HOW FORMATIVE ASSESSMENT SUPPORTS STUDENT CENTERED LEARNING IN A FLIPPED SCIENCE CLASSROOM

by

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DEDICATION

I dedicate this capstone to Doris Taylor for her mentoring, both in the classroom and out, for her support of me as an inspiration to children, and as a guardian of my own spirit. Doris empowered my creativity, and after our parting I always tried to carry forth her rigor and respect for teaching science.

I also dedicate this work to my husband Tim Vandehey for his support and encouragement throughout my MSSE degree fulfilment and our continuing and growing friendship through the years.

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I would like to acknowledge the people responsible for taking their time to discuss the development and implementation of this action research project with me, and always they responded without hesitation. Each individual named has played a vital role in this research in both its logistics and in my emotional support. Thank you, Heidi Berryman-Kellar, Rocky Harris, Jason Mendenhall, Jeff Luther and the Luther team, Rian Petrick, Kevin Kottkey, Kevin's 7th grade class of 2014-2015, Patrizia Mastne, Michael Laus, Lindsay Sanders, John Plagata, Kristi Helzer, my husband Tim Vandehey and my dog Daisy Quain Vandehey for the Frisbee and Chucker ball breaks.

As the author of this study, I wish to declare that I am a current employee of NWEA, working as a science item acquisition specialist with projects directly related to MAP and Skills Navigator. This study has been conducted outside the organization and data was received directly from the participating school. The findings from this study have no bearing on my employment within NWEA.

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ABSTRACT

Students in a flipped classroom environment use a variety of technology to access content information outside of the classroom and develop the skills while in the classroom with the teacher. Studies on new teaching methodologies are show that this classroom design promotes the student's ability to monitor their own progress and feel centered with their learning and not detached. My research reiterated common accounts of student classroom learning and unveiled important information about how well students understood how standards are aligned. The first implementation goal was to use a formative assessment to gather pre and posttest information for the teacher and student. The assessment is a professionally designed and aligned product that gives accurate information on where students are in the skills they have been assessed on. My goal was to see how well students would respond to using the assessment to gather information about their own learning, independent of a structured and timed assessment event.

Results showed that the participant students (*N=35*) who took assessments and tutorials gained 1.6 years in science. Student levels averaged a science mastery of third grade and six months and after the treatment the students averaged at fifth grade and two months. Additional information related to student behaviors and attitudes on learning, assessments and curriculum were brought up through the course of working with the students.

INTRODUCTION

The development of this project came by the way of a relationship a co-worker had with Evergreen Middle School (EMS) in Hillsboro, Oregon and because a student population was needed to perform action research. Rocky Harris, coworker, taught in the Hillsboro district for 25 years teaching geography, history and social studies at Hillsboro High School prior to his career in research and development at Northwest Evaluation Association (NWEA), where he and I met. He devoted several hours a week volunteering as an assistant to Mr. Kevin Kottkey, a 7th grade science teacher, who teaches in a flipped classroom environment.

After leaving teaching, I found a career path on the content and design team at NWEA, writing items for state and district formative tests. The development was meant to provide possible data for the needs of what I do in my work but, still stay true to helping students. My first idea of how to design this research was working with Classroom Assessment Techniques through a course from the MSSE program. After learning of the relationship Mr. Harris had with EMS, I met with the principal and teacher to discuss permission to work in their school

At the time of the development, NWEA had acquired a product and subsequently re-wrote the product that was to help teachers and students in the classroom, today. This formative assessment product is Skills Pointer™. Skills Pointer™ is a drill down set of questions that focus identifying gaps in skills that make up a strand for learning concepts. This assessment was new and exciting because of the potential for making things happen immediately for students and teachers, something I would have liked to have had as a

teacher. As of July 2015 however, Skills Pointer™ has had a phase 2 generational re-make and renamed Skills Navigator™.

Before any more development could ensue, permissions had to be granted from these management teams at NWEA: Product Management, Research and Development, Executive members and our Legal team. The process of negotiating with higher management was relatively smooth and supportive. Gains in self-confidence to make these arrangements, noted.

The students at EMS in the Hillsboro School District in Hillsboro, Oregon have lower than state average scores in science with 46% of students meet state expectations, 44% not meeting, and over 9% are exceeding those expectations. The state averages for students meeting the expectations are 54%, 33% not meeting them and 12% exceeding. The Hillsboro School district is located 20 miles west of Portland, Oregon in Oregon's Silicon Valley and large agricultural areas. It is the fourth largest public school district in Oregon, serving over 20,000 students in grades K-12. The state rating for EMS is a mid-level three, below the state average of low-level four. Compared to other middle schools with equivalent demographics, the school ratings are below district average. Students in Mr. Kottkey's classroom are 56% white, 35% Hispanic and Latino, 4% multi-racial, 2% black and less than 1 % Native American/Alaskan (Hillsboro School District Report Card, 2013).

The Principal of Evergreen supports the flipped classroom design of 7th grade science teacher Kevin Kottkey. Flipping a classroom is easier defined as administering traditional lecture in an electronic format for students to view or read out side of regular

class time. Specifically, Mr. Kottkey uses his classroom website for announcements, reminders and lecture homework. Mr. Kottkey has developed instructional videos for the last two years and continues to bring more ideas to his flipped classroom environment.

Accommodating student learning in the 21st century relies on how content in the classroom is accessed and how students make their learning by their design. Our children will work in industries based on advanced computer systems that require them to identify and solve problems in a way our current educational delivery system does not innately encourage by nature.

Daggett and McNulty (2005) stated in their research: "More extensive scientific and technological advances will occur in the next few years than have happened in the last two centuries. Dealing with these advances requires a different education system from the one in which we were educated." (Flumerfelt & Green, 2012, p. 358)

With more teachers and districts turning to an alternative method of delivering instruction and evaluating educators, other aspects of student achievement need to be researched and explored. Research indicates there is a need to revise how assessments are used in non-traditional classrooms. And, how do we encourage our students to value their own learning process, being self-guided, and motivated to so. My research uses a non-traditional, flipped classroom to observe how the use of the NWEA formative product, Skills Pointer™, affects student centered learning.

The mission at NWEA, is simply, to help all kids learn. The products lead the industry in innovation and in teacher student value. Skills Pointer™, is designed to use as many times a teacher or student finds necessary. This product assesses special skills,

reports immediate feedback to the student, provides a mini-lesson for that skill, reports immediate feedback to the student, provides a mini-lesson for that skill and will allow the student to re-assess until mastery is determined. The focus question for this study is, Does Skills Pointer™ increase student achievement? In the course of the study, sub questions on how Skills Pointer increases student independence, how the teacher incorporates the product in a flipped classroom and how, overall, Skills Pointer™ be an integral part of the daily routine in a 7th grade science classroom were evaluated.

Mr. Kevin Kottkey currently uses a flipped classroom design, and the researcher used Skills Pointer™ assessments in his class for six weeks starting in March 2015 to determine how accessible and valuable the assessments are in a self-guided, student centered environment.

CONCEPTUAL FRAMEWORK

The flipped classroom model is an increasing trend but hard to establish in K-12 education. The basic definition of a flipped classroom consists of disseminating information to the student before class via electronic mediums and devices.
What this means for assessment opportunities will need redefining. The literature reviewed establishes the background necessary to understand the basic structure of the successfully flipped classroom. The practice of inverting, or flipping, classroom instruction is popular, but used sporadically across the country as an alternate delivery of content to students.

McDonald and Smith (2013), describe the flipped classroom as a way to personalize instruction for the different learning differences students have and to allow

the teacher more time to perform quick assessments for understanding. Flipping the classroom transitions the classroom content introduction to content application.

The content information reviewed before class allows students more time to ask questions and practice the content with teacher feedback immediately accessible. There are many deviations of inversion and teachers decide on how to design it specifically for their students' needs. Goodwin and Miller's (2013) research highlighted that "The lack of hard scientific evidence doesn't mean teachers should not flip their classroom; indeed, if we only implemented strategies supported by decades of research, we'd never try anything new (p. 78)." They outlined five evidences that flipped classrooms are beneficial to 21st century learner:

- Improved student-teacher interaction- Teachers move about the room and are not talking to students but interacting throughout the class time.
- Real-time feedback- Spot check assessments, Q & A over homework and teacher assistance with group work are available with greater rigor because of the additional time in class.
- Student engagement- Because there is more one-on-one time with teacher, the students engage quickly and longer, and take more ownership of their learning.
- Self-paced Learning-Because the content is delivered electronically, students who know the background information can fast forward, but students who need to recall the information can rewind and play back the missed information.

- More meaningful homework- Homework consists more of thoughtful reasoning in the content and not the quantity of practice that will happen in the classroom with the teacher.

The results of a case study by Mason, Shuman & Cook (2013) compared the inverted classroom (IC) to the traditional classroom in a Control Systems course in the Department of Mechanical Engineering, at Seattle University, Seattle, WA. The study communicates the impact of flipped classrooms on student learning. The study design, a senior level credit course, was taught for 10 weeks and material was presented to students in traditional and inverted models for two years. The study carefully identified group similarities, content coverage, quiz and exam performance, student perception of teaching, and student perceptions of the inverted classroom. Although rigorous studies of the flipped classroom are scarce, these results corroborate with other key findings. The conclusion of that study supported more teacher-student interaction, more content was formatively assessed to help the teacher design interventions, and performance on final tests improved.

A study by Schell, (2013) finds teachers need to improve assessment strategies in flipped classrooms. Stealth Flipper, Humanities Professor at the University of Texas at Austin has a large enrollment (N=400) and a flipped classroom model. Flipper monitored the viewing patterns of her students and found flipped classroom students who took her nine quizzes per week, continually viewed and reviewed online assets compared to her first implementation of a flipped classroom where she relied on a traditional assessment schedule consisting of three mid-terms and one final exam. Another important outcome

of comparing the two flipped classroom implementations was the resulting percentages of improvement. Lecture and flipped classrooms with traditional assessment yielded little to no increase in student learning, however, when the assessment model changed to multiple quizzes throughout the course, the increase in student learning was remarkable. Student engagement, less resistance to quizzes and reduced cramming were added effects to this flipped classroom.

Pre-class assignments and pre-class online quizzes help students and teachers receive immediate feedback on areas of understanding. This allows the teacher to tailor class activities to close gaps in skill mastery. In a review of study by Brame (2014), on flipped classrooms, Walvoord & Anderson (1998), suggested pre-class writing assignments to help students focus on content and to optimize class time reviews. Feedback is intentional and immediate.

My research project found parallels to most of the discoveries found in the literature review from other science classrooms.

The flipped classroom:

- Allows students more active learning time
- Allows for more review of concepts
- Interventions can be implemented just as easily in a flipped classroom as in a traditional classroom
- Student gaps in learning are reduced
- Students level of responsibility for their own learning increases.

Evidence from a study by Nicol & Macfarlane-Dick, 2006: Herman et al., 2006, confirms the benefits of formative assessments for student learning. “Formative assessment allows teachers to generate feedback and data about the current needs and progress of their students. The information that is obtained gives the teacher the chance to change, improve, refine or accelerate the topic he or she is currently teaching to better meet student needs (Nicol & Macfarlane-Dick, 2006: Herman et al., 2006)."

In my classroom research project, Skills Pointer™ was used as a pre-assessment in Mr. Kottkey’s classroom. Skills Pointer™ was evaluated in the flipped classroom for usability, implementation and student gains in life science. Did Skills Pointer™ facilitate in student mastery of content, increased student engagement and promotion of self-monitoring?

Skills Pointer™, a formative assessment, is a product designed and produced by Northwest Evaluation Association (NWEA). Skills Pointer™ is web-based technology, aligned to district and state standards. Skills Pointer™ provides quick, easy lessons for teachers or students to use when bridging the gap between skills for mastery (Learning Plans on Demand, 2014). “Skills Pointer provides and adaptive, 'goal strand' assessment to diagnose student learning gaps and deficiencies and can be used for progress monitoring within an RTI program. It also contains tutorials and interventions that are designed to help students attain grade level performance as quickly as possible (Northwest Evaluation Association Skills Pointer, 2014).”

Skills Pointer™ assessment is flexible and allows teachers to customize instruction for their students. The test design helps identify gaps in student mastery and

teachers can group students or provide individual instruction in the areas of need. The reports that can be generated for the teacher are quick and easy to use.

Skills Pointer™ has many features designed to help students close the gap in missing skills to improve learning. In a science classroom, students are not bundled in groups by their level of proficiency like math or reading. It is important for a science teacher to know where their students start, relative to where they need to be. This classroom research design collected data on the usability of Skills Pointer™ as a pre-assessment tool to help teachers organize their lessons based on remediation, differentiation, or enrichment opportunities.

Validation of Skills Pointer™ outside of NWEA's research or data was challenging. Credible sources were not available outside the company's research findings.

METHODOLOGY

The research methodology for my project received an exemption by Montana State University's Institutional Review Board and compliance for working with human subjects was maintained.

Participants

The student participants were 7th grade science students. Science teacher, Kevin Kottkey has 215 students and 70 were solicited for the project and 35 returned permission forms to participate in the project. EMS science classes are a mix of all 7th graders and not divided by advanced studies, English as a Second Language, or special education students.

My project was designed for a six weeks observation. March 2-6 was a planned introduction week and March 12- April 27, were data gathering. There was not a comparison group except that the initial assessment was used as the baseline to compare later results after tutorials.

Intervention

Skills Pointer™ is an adaptive test that finds missing skills for students in kindergarten through 8th grade. Used as a pre-assessment, the assessment begins two years below the current grade and questions move up to identify the mastered skills. For success, knowing where individual gaps are in learning is important. Also, finding issues concerning student misconceptions will have an even greater impact. This can benefit the teacher who is preparing new content for the whole group. In the beginning, each student was rostered and assigned a login number. Using classroom iPads™ to access the web and their account, the students took their first assessment in Life Science. Questions aligned with sub-goals from strands that started two years below grade level and focused on basic content expertise. At the end of the short test, averaging ten minutes, the student was able to see mastery results immediately. Students who met mastery level and continue with enrichment reading and activities chose independently which strand they wanted to review next, or, I systematically chose each step for each student by using the reports generated by the assessment.

The lessons and activities, are reading dense. Originally designed for use by teachers, a second generation will be available this summer offering student centered lessons that are fun and easy to access. The lessons are designed for teachers to

implement, but if the student wants to study independently, they can. I assisted students who needed a reader so they could access the content. I wanted to determine if Skills Pointer™ encouraged student-centered growth. Would it give students the freedom to approach their education in a responsible way that ultimately gives them a measurement of their own growth? I think this opportunity to evaluate their own skill level made students comfortable and confident about being in charge of their learning.

Data Collection

Observations were made in two classrooms, total (*N=35*). Data was taken on the amount of learning growth in life science and the attitudes toward the current procedures in the classroom regarding assessments. Classroom iPads™ were a vital component of the flipped classroom environment allowing students to access lesson content. Students accessed their classroom website, tutorials for Skills Pointer™, and Learning On Demand tutorials through these tablets. The initial data collected, the pre-assessment, gave the baseline for comparison to the final assessment at the end of the treatment. The first student survey focused on how students view having opportunities to move at their own pace and how they view their input in determining their learning. Students had the option of accessing their 5 question survey at any time before the next day of class, through the classroom website. Surveys were administered by Survey Monkey™. This was designed to parallel and support Mr. Kottkey's flipped classroom. Students had access to the classroom set of iPads™ to take their web-based assessments and surveys.

In the first week of research, procedures were reviewed, we modeled how to use Skills Pointer™, and we discussed how to read login accounts that kept track of their

progress. Students had opportunities to ask questions. Students practiced accessing Skills Pointer™ during class, on their iPads™. Students took their first assessment to find the pre-assessment grade-level for mastery.

At the start of the second week, students took their first survey (Appendix A). They were asked questions on the procedures, the preliminary work in Skills Pointer™, and how they liked the independence of following their progress.

After the first assessment, students then worked on a tutorial for one of the skills they needed more practice. The students found the content on their individualized page from the classroom website (Appendix B). After the tutorial, students took another short assessment in life science.

When the gaps were identified, short lessons were available for students to review on their own, or with the teacher (Appendix C). After the lesson the student retested on the skill again. The student will not see the same questions again so the gain is through learning the content and not from memorization. There were ten questions in each goal area.

In the following weeks, time was allotted for the rotation of students to come and go at their own pace, accessing the assessment with Skills Pointer™ during their class period or outside of class. Observations were made throughout the project by me in a composition notebook.

Students took a second survey during the third week of this study (Appendix D). Learning on Demand (LOD) reports were available throughout the research and those data were analyzed at the end of the six weeks. LOD is a teacher report generated by

psychometrics developed by education researchers, including our own researchers at NWEA. One LOD report rostered each student and described the level of mastery, or missed skills of each student. Another report can be generated by the teacher, producing practice tutorials for the student to follow immediately or at a later time. The LOD report is a feature of Skills Pointer™ that is used to gather data while in the classroom environment. A new generation of Skills Pointer™, Skills Navigator™ is scheduled for release in June 2015. The data gathered at EMS are recorded and could possibly help support the product in the future.

Hand-written observations were made in a journal by me when I was present in the classroom. I visited the classroom six times in person. Questions for this research are identified in Table 1.

Table 1
Data Triangulation Matrix

Focus Questions	Data Source 1	Data Source 2	Data Source 3
Primary Question: 1. Does Skills Pointer™ increase student achievement in a flipped classroom?	Initial attitudes surveys	Time management observations by researcher	Learning on Demand reports
Secondary Questions: 2. Does the use of Skills Pointer™ engage students in self-monitoring their learning?	Student surveys	Researcher's observations	Survey
3. Does Skills Pointer™ help teachers differentiate, remediate or enrich their students learning?	Skills Pointer Learning on Demand reports	Student surveys	Researcher observations

DATA AND ANALYSIS

Data was collected through Skills Pointer™ assessments, pre-treatment and post-treatment surveys, and observations. These data from Skills Pointer™ tracked student login attempts, assessments, tutorials, and recorded the measure of growth in life science in six weeks. This data showed that students accessed their own learning but not independently. It was necessary for the teacher and me to prompt students to access the tools. I found that once prompted, the students did attempt the class research assignment, and was not dependent on my presence. These values are supported in the frequency of login attempts made by each student throughout the 6 week study.

Impact on Student Self-Monitoring

The first focus question, "*Does Skills Pointer increase student learning in a flipped classroom*?" was tested by taking the assessment and finding the overall gain in learning in life science during six weeks of testing. The table scores are in school years, taking into account the student received a science education since Kindergarten. The decimals represent months of a school year. For example, a starting grade of 3.62 years represents a student in third grade in his sixth month and second week.

The population (*N=35*), averaged a starting grade of 3.62, but the average ending grade was 5.23, resulting in a 1.61 gain in grade level for life science (Table 2).

Table 2
Overall increase in Life Science

Strand	Starting Grade	Ending Grade	Gain in Grade Level
Life Science	3.62	5.23	1.61

Engagement in Responsibility

Understanding how the assessment helps students engage in independent learning was shown in observations and surveys. In answering the question, "*Does the use of Skills Pointer engage students in responsibility for their learning,"* students were first asked how well they understood the flipped classroom design, and how their curriculum was organized. These questions unveiled why or why not, students seem more or less motivated to take ownership in their own learning aside from being prompted by their teachers. The research uncovered a gap in the students understanding of curriculum development and the definition of student centered learning. Students did not understand how each subject, in this case science was designed for them each year. The concept of one skill providing the foundation for a more dimensional related skill later was not in their knowledge base. Students did not understand the development of learning.

For example, students knew their exact feelings on how they like to receive new information. When the question "*How do you like to receive new information*?" was posed, 45% of students identified video lectures as their favorite way to receive the information, and 42% of the population preferred hands-on activities. Notes and reading assignments made up for the remaining percentage (*Figure 1*).

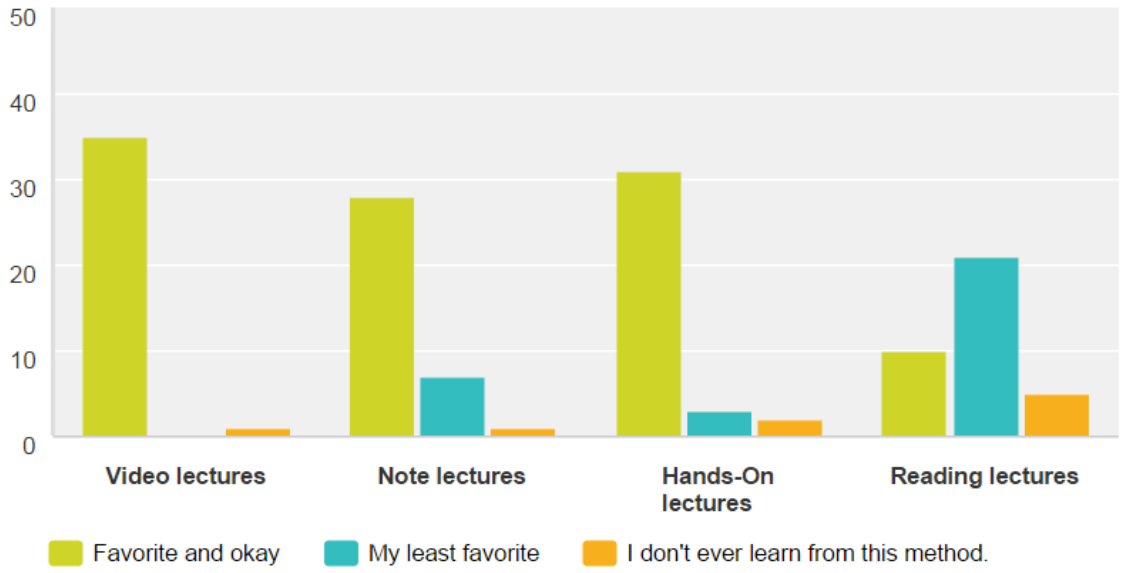

Figure 1. How students like to receive new information, (*N*=35).

The same predictable pattern emerged when students were asked about cooperative learning. When asked, "*Which activity helps you remember new information?*" 66% of the students preferred hands-on, real-world activities or interactive websites in group settings (*Figure 2*).

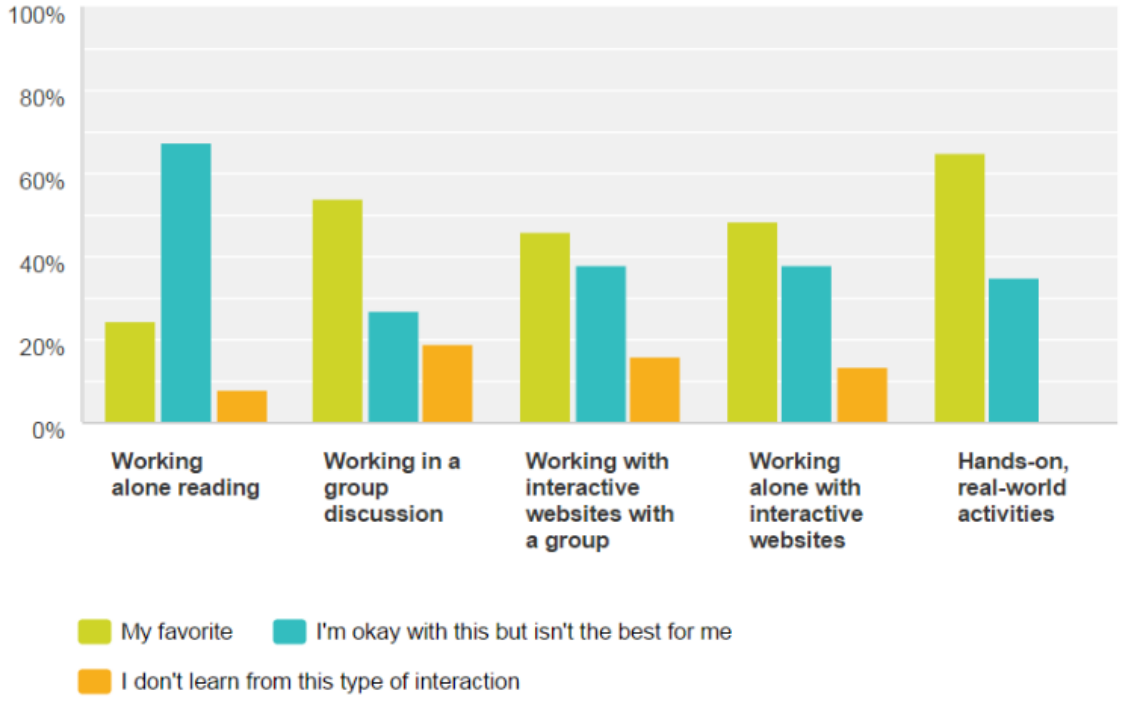

Figure 2. How students remember new information, (*N*=35).

When asked "*What is student-centered learning about*?" students defined it as a free-choice environment not lead by a teacher. They did not see it as managing their own time but curriculum and objectives decided by the teacher, school, school district, and state or federal standards. This point is important because if students understood alignment they might have more securities that their education is planned and not random, facilitating a more real life scenario for them. 49% of students thought that student-centered learning was about them deciding on what concepts they learn, 35% defined it as them deciding on which activities to do to help them learn concepts, while only 16% felt that they decide on how to manage their time with activities provided by the teacher (*Figure 3*).

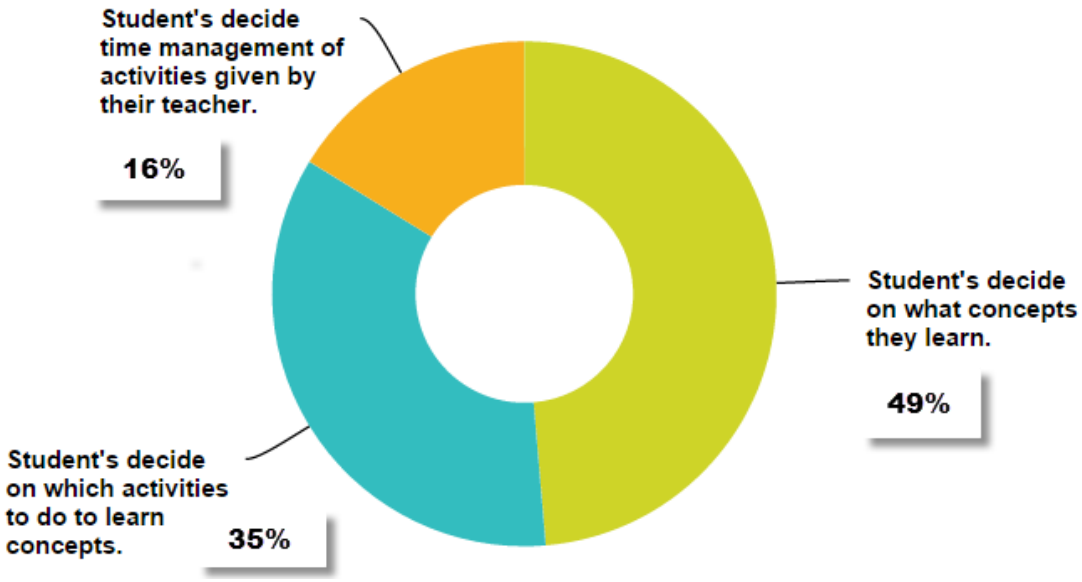

Figure 3. What is student-centered learning?, (*N*=35).

Using Skills Pointer™ as an Enrichment Tool and as a Pre-Assessment

By design a teacher can group students together by skills needed to master or skills used for enrichment. Skills Pointer™ allows teachers this opportunity to provide more rigor for students who grasp concepts easily and enjoy learning or getting ahead. There were three students who were observed using Skills Pointer™ when extra time in class allowed. Mr. Kottkey reports these are his highest scoring students.

Attitudes on Using Assessments to Guide Independent Learning

Student attitudes on self-guided learning through assessments were more positive than expected. Survey questions about how assessments can help them in their learning were mostly positive and showed positive attitudes on why assessing their progress was important. Sixty-five percent of the students felt that knowing the areas that needed work was helpful, 20% thought it helped learning by doing more tutorials on their own, and

15% of the students said it reminded them to listen more to their teacher, and another 5% suggested they know to ask more questions in class. (*Figure 4*.)

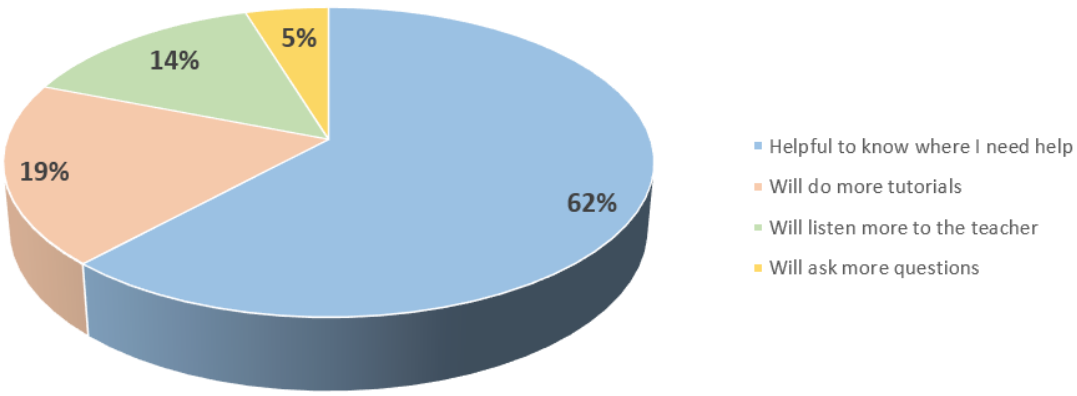

Figure 4. Student Attitudes on Assessment Value Survey, (*N*=35).

INTERPRETATION AND CONCLUSION

This study found that students and teachers can effectively use a Skills Pointer™ formative assessment in their classrooms, enhancing the flipped classroom environment, encouraging students to desire to learn more about their education. It was surprising to see students anxious about which tutorials were assigned and which assessment the needed to take covering the new material. The pace and design of the flipped classroom allows students to be together in a group or individually. The tablets bring engagement into the learning environment. The classroom assignments were driven on the tablet. The students accessed warm-ups, the class website, and video lectures from the iPads™. Adding the assessment intervention complimented the structure.

The literature review pointed out that a flipped classroom nurtured independence in students allowing the student a strong vested interest in their learning by providing different tools for students to access for their success. Mc Donald and Smith (2013). Assessments in the classroom have different manifestations such as classroom assessment techniques, online warm-ups, quizzes and unit texts. The Skills Pointer formative assessment proved to work as another alternative with the additional benefit of grouping students into learning categories immediately for the teacher.

In addition, previous studies indicated that more research is necessary across grade-bands and subjects for the concept to gain momentum enough to encourage a change in traditional classroom design. There is evidence in a study from Goodwin and Miller (2013) that described how a sophisticated process can be implemented in the flipped classroom environment.

Research Challenges and Recommendations for Adopters of Skills Pointer™

The biggest issue that arose in implementing the treatment was getting the permission from parents to allow student participation. Although the project was approved by the principal and the teacher, parents felt it was too impeding on their child's time at school. This meant my subjects were students who really had a desire to participate and whose parents felt their child had the time to invest. These were mostly Mr. Kottkey's better students. This research and its data would benefit from a broader group of individuals. In future and similar conditions, additional classes would have increased the number of participants.

The number of participants was small, but representative. It took one month to gather only 35 signed permission forms from parents. The error was that I decided to send forms home with only two classes and wait to send the other forms when I was ready to work the second set of participants. Because it took so long to gather subjects I was forced to cut my research in half. If I had sent permission forms home with all classes initially, I would have doubled my subjects for the study.

Working remotely from the site was an additional issue that I would attempt to eliminate on future projects. In accordance with a flipped classroom designed with electronic capabilities, I chose to send messages via power point, email or documents which Mr. Kottkey attached to the Action Research page of the class website. He would announce to the students there was an "AR" message and they were asked to go there and follow the attached procedures. This was difficult to implement with 7th grade. Students did not respond as often to the messages when the researcher was not present.

Future Implementation

Implementing Skills Pointer™ in the flipped classroom requires professional development which provides teachers with hands-on instruction on reporting features and preparation of the LOD tutorials. Utilization of the professional development offered by NWEA for partners who implement the product in their districts and schools will ensure easy implementation and student understanding for teachers. I did not have the in-depth training on LOD reports so my learning curve was steep. Key features of the assessment are understanding rosters, using the reporting systems and grouping of students by skill needs.

Learning how to use Skills Pointer™ in a short amount of time from introduction through implementation was problematic for the teacher and so I took the role over because my goal was to be as least invasive as possible to Mr. Kortney's teaching environment.

VALUE

A flipped science classroom provides many opportunities for teaching. The project had clear moments of where it could go and how it could help students. As data became hard to obtain or make sense of, the project became less clear and helpful outcomes were hard to describe. This project put me in the center of many professional areas. To get permission to use Skills Pointer™ I arranged over 15 meetings with NWEA management and two with the Hillsboro School District administration. I had one on one conversations about my project with one of our vice presidents who truly helped me get started by attending my first meeting with the product manager. The coordination of the project gave me opportunities to work with other teams at NWEA. This project has developed my professionalism more than if I had not had this opportunity.

Students who participated in this study were able to witness action research in their classroom. The students asked questions about what I was expected to do and they were always compliant and ready be a part of the study. The participants were given more detailed explanations on how assessments help them and got to see results immediately. Students also had a positive experience with assessment and were aware of the advantages of knowing where they were in their learning of concepts.

I think this research will benefit teachers who are in a flipped classroom but have questions about managing formative assessments in their environment. This research can also help teachers in a traditional classroom who want to see how a web-based assessment like Skills Pointer™ can help them help students learn.

Skill Pointer™ is helping students across the country and evidence shows that it can work for a non-traditional classroom setting as easily as the traditional environment. This research can be used to answer questions of potential partners who are interested in assessments from NWEA.

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APPENDICES

APPENDIX A

SURVEY #1

Survey 1

Survey 1

1. How many times did you log into Skills Pointer this week to take an assessment?

- ○ Zero
- ○ One - two
- ○ three or more

2. Did you review a tutorial this week?

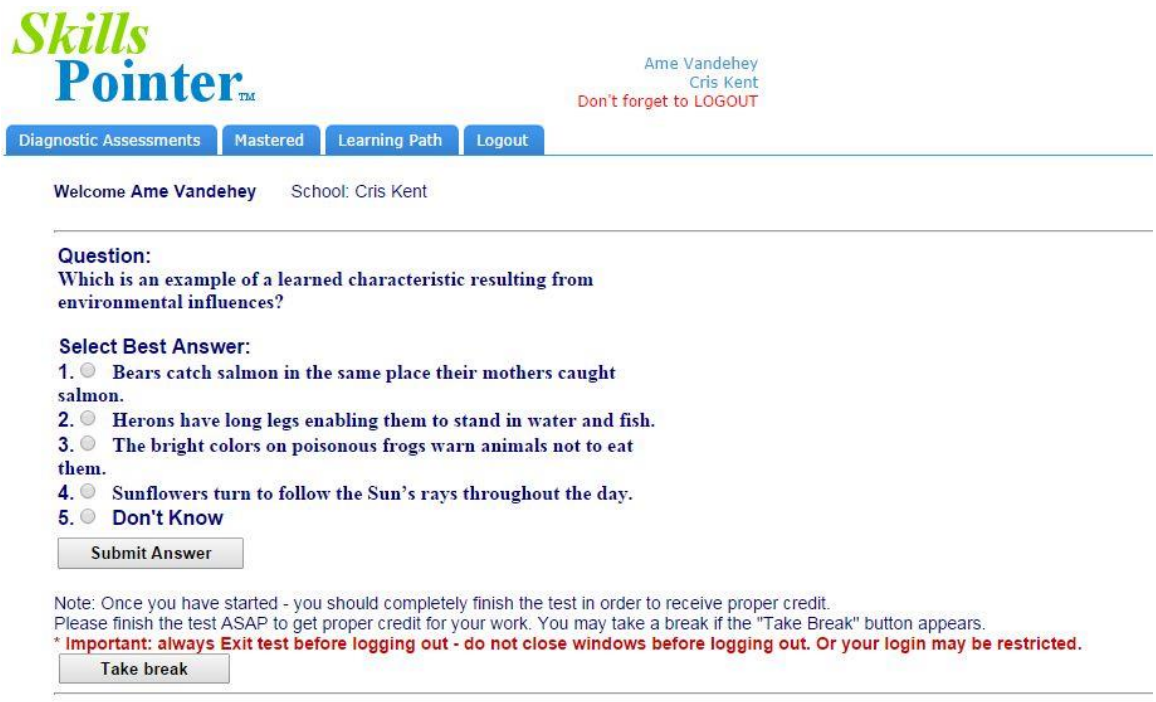
- ○ I looked at one but I didn't do the required work.
- ○ I read the tutorial but I haven't answered any questions.
- ○ I performed one or more activities related to the tutorial.

3. How do you think you can help your independent learning in science?

Done

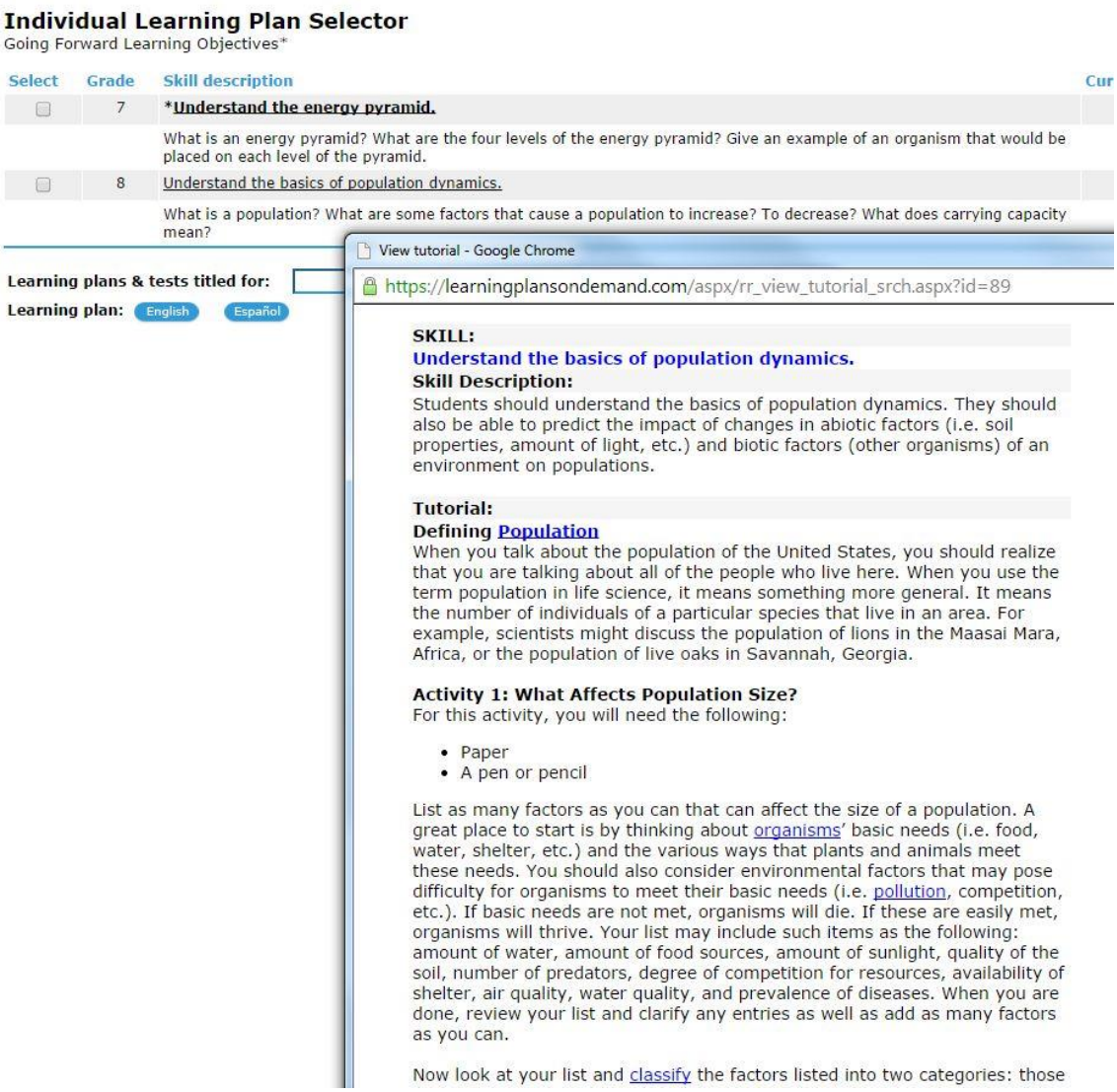
APPENDIX B

FIRST ASSESSMENT IN LIFE SCIENCE


Skills Pointer™
Ame Vandehey
Cris Kent
Don't forget to LOGOUT
Diagnostic Assessments
Mastered
Learning Path
Logout
Welcome Ame Vandehey
School: Cris Kent
Question:
Which is an example of a learned characteristic resulting from environmental influences?
Select Best Answer:
1. Bears catch salmon in the same place their mothers caught salmon.
2. Herons have long legs enabling them to stand in water and fish.
3. The bright colors on poisonous frogs warn animals not to eat them.
4. Sunflowers turn to follow the Sun's rays throughout the day.
5. Don't Know
Submit Answer
Note: Once you have started - you should completely finish the test in order to receive proper credit.
Please finish the test ASAP to get proper credit for your work. You may take a break if the "Take Break" button appears.
* Important: always Exit test before logging out - do not close windows before logging out. Or your login may be restricted.
Take break

APPENDIX C

FIRST TUTORIAL EXAMPLE


Individual Learning Plan Selector
Going Forward Learning Objectives*
Select
Grade
Skill description
Cur
7
*Understand the energy pyramid.
What is an energy pyramid? What are the four levels of the energy pyramid? Give an example of an organism that would be placed on each level of the pyramid.
8
Understand the basics of population dynamics.
What is a population? What are some factors that cause a population to increase? To decrease? What does carrying capacity mean?
Learning plans & tests titled for:
Learning plan:
English
Español
View tutorial - Google Chrome
https://learningplansondemand.com/aspx/rr_view_tutorial_srch.aspx?id=89
SKILL:
Understand the basics of population dynamics.
Skill Description:
Students should understand the basics of population dynamics. They should also be able to predict the impact of changes in abiotic factors (i.e. soil properties, amount of light, etc.) and biotic factors (other organisms) of an environment on populations.
Tutorial:
Defining Population
When you talk about the population of the United States, you should realize that you are talking about all of the people who live here. When you use the term population in life science, it means something more general. It means the number of individuals of a particular species that live in an area. For example, scientists might discuss the population of lions in the Maasai Mara, Africa, or the population of live oaks in Savannah, Georgia.
Activity 1: What Affects Population Size?
For this activity, you will need the following:
Paper
A pen or pencil
List as many factors as you can that can affect the size of a population. A great place to start is by thinking about organisms' basic needs (i.e. food, water, shelter, etc.) and the various ways that plants and animals meet these needs. You should also consider environmental factors that may pose difficulty for organisms to meet their basic needs (i.e. pollution, competition, etc.). If basic needs are not met, organisms will die. If these are easily met, organisms will thrive. Your list may include such items as the following: amount of water, amount of food sources, amount of sunlight, quality of the soil, number of predators, degree of competition for resources, availability of shelter, air quality, water quality, and prevalence of diseases. When you are done, review your list and clarify any entries as well as add as many factors as you can.
Now look at your list and classify the factors listed into two categories: those