish. I believe that one of the primary objectives of the Foundations of Global Health course was to introduce us, as students, to the realm of persononmics, first described by Sir William Osler, one of the founding fathers of modern medicine, as understanding who your patient is rather than what disease they had. Throughout this course, this ‘knowing your patient’ philosophy was repeatedly emphasized in discussions of polio, tuberculosis, and independent projects, all of which provided us with the opportunity to explore the social, economic, environmental, and political determinants of health.”

KB: “I find that this inter-disciplinary approach even demanded us to step outside of our biases and value the unique perspective each stakeholder contributes to develop a holistic understanding of an issue.”

SA: “I completely agree. This course was a space where we were encouraged to engage in discussions that critically analyzed the development of the healthcare system with culture, and the social factors that contribute to the health of populations. Considering the continuing globalization of various sectors of our society, and the multiculturalism of communities, especially in Canada, it was worth taking the time to engage in these dialogues and discuss the implications of systemic practices on the development of the patient-physician relationship, which is the center of clinical practice.”

PKR: “Before we end, I want to ask each one of you to comment on the impact this course has had on you thus far (i.e., in your third-year courses) as well as for your future goals.”

NM: “I see traditional biological and health sciences undergraduate degrees primarily aiming to educate students to ‘think like scientists.’ However, this course challenged me to continuously step outside of my presumptions and biases and think in a multidisciplinary manner so that, every morning as I entered the classroom, I was prepared to ‘think like’ a physician, policy analyst, bioethicists, nurse, lawyer, historian, and the list goes on. This is incredibly important, especially at this time in our world, as the reality is that almost all of our personal tensions and global conflict are a direct result of disregarding ideas and principles that may be unlike, or challenge, our own. As such, I have realized how important it is to look boldly at differing perspectives. This prepares me well to pursue research interests that are not within the domain of a single discipline, like understanding resource allocation in low-income countries, which requires the experience of a physician working with people on the ground and the lawyer working to ensure people’s rights are not exploited while still meeting their needs. Alongside continuously asking questions at the intersection of public health ethics and bioethics, I have also been pursuing foundational courses in globalization, peace studies, philosophy, and social justice to gain clarity on the underpinnings of morality and value systems. It seems reasonable to conclude that this course has inspired me to cultivate capabilities of reason so I can better empathize with another person’s beliefs and way of thinking, empathy being a uniquely human attribute that will serve me well in whichever profession I decide to pursue.”

KB: “This course reaffirmed the value of consistent, but healthy skepticism in evaluating the value of both the content and process features of my coursework. Inspired by the themes I explored in this course, I decided to pursue more contemporary global health courses, focused on applying the tools of business, technical, and social innovations to address global health inequities. To this end, I became more conscientious of the external forces driving actions in global health and developed an appreciation for the relevance of history to current discussions in the field. My future goals currently involve pursuing graduate education in epidemiology, while still being able to maintain my interests in the history of global health.”

SA: “This course has altered my approach to education permanently. Not only have I gained a more holistic view of the several issues that were discussed, I found myself learning, inquiring, and researching for the pure joy of it. I used to be a student who was so enveloped in ‘grades’ that I lost sense of why I was really learning. My mindset has now shifted where I no longer complete an assignment for the sole purpose of reaching an end product. Several times throughout the year I found myself stating that it didn’t matter what mark I received on an assignment because what I had learned was far more rewarding than a ‘grade.’ Upon reflection, I can clearly see how I’ve matured, not only as a student, but also as a young mind that has rekindled her intrinsic passion for learning. Out of this passion, I have enrolled in global health courses that explore globalization and social justice.”

PKR: “Let me tie the strands together. Active learning does work as borne out by numerous studies, but the conditions under which it can be optimal are hard to define. There really is no set formula. However, underlying the approach are some implicit expectations, two of the most critical ones being effort and trust. This applies to both teachers and students. Teachers need to trust their students to make the efforts to learn, the students in turn trust their teachers to make the efforts to ensure that they are getting a meaningful learning experience.”

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S.A., K.B., N.M., and P.K.R. conceived and designed research; S.A., K.B., N.M., and P.K.R. performed experiments; S.A., K.B., N.M., and

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