RocheS²TEM

SUSTAINABILITY · SCIENCE · TECHNOLOGY · ENGINEERING · MATHEMATICS

La Ciencia detrás del Aprendizaje en un Colegio Sostenible

El Rochester en la NASA

5, 6, 7, 8... THE SHOW MUST BEGIN!

Guiding Principles for Brain-Based Education

By Eric Jensen

Founded in 1959

Rochester School

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SUSTAINABILITY · SCIENCE · TECHNOLOGY · ENGINEERING · MATHEMATICS

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¿Cuánta energía en KWh producirían en la ubicación de la nueva sede del Rochester?

Estas fueron algunas de las preguntas que nos hicimos al diseñar la nueva sede LEED Oro del Rochester, las cuales solo se pueden responder con conocimiento de física, matemáticas e ingeniería.

Hemos creado esta nueva publicación de RocheSTEM (siglas en inglés de Sustainability, Science, Technology, Engineering, and Mathematics) para promover la ciencia natural y social, la tecnología, la matemática y la ingeniería aplicada a la vida cotidiana y a un futuro mejor y sostenible en lo ambiental, lo social y lo económico.

Invito a estudiantes, padres y docentes de los diversos niveles educativos del colegio, además de exalumnos, personal no-docente e investigadores, científicos y emprendedores colombianos e internacionales a publicar sus textos, artículos e ideas en esta revista escolar y profesional.

Con la experticia de Hybrytec, empresa de Medellín proveedora de soluciones solares, y la consultoría de Florida Solar Energy Center de Estados Unidos, logramos resolver esas tres preguntas y otras para desarrollar el proyecto de energía fotovoltáica encima de los bloques 4 y 5 de la nueva sede del Colegio Rochester con dos arreglos fotovoltáicos de 10 KW cada uno para un total de 20 KW. Entre estos dos arreglos se ha venido inyectando mensualmente más de 2.100 KWh de energía eléctrica solar (limpia) porque gozamos de 3 a 4 horas sol diariamente en esta sede. Las matemáticas del asunto son sencillas: 20 KW de potencia entre ambos arreglos fotovoltáicos por 3,5 horas sol diariamente, por 30 días al mes da 2.100 KWh de energía inyectada y utilizada por todo el campus escolar. Esa energía equivale al 7% de la energía eléctrica utilizada por el campus, bajando el consumo de la energía de Codensa en igual cantidad, o sea casi $800.000 mensualmente. Estos datos nos podrían servir para calcular en cuánto tiempo terminaremos de recuperar la inversión en esta solución fotovoltáica. ¿Cómo harían dicho cálculo?

Eso es utilizar conocimiento de economía para generar soluciones sostenibles. Los invito a unirse a esta comunidad de aprendizaje útil sobre la ciencia natural y social, la tecnología, la ingeniería y la matemática.

Disfruten,

Juan Pablo Aljure
Director RocheSTEM

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Green School

La Ciencia detrás del Aprendizaje en un Colegio Sostenible

Por: Jorge Quintero
Director de Sostenibilidad
Colegio Rochester

En el mundo es recurrente leer noticias relacionadas con los mejores sistemas educativos, los puestos que ocupan instituciones en el ámbito local y global, gracias a los resultados en exámenes internacionales y las estrategias pedagógicas que garantizan un buen desarrollo de los alumnos. A pesar de toda esta información que nos ofrecen los medios de comunicación, no es común leer acerca de la relación de la infraestructura de las instituciones con la educación, sostenibilidad y salud de los alumnos, especialmente, en nuestro país.

Sin embargo, entidades gubernamentales e instituciones universitarias del país reconocen que existe una correlación entre el ambiente de aprendizaje y la calidad educativa, tal como se menciona en el Plan Maestro de Equipamientos Educativos, “Importancia de la Infraestructura Escolar en la Educación”, formulado por la Alcaldía Mayor de Bogotá en mayo de 2012.

Es así que resulta de suma relevancia comprender cómo el ambiente transciende a la simple noción básica y simple de un espacio físico como contorno natural a uno en donde se crean una diversidad de relaciones humanas que aportan sentido a su existencia. Es decir, estos espacios de aprendizaje constituyen un entorno de permanente construcción significativa de cultura, por lo cual se le debe dar la relevancia requerida.

Por otro lado, cabe mencionar que la legislación en nuestro país es clara al promover, a partir del Decreto 1743, que todos los establecimientos de educación formal, tanto oficiales como privados deben implementar los proyectos educativos ambientales (PRAES), que son formulados para que sus alumnos comprendan la importancia de cuidar el entorno natural. A pesar de que el propósito de los PRAES es coadyuvar a la resolución de problemas ambientales específicos y promover un espacio que permita el desarrollo y concientización de una comunidad en torno a esta temática, lo cierto es que se han quedado cortos a la hora de abordar cómo las

Conglomerado de aulas en el Colegio Rochester.

edificaciones escolares pueden aportar a la creciente problemática ambiental que aqueja nuestro planeta.

La evidencia es que existen instituciones educativas en Colombia, en especial públicas, que carecen en muchos casos de condiciones óptimas para brindar a sus estudiantes una infraestructura que permita su buen desarrollo pedagógico, además de generar en ellos una huella ecológica respecto al consumo de recursos hídricos y energéticos, lo cual redunda en el incremento de emisiones a la atmósfera y, por consiguiente, aportando de manera sistemática al cambio climático.

Según datos aportados por el Consejo de Construcción Sostenible de los Estados Unidos (USGBC), en ese país hay 55 millones de estudiantes y 5 millones de docentes, los cuales representan un poco menos del 20% de su población, comparten varias horas del día y son conscientes de que la calidad del aire, el ruido y la iluminación son claves en el desempeño escolar. Es así que cada día se incrementa en instituciones de este país el interés de medir y reducir su huella ecológica, además de proveer un espacio saludable a sus alumnos y docentes, con el consecuente valor agregado de que la comunidad se concientiza en torno a la relevancia de plantear soluciones en conjunto sobre cómo abordar los problemas ambientales que les aquejan en sus instalaciones.

En este orden de ideas, no es descabellado mencionar que la carencia de una infraestructura adecuada que vele por un confort al interior de los salones y áreas comunes redunda en un menor desempeño escolar y esto podría, de alguna manera, explicar los problemas de aprendizaje que se evidencian en nuestro país.

De hecho, la OMS (Organización Mundial de la Salud) menciona que la población de las ciudades pasa entre el 80% y el 90% de su tiempo en ambientes cerrados, cuyo aire está contaminado en mayor o menor grado, lo que puede ocasionar graves problemas para la salud.

En la actualidad existen suficientes indicios de que en centros educativos, hospitales, áreas de oficinas, centros comerciales, residencias de ancianos, etc., coexiste una variedad de factores que atentan contra la calidad del aire interior y contribuyen a que se presenten efectos nocivos en la salud de las personas.

Según, Morales, et. al. (2010), los contaminantes presentes en el aire al interior de edificaciones, independientemente de que sean químicos,

Aula típica del Colegio Rochester.

Características de los espacios de aprendizaje del Colegio Rochester.

físicos o biológicos pueden variar dependiendo del tipo de actividades que se puedan desarrollar en dichos espacios, el estado sanitario de los ocupantes, la infraestructura física de los materiales y la calidad del entorno. Algunos factores químicos que se pueden clasificar como contaminantes ambientales en el aire en estos espacios pueden ser: dióxido de carbono en altas concentraciones (indicativo de insuficiente aire de renovación en el interior), monóxido de carbono, dióxido de azufre, compuestos orgánicos volátiles, partículas en suspensión, ozono, radón, humo ambiental de tabaco, formaldehído, fibras minerales, isocianatos y resinas epoxódicas. Todas estas sustancias hoy en día han sido identificadas como algunos de los principales riesgos emergentes que pueden aumentar el riesgo de enfermedades tales como: alergias, asma, trastornos de la fertilidad y cáncer. Con respecto a los factores físicos que pueden influir en el confort al interior de los salones están los relacionados primordialmente con la humedad relativa, la velocidad media del aire, la temperatura y el ruido. Además, existen factores biológicos como agentes patógenos, entre los cuales podemos mencionar hongos, bacterias, ácaros, etc.

El CO_2 es un componente presente en el aire que se produce de manera natural en diferentes procesos y que en el caso particular de organismos vivos es el resultado del proceso de respiración celular. Este gas incoloro e inoloro en bajas concentraciones, es más denso que el aire y ligeramente soluble en agua, y las concentraciones máximas deberían rondar entre los 400 y 500 ppm. El problema con el CO_2 en áreas cerradas es que concentraciones muy elevadas pueden conducir a la asfixia por desplazamiento del oxígeno.

La concentración de CO_2 se correlaciona con el índice de renovación del aire del ambiente en el cual se encuentra presente. Por lo tanto, cuando los niveles de CO_2 exceden los 800 ppm y llegan más allá de los 1.200 ppm en áreas interiores,

los ocupantes de estos espacios empiezan a experimentar incomodidad, dolores de cabeza, cansancio, problemas respiratorios, sueño y falta de atención. Todo esto redunda, en el caso de los centros educativos, en la baja calidad del aprendizaje de los estudiantes, e incluso afecta también al personal docente en cuanto a su eficacia a la hora de trabajar con sus alumnos.

Con respecto al confort térmico en ambientes interiores, la capacidad para regular la temperatura depende en gran medida de los sistemas de calefacción, climatización y ventilación que posea el centro educativo. Cabe mencionar que a estos sistemas se les debe hacer constantemente mantenimiento, no solamente para garantizar su adecuado funcionamiento sino que, en la medida que no trabajen bien, su consumo energético es mayor y, por consiguiente, el resultado se ve reflejado en términos de afectación a la variabilidad climática y, por ende, al cambio climático.

Es por esto que las condiciones óptimas de temperatura en ambientes interiores en los salones debe rondar entre los 19ºC a 25.5ºC, (como lo recomienda Eric Jensen en su publicación *"Teaching with the brain in mind"*), y los sistemas deben estar diseñados para proveer estas condiciones y, de esta manera, garantizar un confort térmico y de humedad relativa a las personas que habitan estos recintos educativos. Si no se logran estos valores, se corre el riesgo de que se presenten patologías asociadas dentro de los salones, debido principalmente al desarrollo y la multiplicación de micro-organismos, inicio de procesos químicos o degradación biológica de materiales, lo cual redunda en una cascada de eventos como es el Síndrome del Edificio Enfermo.

Lastimosamente, por experiencia en varios centros de educación visitados, se ha evidenciado que este factor físico al interior de los salones, en muchas ocasiones, no se toma

Sala infantil del Centro de Recursos para el Aprendizaje (CRA) del Colegio Rochester.

El diseño de iluminación de las aulas del Colegio Rochester, se basa en la cuantificación por sensores de luz día, de forma que se encienden progresivamente las luminarias, proveyendo una iluminación homogénea en todas las superficies de las aulas.

en consideración. Es más, el hacinamiento de alumnos y el aporte de aire fresco son factores que se deberían tomar en cuenta a la hora de hacer uso de estas instalaciones.

Otro elemento que vale la pena considerar es el ruido en centros educativos. La OMS lo define como sonido no deseado cuyas consecuencias son molestas para la población, con riesgo para su salud física y mental, por tanto se considera como un sonido molesto, desagradable y perturbador, y se define, además, como un tema de salud pública.

El oído humano solamente puede percibir cierto tipo de ondas sonoras (20 a 20.000 Hz). Las vibraciones y los sonidos de baja y alta frecuencia, a pesar de que no sean percibidos por el oído humano, pueden afectar a los ocupantes de estos centros educativos. Un ejemplo de esto son los sonidos de baja frecuencia que pueden transmitirse a través de estructuras y, dependiendo de la ubicación de las personas, puede afectarlas. Todo esto se conoce como reverberación, lo cual puede llegar tener un efecto contraproducente en los salones llenos de alumnos, ya que puede afectar su concentración.

Con respecto a la iluminación al interior de los salones, cabe mencionar que una inadecuada utilización de luminarias y luz natural puede afectar también el desempeño de los ocupantes. Menos de 300 luxes puede ser nocivo para la visión del estudiante y su aprendizaje. A su vez, es importante mencionar que el uso inadecuado de iluminación tiene un costo económico, social y ambiental alto y, por ende, modificar estos sistemas no afecta únicamente el rendimiento escolar, sino que puede significar un ahorro económico para la institución.

Según el USGBC, el hecho de minimizar el consumo energético en las instalaciones educativas es una de las principales metas en los Estados Unidos. En este orden de ideas, se puede reducir entre un 20% a un 25% el consumo de energía solamente mejorando el comportamiento operacional y de mantenimiento de las instalaciones. Si en Colombia se tomara en cuenta lo que significa esto, ese ahorro económico por concepto de una mejoría operacional y de mantenimiento, podría ser usado en mejorar las instalaciones, mejores sueldos y materiales pedagógicos.

Teniendo en cuenta todo lo mencionado anteriormente cabe preguntarse, ¿cómo podemos pretender tener un futuro más promisorio en este planeta, cuando en los centros educativos de nuestro país no se proveen las condiciones básicas de infraestructura para que nuestra juventud se eduque? Por eso es claro que cada vez más se hace necesario implementar modelos de colegios sostenibles en donde se tenga en cuenta el futuro de nuestros estudiantes, su salud y la del planeta. Para ello debemos proveer a los alumnos de este país condiciones adecuadas (ventilación, protección contra el ruido) que les permitan desarrollar habilidades para abordar y resolver los problemas ambientales globales.

Finalmente, la sostenibilidad depende en gran medida de que realmente nos comportemos

como ciudadanos sistémicos y que garanticemos, de manera individual, el cuidado de nuestro entorno para las generaciones futuras. Imaginemos qué pasaría si algún día los centros educativos del país fueran los líderes en sostenibilidad, proveyendo a sus alumnos las herramientas para innovar y un ambiente sano en donde aprender y jugar.

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Do we want to leave a Water Footprint or an Educational Footprint?

By: María del Pilar Tunarroza Sierra
Science Coordinator and Curricular Sustainability Committee Coordinator
Former Student 1996

How true is that the water will come to an end?

The amount of water on Planet Earth will remain constant and will continue flowing through the water cycle, so the answer is no, the water will not come to an end. What should concern us is water's avalalibility. About 97,5% of Earth's water is in the oceans, 2,5% is in the form of ice and ground water, leaving only a 0,007% in the form of rivers, lakes and dams, available for human beings. This little amount of water is distrubuted around the planet in uneven conditions, for example in the deserts the precipitations are rare, but in the tropical ecosistems the water is always present.

So why are there so many world debates, pacts and concerns about water if it is not coming to an end? The real problem is that in the few places of the planet with fresh water available, the contamination is high; the human population incresases every day as well as its demand for this natural resource. The global warming, mainly generated by human impact, will change the rate of precipitation, will convert some places in dry areas and will cause the glaciars to melt followed by floods and scarce of water for a long time.

In Colombia one of the natural water reservoirs are the moors, which are located between the 2,500 to 3,600 above sea level. These ecosystems are home for certain plants like orchids, epiphytes, mosses and Espeletia spp, which are capable of absorbing and saving as much as 40 times of its weight in water, which is then sent to the rivers by ground water systems.

Another ecological feature characteristic to moors is the one of absorbing and storing CO_2, which is one of the greenhouse gases, responsible for the global warming we are going under in this moment. Moor's soil has a high organic matter concentration and are very deep (near 3m), that's why they can store even more CO_2 than a tropical rain forest.

Moors are also the home for the Spectacled or Andean Bear, *Tremactos ornatus*, which has an important niche as a seed spreader, and as a generator of ecological succession by climbing to the trees and breaking some branches, or old trees, generating clear areas for the sun to penetrate and germinate seeds and small plants that are waiting for the appropiate conditions to grow.

Sadly, this ecosystem is being negatively intervined by humans. Trees and vegetation are being cut for cultivations and for the cattle. These activities damage the natural water irrigation and the structure of the soil to absorbe and retain water, that changes the temperature of the first layer of the soil, the humidity, air currents and precipitation, which will end in a dry ecosystem incapable of regulating water and absorbing CO_2, as it did before. Also people that live in moors have the false belief that the Spectacled Bear eats its cattle, so they hunt it, creating another problem by interrupting the natural ecosystem equilibrium.

But you may think, this does not concern you because you do not live in the moor, kill bears or cut trees, but the truth is you are leaving a water footprint every day. The water footprint is an indicator of the amount of water consumed by a human being. This concept was introduced by Arjen Y. Hoekstra, who explains that water problems are directly related to the world's economy.

Some products require a high consumption of the water to be used in the production process and many countries try to get rid of this issue by simply importing goods. This action generates a

Spectacled Bear. By Luis Guillermo Linares. PNN. Chingaza Biologist (2013).

Moor ecosystem, the habitat for the Spectacled Bear and source of water resources.

huge impact on the water resources of the exporting contries which are gennerally unefficient when it comes to mechanism for conservation of the water resource.

For making a reliable measurement of the water footprint its necessary to take into acount the direct and indirect sources. For instance, at home you may save water by colecting water form the rain, but at the same time, you may use more water than the one collected for washing the car. There's also the matter of the type of water and the purpose it is used for. For example, the so called green water, is the water that comes from rain and can be used again for some tasks, the blue water is the one from lentic and lotic systems, and the grey water is the one required to dilute water that has been contaminated with chemical substances until the environment will tolerate them and generates resilience. That's why measuring the water footprint will vary depending if it is generated by a factory, house, educative institutes, etc. But, whatever the case may be, there will always be a water footprint generated by us. Its our duty to reduce it as much as we can.

We use water every day for cooking, drinking, bathing, cleaning our house and our car, or even for recreation. We also use and buy clothes from factories that contaminate water during the process of dying and the majority of the population consumes cattle meat, which generates a high concetration of methane, a greenhouse gas, and uses a lot of water during the process of butchering.

Due to all these climate changes, population growth, and consumerism that we are going through in this generation, Schools and any educative institutions, have the responsibility to teach and integrate this knowledge in order to promote conservation and scientific research. Gladly, Rochester School has been working hard on providing the students and teachers with knowledge on sustainability and supporting environmental programs.

Our Spectacled Bear participating in community events.

Rochester School has a Curricular Sustainability Committee, composed by teachers from different subjects and volunteer students, in charge of giving tools to teachers and students on how to integrate environmental and sustainability issues in every subject. Due to the global warming, the water scarce in our country and the social problems with the farmers and peasants that inervine moors, the Curricular Sustainability Committee is working on a curricular and national project for saving the Spectacled Bear.

The biologists from the National Natural Park Chingaza has been participating in the project. The objectives relies on finding out the population state of the Spectacled Bear, its area range and its vulnerability in this ecosystem, to find out ways of conserving the moor ecosystem and guarantee fresh water for ours and future generations as well as the ecosystem equilibrium. We want this project to become part of everybody's life, and not only a matter of biologists and scientists. It is our responsibility as part of the planet to use properly the resources and interviene as little as possible in generating a negative impact.

The Spectacled Bear is an emblematic species, that is why the first step in the project is to introduce it to the community.

Rochester School participated in the Green Apple Day of Service, day created by the USGBC -United States Green Building Counil for providing a service to the school and its sorroundings. On this day, September 27th, students build piggy banks with the shape of the head of the Spectacled Bear for saving money to reforest the moor, on this day, students also read and saw movies and documentaries of the Andean Bear and build its representative ecosystem with native plants on one of the buildings of the school. On the Family Day, parents and kids visited this moor ecosystem, learned about its ecological importance and played with the Spectacled Bear.

We will continue focusing our effort on teaching about the importance of preserving the moor ecosystem along with all the flora and fauna it has, for their and our own benefit as an Earth species who need to survive and share resources with others. It's a matter of science and principles.

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Recreation of the High Andean ecosystem.

El Rochester en la NASA

De izquierda a derecha, Laura Montenegro, Laura Guerra, Cristian Acuña, José Miguel Cervantes y Sergio Guerra. En el edificio de investigación de la NASA.

Por: Andrés Prías Gómez
Docente de Química - Bachillerato Alto
Colegio Rochester

El colegio Rochester y el Instituto de Astrobiología trabajan en equipo para que los estudiantes del colegio vivan una experiencia inolvidable de aprendizaje y diversión en las instalaciones y conglomerados de la NASA, ubicados en Cabo Cañaveral, Florida, y se propone como una salida para tener en cuenta en el programa curricular.

El pasado 3 de Julio de 2014, cinco estudiantes del colegio, pertenecientes a los niveles de Escuela Media y Bachillerato Alto, junto con el profesor de Química de bachillerato, se aventuraron en la salida organizada por el Instituto de Astrobiología para participar en el campamento del Kennedy Space Center, visitar los parques de Universal Studios en Orlando y aprender sobre el universo y la naturaleza en el Museo de Historia Natural, ubicado en la ciudad de Nueva York.

Los estudiantes participaron activamente en inglés, durante tres días, realizando actividades en las que fortalecieron habilidades científicas y físicas que desarrollan los astronautas durante su entrenamiento.

Una de las actividades realizadas por los estudiantes fue el entrenamiento espacial físico. Los alumnos vivieron una experiencia fantástica en un transbordador espacial y escalaron, solo con la fuerza de sus brazos, una estructura de acero inclinado que simulaba condiciones de gravedad cero por soportes que contrarrestaban el peso de los participantes.

Tuvieron la oportunidad de almorzar con Mike Mullane, uno de los más reconocidos astronautas, quien fue seleccionado en 1978 como Especialista en Misiones y quien completó tres misiones espaciales en los transbordadores Discovery (STS-41D) y Atlantis (STS-27 & 36). Mullane les contó sobre su experiencia en el espacio y resolvió sus preguntas. Fue un almuerzo inolvidable para Laura Montenegro quien afirma “una de las cosas más interesantes que aprendí es que si un astronauta se llega a lastimar o a cortar en el espacio, debe permanecer con la herida abierta durante 6 meses, o el tiempo que dure la misión, en vista de que la sangre no coagula”.

“Una de las cosas más interesantes que aprendí es que si un astronauta se llega a lastimar o a cortar en el espacio, debe permanecer con la herida abierta durante 6 meses, o el tiempo que dure la misión, en vista de que la sangre no coagula”.

Laura Montenegro

Elaboración de cohetes en papel.

Los estudiantes asistieron a diferentes museos en los que se les explicó detalladamente diferentes misiones espaciales y observaron los elementos utilizados en ellas. Así mismo, participaron en exhibiciones y simuladores de los transbordadores y cohetes utilizados a lo largo de la historia.

Además del entrenamiento físico, también realizaron ejercicios para poner a prueba la creatividad y habilidades científicas.

Los estudiantes fabricaron una nave para simular el aterrizaje de un tripulante espacial. Para ello contaron con diferentes materiales otorgados por la NASA y debían fabricar una cápsula con soportes y paracaídas para que un huevo (tripulante) no sufriera ningún daño al caer desde una altura aproximada de 5 metros. Debían realizar este modelo en un tiempo definido y en unas condiciones par-ticulares, simulando la manera como deben tomar decisiones los astronautas cuando se encuentran bajo presión.

La fabricación, el lanzamiento y el cálculo para que un cohete elaborado con papel diera en un blanco, fue otra de las misiones que asumieron los estudiantes en un ambiente de diversión.

Por otro lado, los estudiantes tuvieron la oportunidad de divertirse en los parques de Orlando, como el parque de Universal Studios, en el cual observaron la elaboración, la producción y atracciones (montañas rusas, emuladores) de algunas de las películas más importantes del séptimo arte, como La Momia, Transformers, Harry Potter y clásicos, como E.T.

En el Museo de Historia Natural, ubicado en la ciudad de Nueva York, los estudiantes realizaron un proceso de consulta sobre el universo y los avances científicos más importantes,

participando en una carrera de observación que involucraba la asistencia a charlas, emuladores y videoconsulta.

“Muy chévere ver e identificar los animales que existían en la prehistoria, además que se encuentran completos y en los tamaños originales”, expresó Sergio Guerra.

Además de aprender y divertirse, los niños tuvieron la oportunidad de conocer lugares emblemáticos de la ciudad de Nueva York como el Times Square, la Estatua de la Libertad, La Quinta Avenida y realizar un picnic en Central Park.

Este viaje de nueve días, también representó un excelente ejercicio de autonomía para cada uno de los estudiantes pues fueron responsables de todas sus pertenencias, manejaron su presupuesto a la hora de hacer compras, pusieron en práctica hábitos como levantarse a tiempo, llevar a cabo su aseo personal, organizar su habitación, y ser puntuales en las citas de encuentro para las diferentes actividades.

Haber participado en esta experiencia con el Instituto de Astrobiología nutre el currículo implícito del Rochester de manera categórica; no solo por vivir en forma práctica el aporte científico que la NASA hace al mundo sino también porque permite ampliar una visión del compromiso que tiene el hombre para contribuir con la calidad de vida de una mejor sociedad, donde todos investigamos, trabajamos y vivimos en armonía con nuestro entorno y los sistemas naturales.

Es una excelente experiencia de la que todos los jóvenes del mundo deberían disfrutar. Afortunadamente contamos con esta gran alianza con el Instituto de Astrobiología y la NASA y realizamos este viaje todos los años en el mes de julio. Invitamos a toda la comunidad Rochesteriana a participar de esta maravillosa experiencia.

Bienvenida a los estudiantes y entrega de camisetas en el Kennedy Space Center.

Global Perspectives

ISTE® 2014 ATLANTA JUNE 28 THRU JULY 1

Registro de asistentes e inicio del evento.

Por: Julián E. Pérez M.
Coordinador Ciencias de la Computación
Colegio Rochester

Dentro de las estrategias institucionales para la promoción de la calidad en la educación que nuestro colegio ha venido implementando desde hace mucho tiempo, está la participación de sus docentes en eventos nacionales e internacionales.

Durante el último período de receso en Junio del presente año, conté con el valioso apoyo institucional para aprovechar la oportunidad de asistir a la conferencia anual de la Sociedad Internacional para la Tecnología en la Educación (ISTE en inglés), que cuenta con más de 20.000 miembros de más de 90 países de todo el mundo, y que desde hace muchos años ha diseñado y promulgado los estándares internacionales ISTE para la implementación exitosa de tecnologías de información y comunicación para el aprendizaje. Ha sido una experiencia muy enriquecedora, ya que precisamente dichos estándares han sido parte fundamental en la estructuración de nuestro currículo de Ciencias de la Computación desde hace más de 8 años, lo que permitió tener una experiencia más profunda con el evento.

La visión de ISTE apunta a un mundo interconectado en el que los profesores comparten experiencias de aprendizaje y los estudiantes son exitosos, colaboran y usan la tecnología con integridad y sostenibilidad.

El evento tuvo lugar en la hermosa ciudad de Atlanta en el estado de Georgia. Durante poco menos de una semana pude apreciar experiencias docentes, herramientas de tecnología para el aprendizaje, estrategias de clase y pude conocer proyectos de aula muy interesantes, así como pude compartir con gran variedad de colegas mi experiencia y la experiencia de nuestro colegio.

Asistí a conferencias muy interesantes sobre:

- Aprovechamiento de tecnologías móviles en el aula para colaborar con los niños en su gestión de tareas y registros de clase.
- Diseño de clases siguiendo el modelo “Flipped Classroom” (aula invertida).
- Diseño de clases tipo “Blended Learning” (aprendizaje combinado).

- Diseño curricular basado en “Project Based Learning” (aprendizaje basado en proyectos).

Conocí implementaciones educativas con tecnologías y herramientas como:

- Realidad Aumentada.
- Gamificación.
- iPads y otras tabletas.
- iTunes U.
- Corona Software Development Kit.
- Google Classroom.
- MineCraft Educational.
- MOOC’s Design: (Massive Open Online Course).
- www.socrative.com
- www.edmodo.com
- www.schoology.com

Conferencia EdTekTalks.

También pude establecer contacto con colegas de diferentes países con el propósito de crear conexiones tendientes a compartir experiencias de aprendizaje, así como pude conocer nuevas herramientas y tecnologías para enriquecer los espacios de aprendizaje.

Ahora el reto es compartir toda la experiencia con mis compañeros docentes en el colegio, siendo sensible a sus intereses, a sus necesidades y al contexto. Desde la primera reunión general del presente año escolar, he compartido lo aprendido en ISTE 2014, y seguiré animando el enriquecimiento de los espacios de aprendizaje a través del uso de tecnologías de información y comunicación.

Aprender, Divertirse y Ser Sostenible

Por: Wilmer Javier Vanegas Mayorga
Docente de Física - Bachillerato Alto
Colegio Rochester

Esta es una experiencia que muestra el trabajo de un grupo de estudiantes de Décimo grado, dentro de la asignatura de Física al abordar un proyecto ambiental. Se cuenta de dónde surge la necesidad de emprender, se habla de cómo se lideran las actividades y por qué cada estudiante, desde su más creativa actitud, decide poner un granito de arena y dedicar tiempo, para buscar estrategias para reutilizar y, al mismo tiempo ayudar a una comunidad. Además se da cuenta de la percepción de algunos estudiantes que participaron en la actividad.

I. NECESIDAD

En el colegio existe un día muy especial para toda la comunidad, organizado por el Comité Curricular de Sostenibilidad, que se conoce como “Green Apple Day of Service”. En este día, toda la comunidad contribuye con su tiempo en la elaboración y ejecución de diferentes actividades que ayudan a conservar nuestro entorno escolar. En otras palabras, es un tiempo en el cual se ofrece a los estudiantes la posibilidad de adquirir información y habilidades para ser sostenibles ayudando a otros de forma desinteresada.

Una de las ideas que surgió para trabajar con los estudiantes de grado Décimo en este comité fue la de construir un posible mobiliario con residuos reutilizables, que fuera útil para nuestra comunidad. Luego de valorar varias opciones, se decidió que, para este proyecto, era ideal iniciar con modelos pequeños y se estableció una meta: Construir algunas sillas para los niños de preescolar y ubicarlas en la zona común de aprendizaje de los conglomerados de aulas.

II. OPORTUNIDAD PARA APRENDER

En la clase de Física se debía plantear la idea de construir estas sillas y a la vez crear una actividad que los estudiantes percibieran como útil, o por lo menos, una actividad en la que pudieran aplicar lo que han aprendido en la clase de Física. Así nació la propuesta de que por grupos de estudiantes (2 o 3), crearan un modelo de silla. Esta debía ser muy resistente, liviana, incluso, era necesario indagar sobre los principios físicos que cumple una silla normal, buscar modelos de sillas que incluyeran formas de parábolas o semiparábolas, que era el tema que estábamos desarrollando en el momento. Además, se tenía la condición de que, para su elaboración, solo se utilizaría cartón, que por supuesto, había sido recolectado y separado de los residuos esperando ser reutilizado.

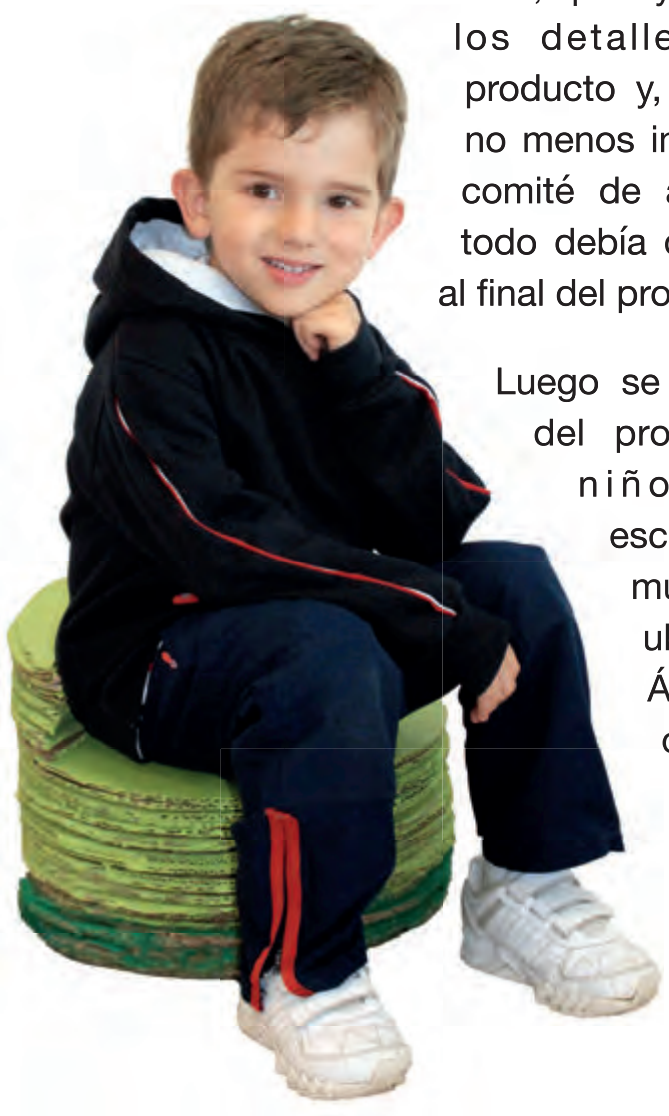
Había una promesa para el grupo que lograra el mejor diseño: sería el presidente de una empresa por un día, y sus compañeros serían sus empleados.

Cada grupo tuvo la oportunidad de consultar y asesorarse y debía, durante una clase, construir un modelo a escala de la silla que había diseñado o que había encontrado en las tantas páginas de Internet que consultan a diario. También debían explicar qué relaciones de resistencia y fuerza tenía esta silla, así como evidenciar que existen parábolas o semi-parábolas en casi todo lo que nos rodea. Cada grupo hizo su mayor esfuerzo y se obtuvieron varios prototipos; sin embargo, había una promesa que se debía cumplir y solo el grupo con la mejor propuesta podía tener su propia empresa.

Prototipos de sillas.

III. JUEGO DE ROLES

Todo este despliegue de creatividad y dedicación fue para lograr que el día 27 de septiembre de 2014, en el cual se celebraba el Green Apple Day of Service en el Colegio Rochester, este equipo de estudiantes lideraran la actividad de crear un mobiliario para la comunidad. Aquí, cada grupo de estudiantes tenía un rol: había un presidente, quien se encargaba de verificar que todos los procesos fueran exitosos, también había dos coordinadores, que facilitaban la ejecución del diseño aprobado. Se creó un comité de molde, que se encargaba de que todas las partes para acoplar en cada producto fueran iguales; un comité de corte, que fueron asesorados por los encargados de infraestructura en normas de seguridad para el uso adecuado de bisturí, y cortaban todas las piezas necesarias: círculos para el cuerpo de la silla, lunas para el relleno y rectángulos para la base. También estaba el comité de pintura, que se encargaba de dejar al 100% la pintura de cada silla; un comité de calidad, que ayudaba a pulir los detalles de cada producto y, por último y no menos importante, un comité de aseo, porque todo debía quedar limpio al final del proceso.



Luego se hizo entrega del producto a los niños de preescolar, quienes muy felices las ubicaron en el Área Común de Aprendizaje y empezaron a disfrutar de un nuevo mobiliario.

IV. PERCEPCIÓN DE LA ACTIVIDAD

"La experiencia de las sillas fue tanto para lo académico como para fomentar el trabajo en equipo. Fuimos capaces de dividirnos los trabajos para llevar a cabo un proyecto, el cual fue divertido gracias a mis compañeros. Fuimos capaces de dar lo mejor de nosotros y de cooperar con trabajo en equipo, las sillas quedaron completas después de trabajar entre todos, apoyándonos."

Nicole Abusaid - Grado 10

"La experiencia de las sillas es una experiencia que no se me va a olvidar. En esta actividad pude ver el trabajo en equipo y cómo de materiales reciclables puedo sacar varias cosas. Este proyecto es uno de los más interesantes que hecho y, además de todo, es un proyecto que ayuda al contexto de nuestro colegio."

Diego Bernal - Grado 10

"La actividad de la creación de sillas, para mí fue muy interesante, no solo porque fue una muy buena acción sino porque el trabajo en grupo y la forma en que la desarrollamos, fue muy divertida. Me encanta saber las diferentes formas de reusar el cartón y las alternativas para tener una vida más sostenible."

María del Mar Franco - Grado 10

“Me sentí muy cómodo y en parte me sentí comprometido con la comunidad del colegio, sentí que desarrollé mi parte artística y motriz, al cortar, pegar y pintar sobre estas sillas. También me gustó el compañerismo que mostramos entre todos ya que nos dividimos el trabajo, y el mío se basó en limpieza: al final encargarme de recoger el desorden y, a medida que íbamos trabajando, decirle a la gente dónde botar la basura y demás.”

Néstor Traslaviña - Grado 10

V. CONCLUSIONES

Aunque fuimos ambiciosos en el proyecto porque inicialmente se quería elaborar más de diez sillas, solo se logró construir cinco.

Lo importante fue el proceso, la forma como se relacionaron la Física, el objetivo de ser sostenible y las responsabilidades que cada estudiante asumió; se hicieron conexiones que pocas veces se hacen, se logró trabajo en equipo, caras felices, personas satisfechas de la labor cumplida, crear un diseño inicial para ayudar a la comunidad y que se puede mejorar en el futuro.

Ver la alegría de los estudiantes al tener y dirigir su propia empresa, el hecho de sentir que a todos les nace un espíritu de colaboración desmedido, ver el esmero y las actitudes apropiadas para dar lo mejor de sí, que este proyecto fuera un éxito y que cada estudiante se sintiera exitoso, son la mejor recompensa de dedicar tiempo a educar.

Spider-Web Geometry

Fourth grade Project

By:
Adriana Biagi Montoya
Math Curricular Advisor for Preschool and Elementary - 5th B Coordinator
Rochester School

Luz Marina Forero
Math Area Coordinator and Math Teacher 10th
Rochester School

Point, line, segment, angle, are some of the most difficult ideas to teach because the topic is abstract and unfamiliar; historically students have issues with those concepts, especially in the way to construct, identify and measure them. That is why creating different tasks to work with them is one of the biggest challenges for a math teacher.

One of the strategies for introducing, reinforcing or evaluating an abstract concept is using hands-on activities.

KNITTING THE WEB

For this activity the class began with the students in a circle. The teacher began by throwing a ball of yarn to a student located across the circle and invited children to do the same, holding a point of the yarn before throwing it to the next student and pulling the yarn to make straight lines, forming a web. When everyone was holding a point, they moved the web until it was on the floor and secured each vertex with masking tape.

The next step was labeling every point which the students find on our spider-web using a sticky note with a letter(Excel style AA, AB, AC…).

WORKING WITH MY PIECE OF WEB

When the web was properly labeled, each student chose a place on the web and lay on it, the teacher took a picture and sent it to the student; the goal was to find every geometric pattern learned in class, such as points, lines, segments, angles, triangles, quadrilaterals, perpendicular, parallel and intersecting lines, and so on.

During a week, at home, they worked over a printed version of their pictures, drawing every pattern they found, pasting it on a bigger piece of paper and labeling it.

Next week, in class, they shared their work in pair and got feedback from classmates and the teacher. Once completed, they showed their work on the walls of the Extended Learning Area.

WHAT I FOUND

To begin the unit of geometry, students performed some activities: they watched a video, looked for definitions, wrote them in their notebooks and represented them graphically, solved the exercises from the book. Finally, they where evaluated through a written test and the results were lower than expected. That was the turning point for the teacher: students needed to live geometry through hands-on activities.

Once they built the spider web and finished their poster, students took a quiz on geometry concepts. The results were amazing!

Students finding geometric patterns.

Fourth Grade Students.

Scene from Gaia (2013)

5, 6, 7, 8... THE SHOW MUST BEGIN!

By: Iliana Aljure León
Rochester School's Arts and Sports Director
Vice-president of Rochester School

Behind the curtains everything is chaos... The technical team redirects the lights, checks for wires on the floor, arranges the black legs, cleans the stage and verifies the musical instruments; everybody runs back and forth to organize the scenery, students hurry to their dressing rooms to finish their hair and makeup, to get their costumes ready and to breathe before the big show... They all wait for the command to start... and all of their senses are sharpened to receive instructions and begin the show... I can't help but think of all the steps that the brain undertakes to create that domino effect of alert:

1. Information is perceived though our senses, or it is activated when we think or remember.

2. Information is first sent to the thalamus for initial processing.

Students on stage, Babel (2014).

3. It is immediately sent to the subcortical areas (e.g. the amygdala), which will recruit other regions.

4. Simultaneously, information is sent to the appropriate cortical structures for further processing (e.g. lobes).

5. If it is an emergency information, the amygdala responds promptly and recruits other brain areas.

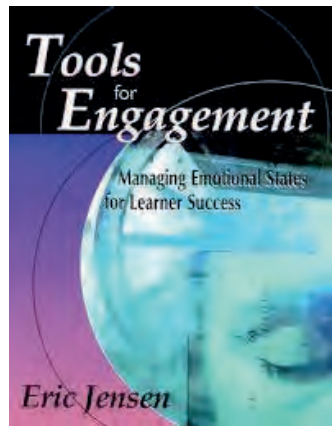
6. Implicit information surpasses the circulating memory, while explicit information is sent to the hippocampus for a more detailed evaluation and to be stored for a while.

7. Content coded as relevant tends to be stored for more time than content considered to be of low relevance, as it is explained by Choice Theory (Glasser, 1999), in the filter of total knowledge.

8. As time goes by, the hippocampus organizes, distributes and connects memories with the other pertinent areas of the cerebral cortex to store them for the long term (Jensen, 2008). This is how the "Perceived World" is created, as Choice Theory explains (Glasser, 1999).

And with every explicit instruction from the accompanying adults, comes what cannot be seen: implicit information1 that is not taught by anyone, but it is experienced in every moment prior to a show. The implicit plus the explicit generate an endless array of emotions that vary from a dash of stress, a little bit of nervousness, a hint of excitement, a pinch of alertness and a good dose of satisfaction. So many hours, days, weeks and months of rehearsal will finally be a reality, through a cascade of hormones, neurotransmitters and neuromodulators that alert each and every body system, noticing the imminence of the upcoming event and asking those systems to perform their masterpiece choreography of team work, so that body, mind and soul are ready for the show.

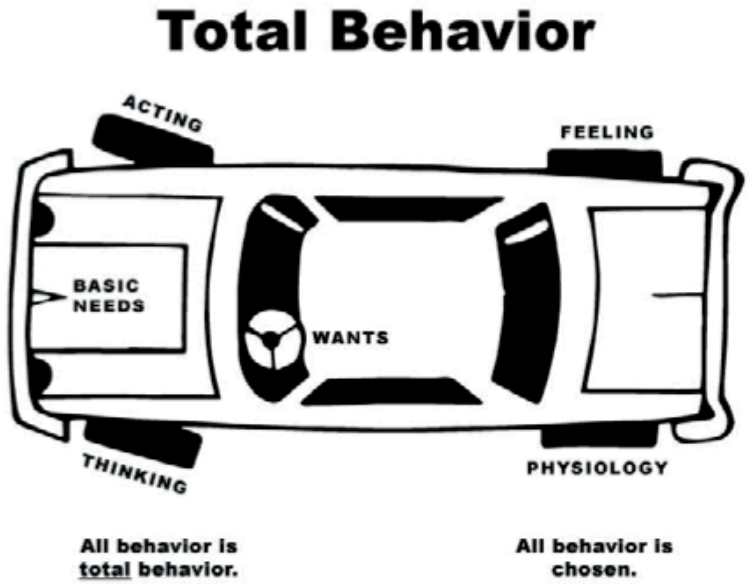
Events that touch our emotions, such as a big school show, are remembered forever. Learning becomes much more meaningful and tends to be stored in our long-term memory. The difference between superficial learning and authentic learning is that the former is forgotten very quickly, while the latter lasts in time because it is satisfactory, involves emotions, makes sense, is personally relevant and encourages intrinsic motivation (Jensen, 2000).



In his book **"Tools for Engagement"**, Eric Jensen urges us to think about our student's emotional states as the fundamental basis for learning. A great revelation in the history of neuroscience was the discovery that all extrinsic behaviors are in some way related to the brain's internal processes. All of the conscious states, from sleeping to imagining, wishing, dreaming and thinking, are the result of the electrochemical activity of the brain. Millions of neurons cooperate to form complex signaling systems that represent behaviors we call "states". In the same way that the wind, sun and humidity

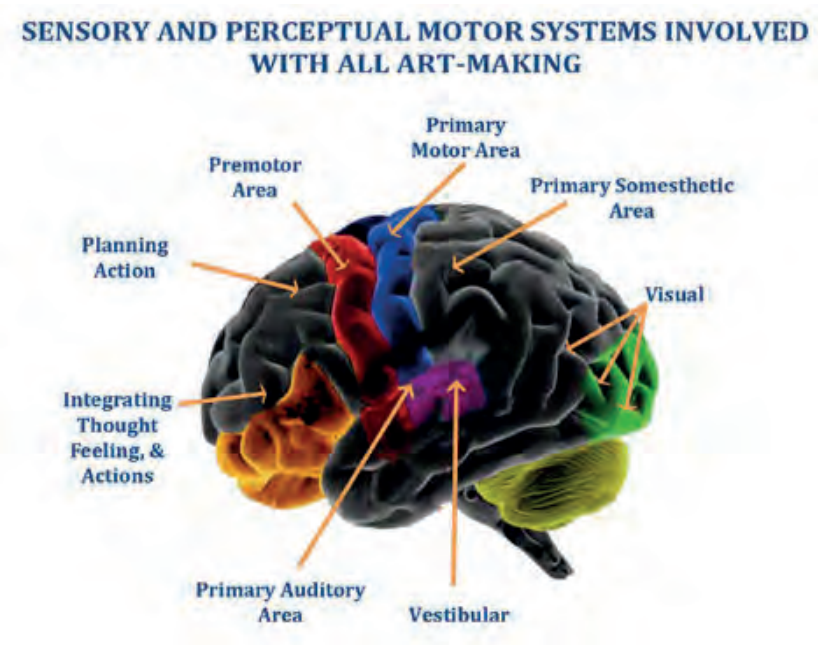
collectively form the atmospheric patterns we know as “weather”, those emotional states permanently create atmospheric conditions in our brain. This weather varies every few seconds and everybody has the ability to control their internal brain weather; in other words, we can control the quality of our lives.

What we feel is real! And on stage this sentence becomes the power behind the work of every participant... Our feelings and emotions combine with our thoughts and actions, and this is finally reflected in our performing behavior, with the natural physiology that precedes that moment of facing the audience: a fast-beating heart, sweaty palms, dry mouth, etc...



Here is where I can’t help but think of the “total behavior car”, a concept I learned with Brian Lennon during my training in Choice Theory in the late 90s, and that became a guide for many of the explanations about my own behavior and that of my dance students. Associating the four wheels of the car with the words thinking, acting, feeling and physiology, helped me create clear images of what I needed to understand about the daily reactions of my pupils. Furthermore, linking the five basic needs (survival, love and belonging, power and recognition, freedom, and fun) with behavior, has been one of the most revealing experiences I’ve had as a teacher, because it enlightens in many ways the path towards my constant search for excellency as a dance teacher (Glasser, William, 1998). Understanding that my students have needs, and that if any of those needs is not satisfied then their behavior is going to be altered, was a realization that made a great difference in the methodology of teaching dance and its applications on the performing arts language. This discovery defined the subject of the thesis I wrote for my master’s in Dance Education, at the University of New York in 1994; its central topic was the analysis of the learning environment of my dance classes, and its results are still a beam of light for this pedagogical path.

Artistic experience, seen from the classroom or the stage, involves specific anatomical structures in the brain, dedicated to the processing of that experience. In the 70s, it was thought that artistic experience only involved the right hemisphere of the brain, a notion that is now obsolete (Jensen, 2001). In his book “Arts with the Brain in Mind”, Eric Jensen poses that the arts are a major discipline with measurable results that are culturally necessary, exist in all populations and have an enormous ethical and aesthetical value that can be exercised rigorously; it is a major discipline that creates a curricular symphony of profound, transversal, sequential, continuous, articulated, vertical and horizontal character. In that same book, Jensen claims that the arts enhance the learning process



thanks to the neurobiological systems they nourish: the sensory system, the attention system, the cognitive system, the emotional system and the motor system, among others.

In his compilation research paper, called “Champions of Change: The Impact of the Arts on earning” (1999), Edward B. Fiske analyzes the non-academical benefits of the arts. I have been able to recognize some of them in our school environment during the past 25 years of artistic experiences at Rochester School. Fiske describes them as follows:

- The arts impact students that normally don’t get involved in anything.
- Students learn to connect in more friendly ways: there are less fights, camaraderie increases, racism decreases and levels of destructive sarcasm also decline.
- The school environment becomes an experience to discover new things. This can rekindle a genuine love of learning in those students that are discouraged by theoretical information.
- The arts foster personal and collective challenges in students of all ages.
- With the arts, students connect to the real world, where all theatrical, musical, dance and plastic products are available to the general public.
- Students learn to be autodidacts, and to use their own learning rhythms to achieve excellence.

Students on stage, Gaia (2013).

- The arts reach diverse socio-economical populations, and open unexpected professional pathways.

I return to my starting point... A school show is much more than what the audience sees. A school show is brain, emotion and cognition at the same time. Artistic experience in the classroom or the stage provides multiple growth opportunities at the social, emotional, cognitive, spiritual and physical level... And there are still people who wonder if the arts are useful in a school environment... It's clear that the answer lies in the text of The Little Prince -"the essential is invisible to the eyes"-, says Saint-Exupéry.

Next time any of you readers sit down to watch a show, make sure your glasses are on so that you can observe what cannot be seen: the symphony of corporal systems, the choreography of neurotransmitters in permanent action, the music sheet of infinite neural connections, and the satisfaction of needs, all of the elements that turn dancers, musicians and actors into super-humans... Those humans that have mutated thanks to the unique and unrepeatable artistic experience!

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Scene from Babel (2014).

Pedagogical Strategies

2014 Systems Thinking & Dynamic Modeling
JUNE 28-30
Integrating Learning Environments

Systems Thinking

By: Luz Marina Forero
Math Area Coordinator and Math Teacher 10th
Rochester School

Systems Thinking and Dynamic Modeling, as developed by Jay Forrester and Peter Senge, among others, provide a conceptual framework and guiding force in the development of curriculum. System Dynamics encourage learners to look beyond just the facts and focus on broader principles.

One of our goals at Rochester School is that our students learn how to be System Citizens, for this reason, the teachers are constantly working towards developing this virtue.

My interest in Systems Thinking began when implementing the software STELLA modeler with students in class. This software is used to model every situation that involves variables by taking into account most of the variables that can affect one another. For example, you can model simple things such as filling or draining a bathtub or more complex systems such as how our WWTP (waste water treatment plant) works. In the beginning, I thought it was just useful for models related to Mathematics or Science through mathematical functions, nevertheless I was pleasantly surprised with what I found.

The conference began by introducing Systems Thinking during the initial session; we developed our understanding of “Systems” by playing with some of the key tools of Systems Thinking, Systems Dynamics and Organizational Learning. This was the first time I realized that it was not strictly a scientific tool, but a tool for everyday life. I watched a video where Preschool students graphed the behavior of the main character of

their favorite story, and they talked about how the mood of the raccoon affected the relationship between the characters; they were able to remember every part of the tale by only seeing the graph.

The following session, On Integrating Systems Thinking (5-12 curriculum), revealed the idea of using Systems Thinking for Social Sciences, Literature and Character Development. The teachers from Charter School of Massachusetts showed us their students work on the topic of World War II, Business Development and how prejudice affects people.

Furthermore, I had the opportunity to enhance my knowledge of how to implement these tools in a Mathematics classroom by using technology with Diane Fisher, and by interacting with people from other areas.

When given the opportunity, I shared Rochester School´s sustainability project and a great amount of people were interested in knowing more about us. Due to this, I shared the school web address. They congratulated me on our impressive sustainability model. I felt overwhelmed with pride and joy.

People from all over the world, including USA, Pakistan, Brazil, and Mauritius Islands shared the objective of learning how to teach children to be world citizens, implementing Systems Thinking to improve their communities. I genuinely believe we are on the right track.

Systems Thinking is a philosophy, a language, a body of knowledge and a set of tools that help us understand and work within complex systems and find the leverage points for sustainable change. The Rochester School is a leading example in this field.

Luz Marina Forero - Rochester School Mathematics Coordinator, Lees Stuntz - CLE Executive Director, and Peter Senge -MIT and SoL Education Partnership.

Compass Learning
Un aliado de calidad

Por: Julián E. Pérez M.
Coordinador Ciencias de la Computación
Colegio Rochester

Para el presente año escolar, nuestro Colegio Rochester ha integrado una importante selección de reconocidas y exitosas tecnologías de información y comunicación, con el propósito de impulsar el logro de sus propósitos relacionados con el aprendizaje para la sostenibilidad, el bienestar y el éxito de vida.

Una de dichas tecnologías es la plataforma Odyssey® de Compass Learning®, que consiste en una solución para el diseño, la articulación, la enseñanza y el seguimiento del currículo escolar, utilizada por más de dos millones de estudiantes, más de 70.000 profesores, en más de 10.000 colegios a lo largo y ancho del mundo.

Esta plataforma tiene como propósito principal el favorecer el aprendizaje a través del diseño de un currículo sensible a las diferencias de los estudiantes en cuanto a necesidades, habilidades, fortalezas y ritmos de aprendizaje, sin dejar de lado la agilidad, la singularidad y la flexibilidad que cada docente requiere para gestionar sus espacios de aprendizaje.

A través de Odyssey de Compass Learning, nuestros docentes tienen acceso a una basta, pertinente, y certificada internacionalmente base de datos de temáticas, actividades, recursos de aprendizaje y de evaluación, en las áreas de inglés, matemáticas, ciencias naturales y ciencias sociales.

Los estudiantes de Primaria Alta, Escuela Media y Bachillerato Alto, tienen entonces la oportunidad de disfrutar de la implementación de un currículo flexible, personalizado por su profesor, y con gran variedad de recursos para el aprendizaje en las áreas descritas.

Algunas de las características más relevantes de esta plataforma son:

- Pruebas preliminares para caracterizar los perfiles individuales de los estudiantes.
- Generación de rutas de aprendizaje individualizadas según las necesidades.
- Experiencias de aprendizaje orientadas a habilidades básicas como la lectura, la escucha, la observación, y la interacción con objetos virtuales como animaciones, simulaciones y otros.
- Currículo certificado y alineado con los estándares nacionales e internacionales.
- Herramientas flexibles y ágiles para la generación de informes y reportes que apoyan los procesos de toma de decisiones en torno al aprendizaje.
- Acceso 24/7 desde cualquier equipo computacional, tableta, teléfono inteligente o dispositivo móvil con acceso a la Internet.

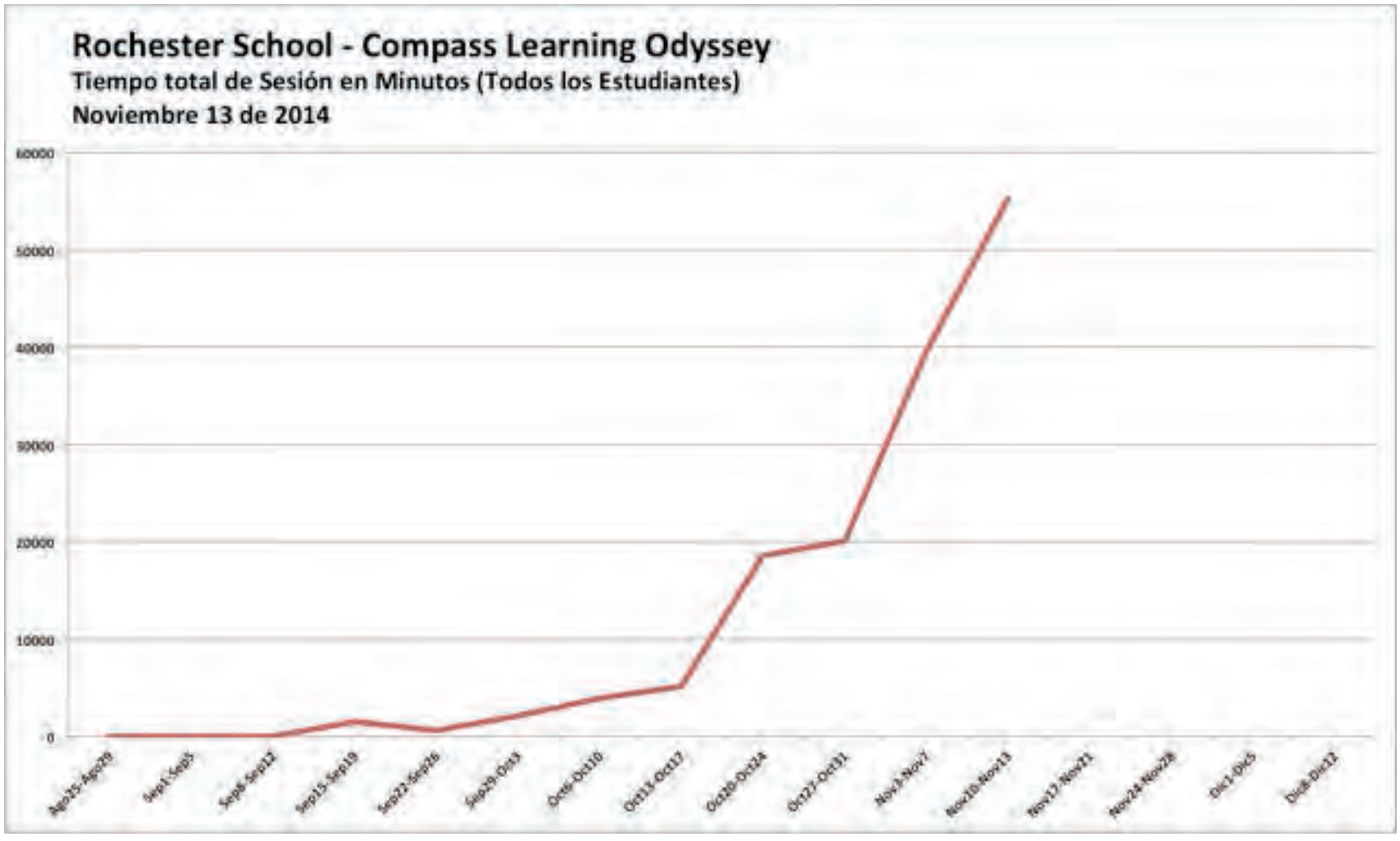
Estudiantes y Docentes utilizando la plataforma Odyssey® de Compass Learning®

En este año Odyssey se ha hecho merecedor de dos premios por Education Software Review (EDDIE), en su décima novena edición, por sus productos Pathblazer y Hybridge, dedicados a fortalecer la instrucción básica y la implementación de espacios de aprendizaje en escuela media para el área de matemáticas.

Nuestro colegio es uno de los pioneros en Colombia en utilizar esta herramienta, lo que plantea un reto muy interesante: Liderar la implementación de tecnologías de información innovadoras para los procesos de aprendizaje de nuestros estudiantes, de manera confiable y sostenible.

Al mes de Diciembre y luego de más de tres meses de implementación, podemos apreciar gracias a las cifras provistas por la plataforma, que los índices de uso por parte de los docentes y los estudiantes han venido incrementándose de forma constante y acelerada, tal y como se muestra en la gráfica:

Es muy grato percibir en el día a día de nuestro colegio que estamos viviendo una época muy interesante de innovación, liderazgo y nuevos prometedores rumbos en todos los frentes. Nuestro colegio ha sido reconocido nacional e internacionalmente desde lo ambiental y lo energético (LEED Gold), por su modelo educativo (Colegio de Calidad Glasser), y ahora se prepara para ser exitoso en el uso de tecnologías de información para la educación con alianzas como la establecida con Compass Learning, por lo que invito a toda la Comunidad Rochesteriana a disfrutar al máximo de las oportunidades que Oddysey proporciona en beneficio de la calidad de nuestro servicio educativo.



¿Por qué el Colegio Rochester ha escogido a Compass Learning?

Seleccionado por ser un programa innovador y rico en contenidos (incluyendo su aplicabilidad en iPad y Android); aumenta el currículo del aula y mejora:

- La productividad docente
- Las fortalezas del estudiante
- El seguimiento de los padres y maestros con la tecnología para fomentar la excelencia educativa.
- La preparación para la universidad

Algunos criterios de selección son:

- Contenidos académicos de Jardín a 11°
- Potencia el uso amplio de los recursos en el salón de clase
- Valor técnico versus el enfoque tema
- Sistema de gestión.
- Alineado con estándares norteamericanos (Common Core)
- Promueve la exploración, aprendizaje cooperativo, resolución de problemas, la reflexión y las conexiones del mundo real en lectura / artes / lenguaje, matemáticas, ciencias y estudios sociales.
- Interactividad y modernas animaciones en su material audiovisual en todos los niveles.

Special Guests

Guiding Principles for Brain-Based Education

Building Common Ground Between Neuroscientists and Educators

By: Eric Jensen

Eric Jensen is a former teacher with a real love of learning. He grew up in San Diego and attended public schools. While his academic background is in English and human development, he has a real love of educational neuroscience. For over 20 years, he has been connecting the research with practical classroom applications.

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ABSTRACT

Many scientific researchers have shown connections between brain functioning and student learning. But a large number of educators have been frustrated with understanding and interpreting the language, limits and scope of recent neuroscientific findings. As a result, many forward-thinking neuroscientists and educators have been forging ahead with their own parallel sets of understandings and conclusions about brain-education interactions and implications. Here, collaboration is suggested to develop a common language and platform for understanding and implementing the research in schools. Specifically, we need of a common body of governing "brain-based principles" that support our collective understanding of learning in an educational context. Seven initial principles are proposed for discussion and it is hoped that more will be added over time. Brain-based learning means understanding these principles.

BACKGROUND

The conundrum is straightforward. By nature, educators tend to be fairly practical. Ask the staff at most schools what they want to hear on their next professional development day and the resounding chorus would say, "Practical strategies!"

While the request seems innocent enough, the difficulties with this approach are many. For starters, much of scientific research was done under very narrow constraints and cannot be widely generalized. Schools, by contrast, are far from a fixed environment. They are a run "on the fly" with a varied curriculum, constant staff turnover, unpredictable social and emotional interactions, a wide spectrum of physical buildings, and highly varied inventory (students). The research that educators typically want to draw from is also varied. We might roughly classify the neuroscientific scientific research into three categories: basic, clinical and applied.

1. Basic research is conducted at the micro level. Studies are often done at on molecules, cells, genes, structures and bodily processes which can seem distant to educators. But much of basic research does have relevance to educators. For example, basic neuroscience studies revealed neurogenesis (the production of new neurons) is conserved in humans and that neurogenesis is highly correlated with learning, memory and mood.

2. Clinical research is typically done with animals or humans, often in a university setting. The experiments are likely to be well-controlled and the results more credible. Clinical research studies on neural plasticity in animals led to human studies which eventually led to commercial programs such as FastForward® facial software "Let's Face It" by Jim Tanaka's team at Princeton.

3. Applied research is typically done in schools (medical, dental and academic) where the results seem more clear, but there are still issues with demographics, sample size, subject variability, compliance, protocol and generalizability. In many cases, longitudinal studies with large sample sizes may be the only appropriate way to study the effects of a particular strategy or model, but there's little funding for large-scale, long-term academic studies. Brain-based learning means using this in your contexts.

CORE ISSUES

It is clear to both of the stake holders that each of the three research domains listed above has its own limitations. But unless educators understand the theoretical and research basis for any classroom strategy, are they really any better off? Unless they can 1) articulate the research basis of their strategies being used, 2) understand the context, scope and limitations of the research being applied and 3) keep track of what is done and the results in the form of actions taken, are educators any better off than using random strategies? For example, many teachers use a classroom "energizer" assuming that it'll increase oxygenation and heart rate (including circulation to the brain). But they may be unaware of the varied contexts for the simultaneous release of chemicals such as cortisol, dopamine or norepinephrine that have a wide (and unexpected) range of effects on student cognition or behavior.

On the other hand, neuroscientists are grounded in research. Research studies are often fraught with confounding variables that suggest limits on the scope, demographics and certainly on the capacity to generalize the experimental results to widespread application. To a degree, their peers play a part in maintaining an industry-wide standard of quality. Scientists understand experimental design and want to be cautious about making any classroom "translation" of assertions of the data into a teaching strategy. Their profession has taught them well to avoid making any leaps from theory to practice that cannot be justified without further research. And while the NIH and other funding agencies have increased their requests for applied studies, not everything worth studying can or should fall into the "applied" area of study.

COMMON GROUND

Each of the two groups (educator and neuroscientist) have different perceptions, different work strategies and different professional needs. What is being proposed is a common ground. Towards this goal, many noted researchers have been fostering interdisciplinary programs (e.g. Kurt Fischer's degree programs at Harvard, Marc Swartz's program at UT Dallas). Many forward thinking educators have also developed opportunities for educators and neuroscientists to interact through mind-brain conferences. These events encourage dialog and increased common knowledge. But what's needed is a philosophical and theoretical bridge.

This common ground could consist of a common set of neuroscientific principles that can be understood by the layperson.

While one could generate dozens or even hundreds of guiding principles, only ten will be introduced as a starting point. If we generate too few principles, the principles become so generalized, they become functionally useless. Yet, too many principles may become too cumbersome for one to learn and apply them all. Several educational consultants (e.g. Caine and Caine, Kovalik and myself) have already developed lists (from 7-12) of brain-mind principles for our own audiences. No claim is being made that this list is either inclusive, or superiour to any other list of principles. The two claims that are being made here are: 1) there may be some value in the application of these in an educational context versus, and 2) the list may be a useful starting point for discussion to help "bridge" the two professions. While countless principles could have been offered, only principles which appeared to have a significant relevance to educators were chosen. As a starting point, the following seven are being presented for discussion. Brain-based learning starts with principles.

1. Brains are dynamic, not static

Principle: Contrary to the fixed brain theory a few short years ago, brains are not fixed. In fact, they are susceptible to change throughout our lifetime.

The changes are driven by myriad of factors. Those factors include experience- dependent changes (nutrition, stressors, exercise, socialization, learning) and experience-independent changes (pruning, maturation, aging). Many changes are the result of gene and environment interactions known as gene expression. In short, our DNA is not 100% of our destiny.

When we change, what specifically changes in our own brain? The changes occur at the system levels, organ levels, chemical, cellular and and genetic levels. As an example, our brain activates variations in the production, survival and death of neurons. It will enhance or diminish cell connectivity, cell size, and alter the location of brain activity. Our brain will have fluctuations in specific areas of tissue size, proportions of gray and white matter as well as baseline chemical levels. In short, our brain is a busy cauldron of activity. While some change is a function of everyday living, a significant amount is actually regulated by our lifestyle. This invites enormous opportunity for influence through education or self-regulation.

Collorary:

While it's true that random activities can change the brain (e.g. trauma) educators should know that certain purposeful, school-wide or classroom experiences can strategically change the student's brain. The ability of the brain to rewire and remap itself via neuroplasticity is profound. Schools can influence this process through skill building in areas such as reading, meditation, arts, career preparation, physical activity and thinking skills that can build student success. The evidence is compelling that when the correct skill-building protocol is used educators can make positive and significant changes in the brain in a short period of time.

Connections for Educators: All educators should know the brain can and does change every day. In fact, every student's brain is changing as they attend school. But many policy-makers squander this opportunity for growth by mandating large bodies of inert content, especially in the early formative years. Students are still sorted like beads, buttons or fruit. Teachers a mandate of 30-90 minutes a day and

3-5x per week to upgrade student skill sets. Teach attentional skills, memory skills and

processing skills. Progress requires focus, "buy-in" and at least a half hour a day. Brain-based learning means you are purposeful about teaching in a brain- friendly way.

Cautions: We now know that underperforming students can usually do much better if the school experiences are positive, targeted and sustained.

But without understanding the specific "rules" for how our brain changes, educators can waste enormous amounts of time and taxpayer money, and students will still fall through the cracks. Evidence suggests the applied, contrasting skill-building needs applications for 20-90 minutes a day at least three or more times a week to students who "buy-into" the process to show sustained results.

2. Human brains are Unique

Principle: A combination of genetics and life experiences make every human brain as unique as a fingerprint. Of those who responded to the UCLA "healthy brain" student advertisement and considered themselves to be normal, only 32% passed the initial telephone screening process. Of those who qualified for the in-person health history and physical examinations, only 52% passed these screening procedures.

Now we can do the math: only 11% of those individuals who believed they were healthy/ normal even qualified for brain imaging. Of the original 2000 students, just over 200 ended up meeting the criteria. The actual study concludes by saying,

"The majority of individuals who consider themselves normal by self-report are found not to be so." Let me repeat: almost 90% of human brains are atypical, damaged or in some way not healthy. That does NOT mean that many students have not compensated; they have.

Collorary:

Connections for Educators: This principle says much more than "One size does not fit all" or that "differentiation is a good idea. This is a profound understanding that tells us the entire educational model is outdated. For decades, educators were told that there is a large body (80-95%) of "mainstream" kids who were normal or typical. The remaining students were identified as "outliers" and typically classified as gifted, behavior disordered or requiring special education. This model does not match up with the scientific data on brain variations. What is more accurate to say is, "We have significant variation in the large majority of our students (80-95%) and the remaining "outliers" have what we call a typical or "healthy" brain. Brain-based learning means respecting uniqueness by using variety and choice in the teaching process.

Cautions: While the political and educational implications of this are enormous, it is unknown to what degree this should shape policy. Certain schools expend a significant amount of resources (time, money and policymaking) to socialize students into "sameness" such as private prep schools, military schools, parochial schools and selected public schools. To the degree that these schools succeed, students many become more alike in their behaviors. Yet, on the whole, we are unique beings with a unique set of beliefs, experience, knowledge and actions. Schools that can engage students via their differences can meet needs better.

CONNECTIONS:

3. Brains Use Active Construction of Learning

Principle: We could categorize student learning (information, values or skills, etc.) in many ways. One way to group it would be to answer the question: "Was the knowledge "actively constructed" or "transferred" to you? The human

brain is designed for interactive learning. The human being is more helpless at birth than most other mammals. We are born more than “open” to environmental input; we require it to develop our brain properly. Without interactive visual, auditory and tactile input, our systems misfire and underperform. But our brains are designed to actively manage our experiences, not passively “download” them.

Useful, practical, functional knowledge is based in activity not passivity (Singer, 1995). While it has the capacity for a “sit and git” experience in a classroom memorizing numbers, poems, facts and geography lessons, this declarative capacity may be the weakest of all the brain’s learning systems. In fact, we cannot talk about the interface between the brain and learning or the brain and the environment as if these are isolated variables. For our brain, interactive learning experiences in a relevant environment are processed in far differently and more potent ways than sitting in a classroom and reading or memorizing a text.

Collorary:

At school, beginning in the middle and upper elementary grades (ages 8 and above) there is an increasing percentage of students being asked to sit “still and learn.” Brain-based learning means you orchestrate learning in ways that allow students to piece together the learning.

Connections for Educators

Cautions

Cognitive and Neuroscience. When animals and people do things in their worlds, they shape their behavior. Based on brain research, we know that likewise they literally shape the anatomy and physiology of their brains (and bod- ies). When we are simply exposed to events and information learning and teaching require active construction of knowledge, as research has demonstrated consistently in cognitive science for over a century (Baldwin, 1894; Bartlett, 1932; Piaget, 1952) and in neuroscience for 50 years (Singer, 1995). The conduit metaphor works to some degree for learning bits of information, but for using knowl- edge instead of reciting facts, cognitive and neuroscientists are replacing the conduit metaphor with a model of knowl- edge as actively constructed. People build knowledge by using it actively to do things in the world. For example, Piaget’s (1952) fundamental metaphor for knowledge is grasping ideas and facts with the mind and manipulating them physically and mentally.

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CONCLUSION

The first premise is that the emerging field of brain-based education needs a broader platform on which further work can be built. Many neuroscientists are unfamiliar with the demands faced by everyday classroom teachers, working with students age 6-17. Correspondingly, most educators lack the technical background to understand journal articles and create well-designed experiments what would yield useful data. Yet we must learn to understand each other and have a common vehicle with which we can move forward.

This article has suggested the potential value of a set of brain-based principles. It is the author’s view that these principles could be reviewed and refined in open forum ways similar to a Wikipedia posting process. Ultimately, these principles can be shared on websites and journals as a common platform for both educators and neuroscientists. Further discussion, insights and commentary will refine and update the proposed principles as both collegial insights and new research warrants.

4. Human brains are social brains

Social conditions influence our brain in multiple ways we never knew before. Today, sociology is

now influenced by the journal of Social Neuroscience. The student experience at school is a highly social experiences, which become encoded through our perceptual awareness which may encode our sense of reward, acceptance, pain, reciprocity, affinity and cooperation.

Neuroscience Connections. Isolation and poor social conditions, isolation or social "defeat" are correlated with fewer brain cells! Nobody knew this occurred five or ten years ago.

Educational connections: Do NOT allow random social groupings for more than 10-20% of the school day. Use targeted, planned, diverse social groupings with mentoring, teams and buddy systems. Work to strengthen pro-social conditions.

Teacher-to-student relationships matter, as do student-to-student relationships.

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5. Physical and cognitive connectivity

Our brains, bodies and minds are intricately connected. Physical activity, recess and movement are critical to education. Why? We now know that we can grow new neurons through our lifetime and that they are highly correlated with memory, mood and learning. This process can be regulated by our everyday behaviors, which include exercise. The optimal activity is voluntary gross motor, such as power walks, games, running, dance, aerobics, team sports and swimming.

Neuroscience Connections. We also now know that early childhood movement wires up the brain to make more efficient connections. That supports the later academic learning. Schools can and should influence these variables.

Educational connections: Educators ought to be encouraged to support more, not less physical activity. It raises the good chemicals for thinking, focus, learning and memory (noradrenaline, dopamine and cortisol). Students need 30-60 minutes per day to lower stress response, boost neurogenesis and boost learning.

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6. Uniqueness is the rule, not the exception

Schools are pushing “Differentiation” as a strategy to deal with the differences in learners. That’s close, but not quite the truth. In fact, instead of there being mostly “typical” students with some with “differences” the brain research tells us the opposite. Let’s find out how common it is to have a “healthy brain.”

Neuroscience Connections.

Practical school application: Make differences the rule, not the exception at your school. Validate differences. Never expect all students (4th graders, for instance) to be on the same page in the same book on the same day. That runs counter to an extraordinary research databases that shows variations in maturation rates and other brain differences. Allow kids to celebrate diversity, unique abilities, talents and interests. Give them the skill sets, relationships and hope to succeed.

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7. Brains are designed for “gist” processing

New evidence suggests the value of teaching content in even smaller chunk sizes. Why?

Neuroscience Connections. The old thinking was that students could hold seven plus or minus chunks in the head as capacity for working memory. But that science is outdated. The new research says two to four chunks are more realistic. In addition to this shorter capacity for working memory, our mid-term “holding tank” for content, the hippocampus, has a limitation on how much it can hold. It is overloaded quickly, based partly on learner background and subject complexity. There are other reasons our students get overloaded quickly with content. Learning and memory consume physical resources such as glucose and our brain uses this quickly with more intense learning.

Practical school application: Teachers should teach in small chunks, process the learning, and then rest the brain. Too much content taught in too small of a time span means the brain cannot process it, so we simply don’t learn it. Breaks, recess and downtime make more sense than content, content and more content. Here’s the guideline: the more background the learner has and the greater the complexity of the content, the shorter the time chunk (use 4-8 minutes). The greater the background knowledge, the less the complexity, the longer the “input” stage (8-15 min.) is acceptable. Under no condition, should there be more than 15 consecutive minutes of content input. Share this with your teachers. But share it in a small chunk, and then allow time for processing it.

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8. Role of the Arts

The role of the arts in schools continues to be under great scrutiny. But five neuroscience departments at five universities (University of Oregon, Harvard, Univ. of Michigan, Dartmouth, and Stanford) have recently completed projects studying the impact of arts on the brain. Arts and Neuroscience is a new journal that tracks the connections being made by researchers. The recent results suggest that arts are far better than earlier believed. They show that certain arts boost attention, working memory, and visual spatial skills. Other arts such as dance, theater and drama boost social skills, empathy, timing, patience, verbal memory and other transferable life skills.

Practical school application: Make arts mandatory and give students the choice of several, support with expert teachers and the time to excel at it. Right now, evidence suggests that you get the most value from 30 to 60 minutes a day three to five days a week. Arts support the development of the brain's academic operating systems in ways that provide many transferable life skills.

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9. Humans are emotional by nature

Humans have the remarkable capacity to display many emotions, but only six of them are "hard wired" or built in at birth. This is profound because it tells us that unless children get these emotional states taught to them early (ages 0-3), when they enter school, they'll be emotionally narrow. Kids rarely ever get the emotional skills built in to ready for school. This leads to more discipline problems and weakened cognitive skills in school. This means we'll have kids at school who do not understand appropriate emotional responses (e.g. cooperation, trust, shame and humility) unless we teach them at school. Most kids are not getting these taught at home. You class should offer quick, daily skill-building with blended-in-daily practice.

Otherwise students will misbehave, not understand directions, fail to be respectful to teachers and show no empathy when others are in pain. There are more early childhood kids in day care (60-80%) today compared with 10-12% in two generations ago. This is also profound because out of the possible hundreds of emotional states, only a few are good for learning (e.g. anticipation, curiosity, suspicion, confusion). Most states are, in fact, bad for learning.

Practical school application: This suggests two things. One, we must teach appropriate emotional states as life skills (e.g. honor, patience, forgiveness and empathy) and, secondly, it's important to read and manage the other emotional states in the classroom. In good states, students learn well and behave better. Insist that teachers build social skills into every lesson. Ask that they use the social structures that are advocated in cooperative learning programs every day. The better the social skills, the better the academics. Many good programs are in books, workshops and online. Why put effort into this area? Kids who learn patience, attention, empathy and cooperation will be better students.

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10. Special Education

There have been stunning strides in rehabilitation of brain-based disorders, including Asperger's, learning delays, dyslexia, and autism. The discovery that aggressive behavioral therapies, new drugs and revolutionary stem cell implantation can be used to influence, regulate and repair brain-based disorders has been amazing. Now we have the Journal of Rehabilitation and The International Journal of Rehabilitation Research. Psychiatry is now guided by the journal Biological Psychiatry. These journals showcase innovations suggesting special education students may be able to improve far more than we earlier thought.

Practical school application: Make sure all teachers (not just special ed) learn the latest in dealing with special education learning delay recovery. Most kids can be brought back into regular ed classes, but not with inclusion-only strategies. It takes consistent hour-a-day skill building or the student won't change. Learn the right skills and go to it 3-5 days a week.

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11. Memory is Malleable

The recent brain/mind discovery that even memories are not fixed but, instead, are quite malleable is powerful. Every time you retrieve a memory, it goes into a volatile, flex state in which

it is temporarily easily re-organized. This is highly relevant for teachers and administrators who are responsible for student learning and classroom testing. Every time students review, they might change their memory (and often do). Yet, without review, they are less likely to recall their learning. It suggests that teachers use several strategies to continually strengthen memory over time instead of assuming that once learned, the memory is preserved.

Neuroscience Connections.

Practical school application: First, teachers should review the content half way between the original learning and the test. If content is taught Monday and tested on Friday, then review should be on Wednesday. Second, teachers should mediate the review process with students through structured reviews such as written quizzes or group work that ensures quality control. Otherwise the material is more likely to get confused and test scores drop.

Citations:

Pashler H, Rohrer D, Cepeda NJ, Carpenter SK. (2007) Enhancing learning and retarding forgetting: choices and consequences. Psychon Bull Rev. Apr;14(2):187-93.

Pashler H, et al. (2005) When does feedback facilitate learning of words? J Exp Psychol Learn Mem Cogn. Jan;31(1):3-8.

BRAIN-BASED EDUCATION INSIDER

A field has emerged known as “brain-based” education and it has now been well over twenty years since this “connect the dots” approach began. In a nutshell, brain based education says, “Everything we do in education uses our brain; let’s learn more about it and apply that knowledge.” However, this author suggests a new collaborative process which does more than establish connections between brain function and educational practice. We need a common ground on which both educators and neuroscientists can agree.

But it is not the job of classroom teachers to understand and formulate.

If your question was, “Are the approaches and strategies based on solid research from brain-related disciplines or are they based on myths, a well-meaning mentor teacher or from “junk science?” Now you know the answer. We would expect an educator to be able to support the use of a particular classroom strategy with a scientific reasoning or studies.

Each educator ought to be professional enough to say, “Here’s why I do what I do.” I would ask: Is the person actually engaged in using what they know, or simply having knowledge about it, but not actually using it? Are they using strategies based on the science of how our brain works? Brain-based education is about the professionalism of knowing why one strategy is used over another. The science is based on what we know about how our brain works. It’s the professionalism to be research-based in one’s practices. Keep in mind that if you don’t know why you do what you do, it’s less purposeful and less professional.

Chronic stress is a very real issue at schools for both staff and students. Recent studies suggest 30-50% of all students fell moderately or greatly stressed every day. Acute and chronic stress is explored in theJournal Stress, the International Journal of Stress Management, the Journal of Anxiety, Stress and The Journal of Traumatic Stress. In some schools, the numbers are double that! For those from poverty, the numbers can be higher. These pathogenic allostatic stress loads are becoming increasingly common and have serious health, learning and behavior risks. This issue affects attendance, memory, social skills and cognition. Some stress is good, chronic or acute stress is very bad for behavior and learning.

Practical school application: Teach students better coping skills, increase student perception of choice, build coping skills, strengthen arts, physical activity and mentoring. These activities increase sense of control over one's life, which lowers stress. All of these can reduce the impact of stressors.

Citations:

Johnston-Brooks, C. H., Lewis, M. A., Evans, G. W., & Whalen, C. K. (1998, Sep-Oct). Chronic stress and illness in children: The role of allostatic load. Psychosomatic Medicine, 60(5): 597-603.

Koomen, H. M. & Hoeksma, J. B. (2003, Dec). Regulation of emotional security by children after entry to special and regular kindergarten classes. Psychological Reports, 93(3Pt 2):1319-34.

In fact, neuroscience is exploding with discoveries about the brain as being highly malleable. We used to think about the paradigm as either genes or experience. We now know it can be a hybrid of both! New journals called Gene Expression, Gene Expression Patterns and Nature Genetics explore the mechanisms for epigenetic (outside of genes) changes. We now know that environments can trigger genes to express themselves in ways we never would have predicted—IF you know what to do. You can upgrade a student's capacity for memory, processing, sequencing, attention and impulsivity regulation. Why not teach these skills to give students the tools to succeed?

The brain changes! Plasticity is a lifelong quality that varies only in degree. The big message here is simple: Brain-based learning means understanding how the brain works and applying it to your work in a positive way.

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