

EVALUATION REPORT

**The 2018-19 External Evaluation Report of the
American Museum of Natural History's
RGGGS MAT Program**

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Executive Summary

The 2018-19 External Evaluation Report of the American Museum of Natural History RGGG MAT Program

The AMNH RGGG MAT program is an innovative residency program that is designed to prepare science teachers for high need schools in metropolitan New York City (NYC) and other parts of New York. Originally approved by the New York State (NYS) Board of Regents as part of the state's Race To The Top (RTTT) award, the program is designed to prepare cohorts of teacher candidates in a residency program to earn a Board of Regents-awarded Masters of Arts in Teaching (MAT) degree with a specialization in Earth Science for grades 7-12. The 15-month, 36-credit residency program is followed by two years of induction support for new teachers. In addition to a full academic year of residency in high-needs public schools, teacher candidates complete two AMNH-based clinical summer residences, one a museum teaching residency prior to entering their teacher preparation partnership schools, and a second museum science practicum residency prior to entering the teaching profession. By fall 2018, the program had prepared over 90 certified Earth Science teachers to teach in high need middle and high schools in the state of New York.

The multi-year external evaluation of the AMNH-MAT Program is being conducted by the Center for Education Policy, Applied Research, and Evaluation (CEPARE) at the University of Southern Maine. CEPARE is responsible for both the formative and summative evaluations of the project. Evaluation strategies used during the grant period included a variety of quantitative and qualitative tools, including surveys, observations, focus groups, interviews, and document analyses. This mixed-method approach assists the evaluators in capturing the complexities of the project, triangulating the evaluation evidence, and providing useable and appropriate formative evaluation feedback to the project staff.

The 2018-19 evaluation evidence indicates that the innovative AMNH RGGG MAT residency program continues to be successful in preparing beginning Earth Science teachers to teach in high need schools, to have positive impacts on middle and high students in these schools, and positive impacts on mentors in partnership schools. The evidence from the course evaluations indicate that the MAT Residents are receiving good instruction and the knowledge, skills and practice to become well prepared beginning teachers, and that the two-year Induction program is successfully supporting the beginning teachers. This claim is further supported by hiring principals who rate the MAT graduates as being very well prepared for their first teaching assignment. Additionally, an analysis of the five-year retention rate of the MAT teachers indicated a very large majority of the MAT graduates are still teaching, and for the small number who have left teaching, the factors that influenced their decision to leave the teaching profession were external personal and professional factors, not factors related to the MAT preparation program nor their beginning teaching experiences.

The evaluation evidence also indicates that the MAT program, and its structure and processes continue to have positive impacts on the teacher partnership schools and their teachers. Mentors report that working with the MAT Residents has improved their classroom instruction and had positive impacts on their students' academic learning. Thus, the program is not only experiencing continued success in preparing beginning teachers, but also improving high need schools working with the program.

The 2018-19 External Evaluation Report of the American Museum of Natural History RGGGS MAT Program

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I. Introduction

The AMNH RGGGS MAT Earth Science Residency Program is an innovative teacher preparation residency program that is designed to prepare Earth Science teachers for high need schools in metropolitan New York City (NYC) and other parts of New York. The program is also a unique one. To date, it is the only teacher preparation residency program located in and implemented by a natural history museum, the American Museum of Natural History (AMNH). Originally approved by the New York State (NYS) Board of Regents as part of the state's Race To The Top (RTTT) award, the program was designed to prepare cohorts of teacher candidates in a residency program to earn a Board of Regents-awarded Masters of Arts in Teaching (MAT) degree with a specialization in Earth Science for grades 7-12. The 15-month, 36-credit residency program is followed by two years of induction support for new teachers. By fall 2018, the program had prepared over 90 certified Earth Science teachers to teach in high need middle and high schools in the state of New York.

The program partners with four high need middle and high schools in New York City and Yonkers to prepare the Earth Science teachers. These partner schools are Bronx Early College Academy for Teaching and Learning (Bronx), Midwood High School (Brooklyn), Hunter's Point Community Middle School (Queens), and Roosevelt High School (Yonkers). As members of a cohort, MAT residents complete two five-month residencies in two of the partner schools consisting of four days each week in residence in the schools, and 1-plus days of course work per week at the museum. In addition, the MAT residents complete two AMNH-based clinical summer residencies, one a museum teaching residency in the summer before entering their teacher preparation partnership schools in the fall, and a second museum science practicum residency in the summer following the school year and immediately prior to entering their first year of teaching. All the courses and the clinical

summer residencies are taught by teams of doctoral-level educators and scientists from the American Museum of Natural History.

The initial funding of this innovative museum-based residency teacher preparation program was federal RTTT funding awarded to the state of New York, and a grant awarded from the National Science Foundation DRK-12 program to AMNH to support the program development and implementation, conduct an on-going formative evaluation of the program over the course of a five-year grant period, and to examine the impacts of the program.

The evidence from the external evaluation of the initial AMNH-MAT program indicated that the program was successful in designing and implementing this new type of residency teacher preparation program, and copies of these evaluation reports are available upon request from the American Museum of Natural History. Additionally, based on this evidence the project directors concluded that the program could be further enhanced, expanded and refined in several areas. Accordingly, the American Museum of Natural History applied for and was awarded two additional grants; a National Science Foundation (NSF) Noyce grant, and an U.S. Department of Education TQP grant to continue to develop and refine the preparation program.

The external evaluation of the AMNH RGGS MAT program has been, and continues to be, conducted by The Center for Education Policy, Applied Research and Evaluation (CEPARE) at the University of Southern Maine. The focus of recent yearly evaluations has been to monitor and evaluate program refinements and program impacts on the MAT residents after they have graduated from the program, the students and schools they teach in their initial years of teaching, and the impacts on the program partnership schools.

The AMNH RGGS MAT program is one of many urban teacher residency (UTR) programs across the country preparing new teachers. There are now over 50 residency programs in the United States (Guha, Hyler, and Darling-Hammond, 2016). These UTRs are seen as innovative preparation programs designed to exhibit best practices in recruitment, admission, preparation, and the placement of the graduates of these programs into urban settings (Berry, Montgomery, Curtis, Hernandez, Wurtzel, and Snyder, 2008; Solomon;

2009). And the early evidence has indicated that these programs have been successful in teacher retention and student performance (Guha et al, 2016; Papay, West, Fullerton, and Kane; 2012).

The AMNH RGGGS MAT program is similar in many ways to other UTR programs, but it is also a unique UTR. It is unique in that the teacher preparation program has been designed and implemented by a major natural history museum. Secondly, the school residency portion of the program is located in partnership schools in high need urban middle and high schools. Additional features of the program are designed to have significant impacts on the partnership schools through the teacher mentoring program, and are designed to provide critical induction support to the beginning teachers during their first two years teaching in high need schools. Thus, the AMNH RGGGS MAT program is similar to many other UTR residency programs in that it also uses best practices to recruit, admit, prepare, and support its graduates. But the AMNH RGGGS MAT program is also unique in that the program has been developed and implemented through a major natural history museum, and, thus, the program provides an opportunity to develop, implement and evaluate a teacher preparation program within and closely connected to an informal learning institution.

Evaluation Plan and Activities

CEPARE is responsible for both the formative and summative evaluations of the project, and the evaluation evidence has, and continues to be, collected and analyzed using a variety of quantitative and qualitative tools. Evaluation strategies used over the course of the program development include a variety of surveys, observations, focus groups, interviews, and document analyses. This mixed-method approach assists the evaluators in capturing the complexities of the project, triangulating the evaluation evidence, and providing useable and appropriate formative evaluation feedback to the project staff.

The overall goals of the ongoing evaluation have been three-fold: (1) to conduct a formative evaluation of the program each year, which is designed to collect and provide timely feedback to the project staff about the efficacy of program components and activities; (2) to conduct a yearly summative evaluation which is designed to assess the fidelity to the program design; and (3) to provide project staff with quantitative and

qualitative data needed to describe, interpret, analyze, make adjustments if needed, and ultimately report and disseminate findings from this innovative program.

Focus of this External Evaluation Report

The external evaluation team has continued to monitor project activities to assess progress that is being made in fulfilling the grant goals and objectives. For the 2018-19 year, the external evaluation was focused on four key components of the program: (1) course evaluations; (2) the mentoring program; (3) the induction program; and (4) program impacts.

II. Course Evaluation Results

One of the key strengths of the program is the faculty and the courses they teach. When MAT residents were asked what they thought were strengths of the program, the first and most often mentioned strength was the faculty. They feel the faculty is very responsive, and very supportive of the MAT residents, both academically and emotionally. And they feel the faculty go out of their way to share advice and resources. MAT residents indicated they liked and appreciated the focus on “real deep science knowledge” as well as the focus on pedagogical knowledge, and they appreciate learning in and about the museum.

In terms of evaluation evidence of course effectiveness, the MAT residents assess each course through completion of end-of-course evaluation surveys. Six items on these surveys have been closely monitored by the external evaluators in recent years, and in 2018-19 three additional items were monitored. The original six included two items that historically have been found to be accurate correlates of successful courses, and four items which focus on particular aspects of the MAT program that are key to the innovative program. The six items provided evaluation assessments on course organization, and preparedness of course instructors, as well as assessments of working with special populations, working with students with diverse backgrounds, technology use, and the use of the museum and its resources. The additional items closely monitored in 2018-19 deal with: (1) instructor feedback; (2) the co-teaching model; and, (3) the transferability of course content to residency placements. These three items were selected for additional

monitoring because prior course evaluation data and focus groups evidence had uncovered some unevenness in how these areas we being addressed in the courses.

Table 1 reports the average rankings on these nine items for the program courses. The item averages could range from 1.00-5.00, with higher averages indicating greater agreement with the item. Average levels of agreement are represented by an average score of 3.00. All the MAT residents completed the course evaluations.

Table 1: MAT Residents’ Assessments of Program Courses (N=15)

Evaluation Item	MAT Courses										
	SOS	SCI 670	EDU 610	EDU 620	SCI 665	EDU 600	SCI 675	EDU 640	EDU/SCI 660	EDU 650	EDU 630
1. The course was well organized.	4.07	4.67	3.50	4.40	2.13	3.14	2.57	3.73	4.79	4.27	1.92
2. Instructors were well prepared.	4.20	4.73	4.21	4.80	2.67	4.29	2.79	4.13	4.79	4.60	2.69
3. Increased ability to work with students with disabilities or unique strengths.	2.92	3.67	4.43	3.73	2.13	N/A	1.75	3.20	4.14	3.80	3.31
4. Increased ability to work with students from diverse linguistic, cultural, ethnic, and social backgrounds.	2.83	3.33	4.29	3.80	2.20	N/A	2.00	3.07	4.14	4.13	3.00
5. Increased skills in using instructional technology.	3.29	3.53	3.29	3.47	2.67	N/A	3.08	3.73	4.29	3.87	2.54
6. The instructor effectively integrated the use of the museum and its resources.	2.29	4.47	4.50	4.13	3.00	4.71	2.86	4.13	4.57	3.80	2.00
7. Instructors provided prompt feedback on written work.	3.27	4.93	4.00	4.47	1.73	3.71	2.50	3.71	4.85	4.27	1.92
8. The co-teaching format modeled in this course was effective.	2.29	4.47	3.64	4.73	2.27	N/A	2.43	3.73	4.79	3.73	2.54
9. I was able to (or will be able to) transfer what I learned in this course into my residency placement.	2.71	4.33	4.50	4.67	2.40	N/A	2.50	3.93	4.50	3.87	2.92

As may be seen from the evidence in the table, most of the program courses continue to be a strong component of the program. A majority of the rankings were very positive. Over 65% of the item averages were over 3.00, with over 40% of these item

averages above 4.00. Although high, these percentages were somewhat lower than for 2017-18, primarily because of lower ratings assigned to three courses in 2018-19.

Some of the course ratings improved from previous years, and two courses have consistently received some of the most positive ratings by the MAT residents over the entire length of the program, beginning as early as Year 1 of the pilot program. These courses are: (1) EDU650 Foundations of Education; and (2) EDU/SCI660 Earth Science Literacy Journal Seminar.

In terms of the three additional course evaluation survey items that were more closely monitored in 2018-19, three courses in particular received very high ratings, all substantially above 4.00. These three were: (1) SCI670 Earth System; (2) EDU620 Curriculum and Instruction; and (3) EDU/SCI660 Earth Science Literacy Journal Seminar. The MAT residents in these courses indicated that their instructors provided prompt feedback on written work, and modeled effective co-teaching strategies. Also, students reported that they were able to transfer what they learned into their residency placements.

Thus, overall, the program courses continue to be one of the real strengths of the program. Candidates believe they are learning good science content, and learning about good pedagogical strategies for teaching science. The positive quantitative ratings for the courses were reinforced by the comments the MAT residents made about the various courses and course components. Typical comments include the following:

I liked the demos that we did in these classes. I believe that I can use these to help my students understand difficult concepts. I also liked the online resource-sharing element of the course. The resource will be helpful in my teaching of weather and climate.

This is a great course. All of the demonstrations of using technology and equipment will be very helpful for teaching in high need schools.

Mindfulness of students' backgrounds is very important in teaching them about anything. I am glad that I will be able to use the skills I learned in the course to support positive change in my students' communities so that they will be able to challenge and get the support of authority to make their lives better.

I thought the focus on the history of the schools and the ways the schools have historically been inequitable for students of color, students of low socioeconomic

status and immigrant students was very helpful in providing context for teaching in urban and high need schools.

The science journals and nature of science discussions helped me to better understand how to help my students connect with the larger scientific world.

[The instructors] are gifted teachers. I learned so much seeing how they teach. They also very deliberately model specific practices. They make a point of teaching how we should teach. This class is a great mix of pedagogy, practice, and science.

The extensive work on performing demonstrations for a phenomenon-based teaching style and talk-moves has helped me a lot in getting students engaged in class and will continue to help me. Continually returning back to the talk-moves worksheet was really helpful to get me to actually use it as a tool in my own teaching.

I think the literacy strategies of the course will be useful in helping me prepare to teach in a high-needs school. Annotation and illustrations that are done by students will be helpful in assisting them to learn the content material. Additionally, I enjoyed the fact that students can learn the content in their own language.

Modeling lesson gave me a really good idea of how to structure investigations in the classroom. Some of which I am really excited to bring into my own school.

The sample lessons highlighting the use of NGSS standards and figuring out cool ways of teaching earth science material incorporating the standards were incredible!

I really enjoyed all the science activities that we did in class. Many of them will be very useful in my future classroom. And having the breakdown of exactly how these were accomplished was a very useful model for constructing, differentiating, and managing classroom activities.

The summer experience gave us a glimpse of what to expect during our school residencies. The Lang program was an excellent learning experience. I wish we had more training on action research journal writing styles.

The course lesson plans were very useful and I gained a better understanding of creating them. The residents performing the lessons were also useful and helpful, I will be able to use a similar pedagogy. The last portion of the course was also very useful. I enjoyed working in a team to develop a lesson plan, bring together materials, and co-teach the particular topic.

The evaluation evidence clearly reveals that the courses continue to receive high ratings this past year. However, the MAT resident students did report some concerns about three courses in particular: (1) SCI665 Space Systems; (2) SCI675 Weather, Climate, and

Climate Change; and (3) EDU630 Developmental Variations. None of the three courses received consistently negative ratings on all the course evaluation survey items, but these three courses were mentioned most often as not modeling good co-planning and co-teaching as well as instructors in other courses, and not modeling the best practices the program is attempting to teach them.

It is important to recognize that the course evaluation data, both in terms of survey item ratings and focus group discussions, indicate that the program courses are a key positive component of the program. At the same time, and based on the same sources of evaluation evidence, the external evaluators make the following recommendations:

1. *Steps should be taken to incorporate the strengths and positive attributes found in the SCI 670 science course into the SCI 665 and SCI675 science courses.*

The various aspects of the SCI 670 Earth Systems course have received positive ratings from students fairly consistently in recent years. It would be very beneficial for those aspects of this course to be identified and articulated, and that steps be taken to have these aspects incorporated and emphasized more into the other core science courses in the program.

2. *The program engage in an in-house professional development program for faculty to share and analyze current practices, focus on understanding and reinforcing best practices that underpin the MAT program, and introduce and practice modeling the four core high leverage practices that are the basis of the new Noyce grant.*

One of the important features of the new Noyce grant awarded to the AMNH RGGG MAT program is the focus on developing culturally responsive teaching practices and four core high-leverage practices into the repertoire of skills program Fellows develop and practice in their classes in the partnership schools. This will require embedding these practices throughout the program, beginning in the program courses. There is evidence that these core practices are already incorporated to some degree in some of the program courses. With the new grant it now becomes important that these practices be taught, practiced and demonstrated more consistently across program courses and in the residencies. To accomplish this an in-house professional development program is recommended.

III. Mentoring Program

A second major focus of the 2018-19 continuing external evaluation was the Mentoring Program. The Mentoring Program consisted of three core components: (1) a 5-

6-day Mentoring Academy designed to provide the school mentors with professional development on mentoring; (2) school on-site meetings with the mentors and Senior Specialists; and (3) opportunities for the mentors to participate in additional professional development activities provided by the museum.

Each year the MAT program conducts a 5-6 day Mentor Academy for all new and returning mentors in the partnership schools. The Mentor Academy consisted of professional development days each year in which the mentors are introduced to and provided opportunities to analyze and practice well-established evidence-based mentoring strategies and skills. Additionally, the mentors are provided training in the use of a set of mentoring tools, tools designed to help them monitor the development of their MAT residents and provide the residents useful formative feedback for improvements.

As in previous years, evaluation evidence on the Mentor Academy, and the impacts of the professional development on the mentors’ practices and on the mentors’ instruction, was collected through observations of program activities, a mid-year focus group with mentors, and an end-of year mentor survey.

The Mentor Academy is designed to provide professional development of the program mentors by increasing their skills to mentor the MAT residents. At the end of each of the Mentor Academy professional development days, mentors were asked about the effectiveness of the day’s program activities. Table 2 reports an average of the mentors’ assessments of the professional development activities over the length of the Mentor

Table 2: Mentors’ Assessment of the Mentor Academy Sessions (N=15)

Activities	Strongly Disagree	Disagree	Disagree a Little	Agree a Little	Agree	Strongly Agree
This professional learning session will help me increase my effectiveness.	0%	0%	0%	0%	78%	22%
The content of this professional learning session gave me valuable tools and strategies.	0%	0%	0%	0%	56%	44%
This professional learning session deepened my thinking about mentoring and the MAT program.	0%	0%	0%	0%	56%	44%
I will use what I learned in my ongoing professional practice.	0%	0%	0%	0%	56%	44%
I feel included and heard in the MAT mentoring community.	0%	0%	0%	0%	56%	44%

Academy. On average, fifteen (15) mentors provided their assessments for each session of the Mentor Academy. As may be seen from the assessments, all the mentors found the sessions helpful in multiple ways. There was a slight decline in the percentage of mentors that checked “Strongly Agree” with the description of the impacts of Academy activities, but all “Agreed” or “Strongly Agreed” that the activities were helpful. All the mentors “Agreed” or “Strongly Agreed” that the sessions increase their effectiveness, provided them valuable tools and strategies, and deepened their thinking about mentoring. The mentors also indicated that they planned on using the skills and strategies they learned in their own professional practice. Finally, all the mentors reported that they felt they were included and heard in the MAT mentoring community. Thus, it is clear that the mentors found each day of the Mentor Academy to be valuable to them in preparing them to mentor MAT residents, and valuable to their own professional development.

Additionally, the mentors singled out three Mentor Academy activities they found particularly useful. They appreciated the time spent norming the Observation and Disposition rubrics that they were using in assessing their mentees. They appreciated the time spent discussing diversity, equity and inclusion, an area given more attention in the 2018-19 academy. And third, the mentors indicated that they appreciated the time they spent with their mentees. They remarked that it is often difficult to have co-planning time with their mentees.

The mentors did mention three specific topics and areas they had some concerns about. One was concerning the time spent on reviewing the various tools. Table 3 on the next page reports what tools and how often the tools were used by the mentors in 2018-19. As may be seen in the table, use of the tools varies considerably among the mentors. For example, approximately 50-60% of the mentors report using the Collaborative Assessment Tool (CAL) and/or the Seating Chart Tool less than once a month, while 1/3 of the mentors reported using the CAL 1-3 times a month, and 1/5 never used the Seating Chart Tool. In the case of the Getting To Know Students Tool, approximately one-half of the mentors reported never using the tool. Additionally, approximately 50% of the mentors indicated they used the Observation Rubric and/or the Disposition Tool less than once a month, while approximately 1/3 of the mentors reported using these tools 1-3 times a month.

Table 3: Transfer and Use Levels of Mentoring Tools in Classrooms (N=22)

How often activities occurred in Mentor classrooms	Never	Less than once a month	1 to 3 times per month	1 to 3 times per week	Every day	NA
d. I used the MAT Observation Rubric to observe my MAT teacher resident.	5.3%	42.1%	26.3%	10.5%	0.0%	15.8%
e. I used the MAT Disposition Tool with my MAT teacher resident.	0.0%	52.6%	31.6%	0.0%	0.0%	15.8%
h. I used the CAL (Collaborative Assessment Log) with my MAT teacher resident.	0.0%	47.4%	36.8%	10.5%	0.0%	5.3%
i. I used the ASW (Analyzing Student Work) Tool with my MAT teacher resident.	31.6%	31.6%	21.1%	5.3%	0.0%	10.5%
j. I used the Seating Chart Tool with my MAT teacher resident.	21.1%	57.9%	0.0%	5.3%	0.0%	15.8%
k. I used the Getting to Know Students with my MAT teacher resident.	47.4%	26.3%	5.3%	0.0%	0.0%	21.1%
l. I incorporated the Instructive Collaborative Facilitative framework with my MAT teacher resident.	5.6%	27.8%	22.2%	16.7%	0.0%	27.8%

These use levels reported for 2018-19 are similar to use levels reported in previous years, even though the mentors continue to receive training each year in the use of the tools. It appears to the external evaluators that the more experienced mentors have decided what level of use of the tools they think is most appropriate in their work with their mentees. Many mentors have been working with the program for multiple years, and they report that they feel much of the work around the tools is repetitive for them.

A second concern mentioned by the mentors is their continuing interest in more differentiated learning for: (1) new and returning mentors: and (2) SPED and EL mentors. As reported above, the experienced mentors see less of a need to continued activities surrounding the use of tools, while at the same time recognizing the need for these activities with new mentors. Several mentors mentioned again, as they have mentioned in previous year, the desire to have more opportunities to talk and learn from other mentors, both informally through conversations, and more formally with experienced mentors sharing how they use the tools, talk with their mentees, manage their mentees, etc. Mentors

reported that these were very helpful and important features of the Mentor Academy that helped them learn from each other and plan effectively with their MAT residents.

In the case of SPED and EL mentors, many feel that the activities and assignments are not relevant because they are not things they can do with their students. They would like to see more activities devoted to their unique teaching and mentoring needs.

A third concern voiced by the mentors was related to one component of the mentoring program that takes place during the school year. The Senior Specialists meet once a month, either separately with the mentors or with the mentors and their mentee together. Mentors mentioned in a focus group that they appreciated very much the contact and help they receive from the Senior Specialists. But many mentors voiced concerns about the monthly after school meetings. They did not feel they are particularly helpful and a good use of their time. They indicated they would like more opportunities for the mentors and mentees to meet jointly, and possibly more time spent on particular strategies they could use with their mentees and in their classrooms.

A final concern, although not raised by the mentors, is of some concern to the external evaluators, and this is related to program expectations of the mentors. Table 4 reports the self-reporting of the mentors in key program expectations. As shown in the table, and as one might expect, there is considerable variation among the mentors with regard to the use of informal learning resources and their help in preparing their mentees

Table 4: Transfer and Use of Mentoring Strategies in Classroom (N=22)

How often activities occurred in Mentor classrooms	Never	Less than once a month	1 to 3 times per month	1 to 3 times per week	Every day
a. I co-developed lesson plans with my MAT teacher resident.	0.0%	0.0%	26.6%	53.3%	20.0%
b. I co-taught lessons with my MAT teacher resident.	0.0%	0.0%	13.3%	60.0%	26.6%
c. I provided feedback to my MAT teacher resident.	0.0%	0.0%	33.3%	38.9%	27.8%
f. I used museum and/or other informal learning resources with my MAT teacher resident.	2.5%	33.3%	50.0%	11.1%	2.5%
g. I helped my MAT teacher resident prepare for job searches.	17.6%	41.1%	29.4%	5.8%	5.8%

for future employment. But one-third of the mentors report only providing feedback to their mentee 1-3 times per month, and approximately 1 in 4 mentors co-develop plans with their mentee only 1-3 times per month. This variation is also documented in focus groups and interviews with the MAT residents. They report that the supervision and mentoring they received from their two mentors over the course of the academic year varied by school and by individual mentor.

In summary, and as in the case of the program courses, the Mentor Academy is viewed as an important component of the program. Mentors report that they find it to be valuable and useful to them as they work with their mentees, and the evidence indicates that many mentors are using the tools and strategies learned in the Academy during the residencies. But the evidence also shows that the transfer of the content and skills learned in the Academy into mentors' practice is not always consistent. This is similar to evidence found in recent years. And as stated by these external evaluators last year, some of the variance in transferability may be attributed to differences in the development stages of the MAT residents, and one expects some variance among mentors as they exercise their professional judgment and practice. This suggests that this large variance in some cases, and the feedback from the MAT residents themselves, could benefit from further exploration and analysis.

Consequently, based on the evaluation evidence for the mentoring program, the external evaluators make the following recommendations:

- 3. An analysis and review be undertaken of the time and work devoted in the Academy to reviewing and practicing the use of the mentoring tools.*

Mentors new to the program benefit greatly from the introduction and practice of the mentoring tools. However, because this has become somewhat repetitive for the more experience mentors, the program should consider modifying the amount of time experience mentors spend on reviewing and practicing with the mentoring tools.

- 4. The program should continue to monitor how the skills and program expectations developed in the Mentor Academy are being Transferred and translated into the mentor's work with the MAT teacher resident.*

As mentioned above, some variation is expected and necessary in terms of transfer levels and completion of program expectations. But one would also expect the variation to become less over time for more experienced mentors in

the program who have participated in multiple mentor academies. Accordingly, it is recommended that transferability and expectations in the program be monitored more closely by the PI and staff.

5. *The program should incorporate greater differentiation in the Mentor Academy curriculum.*

It is clear that the more experienced mentors in the program would like to have more opportunities to learn from each other, and a more predominant role in delivering the curriculum. Additionally, a review should be undertaken of the needs of the SPED and EL mentors, and curriculum activities be more closely designed to fit their needs.

6. *The use of the monthly after school meetings should be reviewed, and consideration be given to modifying the use of these meetings.*

Given the suggestion from some of the mentors for more activities surrounding specific teaching strategies, and given the focus of the new Noyce grant, consideration should be given to spending time in the after school meetings working on the high leverage culturally responsive teaching practices the Fellows will be required to practice in the Residencies.

IV. MAT Induction Program

A third major focus of the continuing external evaluation in 2018-19 was the monitoring and assessment of the Induction component of the MAT program. Key strategies during the two-year Induction Program include monthly meetings of the MAT resident graduate teachers at the museum, school visits and classroom observations, and opportunities for participation in other professional development activities offered by the museum (e.g., planning forums). The Induction Program staff also provides, as needed, ad hoc consultations with the new teachers. Both Cohort 5 and Cohort 6 participated in the Induction Program during 2018-19. Although all these activities are voluntary, the monthly meetings and planning forums were well attended, both by Cohort 5 and Cohort 6 MAT beginning teachers.

As in past years, the MAT Induction Program staff continued to use New Teacher Center tools and protocols, as appropriate, in the induction activities. The tools are used to support mentor conversations, and to provide structures for collecting classroom data and analysis of student work. The tools also include lesson plan template models, support for learning about students across multiple dimensions, support for communicating with parents and administrators, and an inquiry cycle action plan.

Project staff also continued to conduct multiple school visits, particularly in the first year, of the MAT beginning teachers in the New York City area and beyond. The visits included a pre-observation conversation, the classroom observation, and a post-observation conversation. The beginning teachers welcomed these visitations, and many remarked that the classroom observations were particularly helpful.

The external evaluators observed induction program activities and conducted a mid-year focus group with teachers participating in a monthly meeting. The beginning teachers reported there were many positive aspects in the Induction program. These included: (1) the opportunity to meet and learn from other members of their cohorts; (2) the ability to share and get concrete ideas from the Induction program leaders; (3) constructive feedback and help from the leaders; and (4) additional help in identifying museum resources.

For the first year MAT teachers, they continue to report that the format and activities included in the Induction Program are very helpful and supportive of them. They feel the emotional support they receive, and the opportunities to learn from their cohort members, to be very valuable and necessary. They also report that the classroom visits during the first year are important and very helpful, and that the planning forums are beneficial.

The second year teachers are appreciative of the change in focus in the second year, where more emphasis and time is devoted to exploring specific instructional strategies. They like learning how other members of their cohort are addressing classroom issues and how they are using specific instructional practices. At the same time, the second year teachers in 2018-19 reported that they feel they need more help with how to implement NGSS, and more help in learning how to use specific instructional practices. They report that the time spent on video taping themselves is not particularly helpful in addressing their needs, nor the best use of time.

Based on these analyses, the external evaluators recommend the following:

7. *The current curriculum and practices used in the first year of the Induction Program should continue, while more emphasis on specific instruction practices should be incorporated into the second year of the program.*

As mentioned above, with the new Noyce grant, the program is focused on the development of four specific high leverage culturally responsive practices. Although this focus is a part of the preparation of the Noyce Fellows, it would be beneficial if these four strategies were given more priority in the Induction program for Cohort 6 and Cohort 7.

V. MAT Program Impacts

The external evaluation has also continued to conduct analyses in several areas related to the impacts of the program. These included: (1) the MAT teacher graduates' self-assessment of the preparation program; (2) hiring principals' assessments of the MAT teacher graduates; (3) an analysis of the performance of MAT teacher graduates' middle and high school students in high need schools; (4) an exploratory study of the many factors that impact teacher retention, and the contribution the museum and program make toward retention; and (5) the impacts of the MAT program on the mentor teachers and their schools.

Turning to the analysis of these program impacts, the MAT beginning teachers were asked to provide their own self-assessments of how well they thought the AMNH RGGG MAT program had prepared them to begin teaching in high need schools. The beginning teachers were asked to provide this assessment at the end of their first year of teaching by reflecting on their preparation program. More specifically, the teachers were asked: *Overall, how well prepared were you for teaching upon completion of the AMNH-MAT program?* Seven (7) teacher graduates from Cohort 6, which represented approximately 50% of the teachers in the cohort, responded to this question on a voluntary survey that they completed at the end of their first year of teaching. The evidence from this self-assessment indicated that a majority of the respondents felt well prepared for their first year of teaching. Over 70% of the teachers indicated they felt "Adequately" to "Very well" prepared for this first teaching job.

The teacher graduates were also asked to provide self-assessments of their preparation in eight specific areas: (1) science content knowledge; (2) student needs; (3)

instructional planning; (4) learning environment; (5) instructional strategies; (6) safety; (7) school and community relations; and (8) professionalism.

Table 5 reports the teacher graduates’ self-assessments for each of the eight preparation areas. The numbers in the table are the Grand Means of the individual items under each area on the survey. The averages could range from 1-4 (1=poorly prepared; 2=adequately prepared; 3=well prepared; or 4=very well prepared). As shown in the table,

Table 5: Teacher Graduates’ Self-Assessment of the MAT Program (N=7)

Area	Cohort 6
1. Science content knowledge	3.31
2. Student needs	2.69
3. Instructional planning	3.15
4. Learning environment	2.86
5. Instructional strategies	3.06
6. Safety	2.80
7. School & community relations	2.87
8. Professionalism	3.10

four of the averages were above 3.00 indicating that the teacher graduates felt that they were Well Prepared in these areas. Three of the remaining four area averages were above 2.75 indicating the teachers felt more than Adequately Well Prepared in these areas.

The two areas with the highest averages were in the areas of Science Content Knowledge and Instructional Planning, the same areas with the highest rating as for Cohort 5 last year. The area receiving the lowest average, relatively speaking, was preparation for meeting student needs. However, even in this area, teacher graduates reported they were more than adequately prepared for their initial teaching job.

A second assessment of the impacts of the MAT program was provided by hiring principals, principals who had hired Cohort 6 program graduates. While the self-assessments provided by the beginning teachers are informative, assessments of the new teachers by their supervisors, supervisors who conduct classroom observations and are required to conduct an annual evaluation of the new teachers, is particularly important. Consequently, the principals who hired and supervised the new MAT beginning teachers

were surveyed about how well prepared the MAT teachers were as beginning teachers. Nine (9) principals completed the survey, for a return rate of 60%, a percentage slightly higher than last year.

Principals were asked to assess the preparation of the MAT teachers by rating their overall satisfaction level with the MAT beginning teachers they had hired to teach in their schools. The principals could choose a satisfaction rating along a 6-point continuum: (1) Very Dissatisfied; (2) Dissatisfied; (3) Somewhat Dissatisfied; (4) Somewhat Satisfied; (5) Satisfied; or (6) Very Satisfied. In terms of the overall assessments provided by the principals, approximately 80% of the hiring principals rated their satisfaction with MAT teachers to be “Satisfied” or “Very Satisfied”.

Principals were also asked to provide their assessments in the same eight areas of preparation as were asked about with the MAT teacher graduates: (1) science content knowledge; (2) student needs; (3) instructional planning; (4) learning environment; (5) instructional strategies; (6) safety; (7) school and community relations; and (8) professionalism. In this case, and as a reference point, principals were asked to provide their assessments of the MAT graduates they had hired *“compared to graduates they have hired from other teacher preparation programs”*.

Table 6 reports the principals’ assessments for each of the eight preparation areas. As in the case of the MAT beginning teachers’ self-assessments, the numbers in the table are the Grand Means of the individual items under each area on the survey. The averages could range from 1-4 (1=poorly prepared; 2=adequately prepared; 3=well prepared; or 4=very well prepared) with higher scores indicating assessments by the principals of better preparation of MAT graduates compared to other graduates.

As may be seen in Table 6, five of the averages were above 3.00 indicating that the principals felt that the MAT teachers were Well Prepared in these areas. The averages for the other three areas were between 2.45-2.80 indicating the principals felt the beginning teachers were more than adequately well prepared.

Table 6: Principal's Assessment of MAT Graduates (N=9)

Area	Cohort 5
1. Science content knowledge	3.41
2. Student needs	2.70
3. Instructional planning	3.27
4. Learning environment	2.45
5. Instructional strategies	3.00
6. Safety	3.48
7. School & community relations	2.79
8. Professionalism	3.35

Relative to hiring principals' assessments of beginning teachers they had hired in previous years, the results are somewhat mixed. Principals' assessments of the new teachers' knowledge of science content, their ability to plan effectively for instruction, provide a safe learning environment, and for their professionalism, were higher than last year.

When asked what they thought were strengths of the program, hiring principals made comments like the following. Strengths include:

Candidate possess very strong understanding of the content, is able to create strong lesson plans, and uses technology well.

Integrating real-world contexts and professional level science practices to engage students in learning earth science. Strong ideas for project based learning, guiding questions, and field experiences.

[The new teacher] is infectious with her love for earth science and our students see it and are engaged.

Very strong content knowledge and very organized. She reflects the intelligence and preparation of her undergraduate degree from UVA.

In three areas, the ratings by the principals were lower, relatively speaking. And these relative standings are similar to findings from earlier years. The three areas are meeting student needs, establishing and maintaining a strong learning environment, and the new teachers relationships with the school and community. A closer examination of

individual principal responses revealed that the assessments by some of the principals reflected their perceptions that the classroom management skills of the beginning teachers could have been better. This is an area of concern often expressed by principals hiring beginning teachers, regardless of the teacher preparation program the new teachers complete. In light of this reality, the external evaluators still believe it is important for the program to continue to enhance the program in this area. Thus, it is recommended that:

8. *The program explore ways to further enhance the MAT beginning teachers skills in classroom management through the Induction Program.*

Some principals believe the classroom management skills of the MAT beginning teachers could be stronger. This is not an uncommon perception many principals' hold about first year teachers. The program is aware of this concern and has taken steps to address it more in courses and the residency placements. However, since this is an area of skill development that many times can only be addressed as the beginning teachers becomes the teachers of record, it is recommended that the program consider ways to further assist in this skill development in the Induction program.

Thus, the overall evidence indicates that the hiring principals are very pleased with the MAT beginning teachers they have hired. This is an important indicator of the success of the program. But while it is important to find that the program was successful in the eyes of the hiring principals in preparing first year teachers, the fundamental goal of the AMNH RGGGS MAT program has been to effectively prepare beginning teachers so that they may effectively help students in high need schools learn more Earth Science and to learn it in better ways. Over the years, the AMNH RGGGS MAT program has examined impacts in this area by tracking the impacts of the teachers on their students' academic performance through the lens of student performance on a standardized test, the New York Regents examination in Earth Science. More specifically, the program has contracted with researchers at the New York University Institute for Education and Social Policy to conduct a multi-year study designed to provide an answer to the following research question: *How do students taught by MAT graduates during their initial years of teaching perform on the Earth Science Regents exam as compared to students taught by first and second year teachers who were trained in other programs?*

There is substantial research that indicates that most teachers in their early years of teaching have a difficult time demonstrating positive impacts on student performance on standardized tests. Research also shows that teacher effects many times only occur with 3-5 years of teaching experience. And while these research studies have been conducted in a variety of schools, few, if any, have been conducted in high need, low performing schools like those the MAT teachers have committed to work in for at least four years. Consequently, while difficult, obtaining an answer to the research question has been very important in assessing the impacts of the MAT program.

The early research evidence analyzed by the New York University researcher has clearly shown that the AMNH RGGG MAT goal of addressing the shortage of Earth Science teachers in high need urban schools in New York is being met. The analyses have found that over 90% of the MAT teachers are working in these types of schools. Furthermore, the analyses have revealed that the MAT teachers are teaching the higher need students within these high need schools. This is a very important finding, and one that bodes well for the longer-term impacts of the MAT program.

In terms of student academic performance, the results indicate that students of MAT graduates are doing as well as, or better than, students not taught by MAT graduates, including those taught by teachers who have more years of teaching experience. To paraphrase from the summary of the 2019 New York University Institute for Education and Social Policy report entitled AMNH Master of Arts in Teaching Earth Science: Analysis of Cohorts 1-5:

We find that:

- MAT teachers continue to teach in high needs schools. Similar to previous years, we find MAT teachers continue to teach in schools that have a higher percentage of poor students, black and Latinx students and lower percentages of Asian and white students compared to schools citywide.
- Student of MAT teachers are more likely to take the Earth Science Regents than students of other teachers. We find that a larger percentage of students of MAT teachers continue to take the Earth Science Regents each year, compared to students taught by

comparison group teachers.

- The results continue to show no statistically significant difference in performance between students of MAT and non-MAT teachers. Overall, there is no statistically significant difference between students of MAT teachers and non-MAT teachers on performance on the Earth Science Regents.
- PSM results continue to show that students of MAT teachers do as well as students of more experienced teachers. On average, teachers of the PSM matched comparison students have 8.8 years of experience, compared to 1.5 for MAT teachers. Overall, MAT students score 0.05sd higher than their matched counterparts although this is not statistically significant (p. iii)

Thus, the results from an analysis of the impacts of the MAT teachers' on their high school students indicate that even though the MAT teachers are teaching more disadvantaged students, more of their students are taking the Earth Science Regents examination, and scoring as well as students who are less disadvantaged.

In 2018-19, an additional study of the program impacts on teacher retention was undertaken by CEPARE researchers. The MAT AMNH RGGS has reported that:

47 out of 50 graduates of the AMNH RGGS Earth Science Residency Program from the first, second and third cohorts, or 94%, have stayed in teaching for 3 or more years: 94% (44 out of 47) continued to teach in high needs schools; and ~100% (47 out of 47) continued to teach in New York State.

- Studies of retention of graduates of residency programs finds higher rates, ranging from 80-90% in the same district after three years and 70-80% after five years (Guha, Hyler & Darling-Hammond, 2016).

Thus, a very high percentage of teachers who have participated in the MAT teacher preparation program have been retained in the profession and are teaching in high need urban schools. To explore what factors may have played a role in this higher retention rate, researchers from the Center for Education Policy, Applied Research and Evaluation (CEPARE) conducted a mixed-methods study of the retention of MAT teachers. Entitled A Study of the Factors that Influence the Retention of Graduates of the American Museum of Natural History's Science Teacher Education Program, and using a conceptual framework developed by Heineke, Mazza, & Tichnor-Wagner (2014), the CEPARE researchers

identified several factors that may have influenced retention.

The findings suggest that MAT teacher graduates' decisions about their careers following the end of the teaching commitment were complex in nature, and were shaped by multiple levels of influence. The participating MAT teachers reported that their experiences in the classroom and with students was the most influential factor in their experiences as teachers during their first years of teaching. Additionally, the MAT teachers reported that the school level supports they received also influenced these teachers' experiences as beginning teachers. Both those who stayed in the profession and those who left taught in schools where the teachers and administrators with whom they worked were positive and supportive. Both those who stayed in the profession and those who left said they were treated like professionals. For those participants who remained in the profession, this proved to be an important variable that influenced their decision to stay. For those who left, it was not substantial enough to detract from their pursuing their alternative professional goals.

Policies that impact teachers and their teaching also influenced MAT teachers' experiences in teaching. Both those teachers who stayed in the profession and those who left felt pressure for their students to perform well on standardized metrics of achievement. However, this pressure did not seem to impact teachers' decisions to stay or leave the profession.

Although each of the graduates who decided to leave the profession may have been influenced by their experiences as teachers when making the decision about their future career plans, they were more influenced by historical and external factors. Teachers who left the profession left for reasons external to their teaching experiences.

But a key factor that appears to have played a role in retention is the teachers' continue involvement with the museum and informal learning. The Museum was a resource and source of support for all of the MAT teachers who participated in this study. The AMNH RGGGS MAT program and the Museum became part of teachers' identity as a teacher. MAT teachers saw themselves as representatives of the Museum in their classrooms, and as a result, their students identified that connection as a core part of their

experiences with the teachers. This was reflected through their ongoing trips to the Museum, instances in which they connected with the MAT faculty to secure support for specific tasks, such as starting a science fair, and connecting their students with Museum-based opportunities, such as afterschool and summer programming. Clearly, the program and the museum have had a lasting impact on the MAT teachers and influenced their teaching practice and views of the teaching profession.

One final area that was explored in 2018-19 in terms of program impacts was the impacts of the program on the mentors and their classrooms. Mentors were asked specifically about impacts on different program components (e.g., working with the Senior specialists, Mentor Academy activities, the monthly mentor meetings, etc.) and their responses mirror evidence reported earlier in this report. The mentors were also asked about the impact of the program on their own practice and on their schools. Twenty-two (22) mentors completed and submitted the survey, and this evidence appears in Table 7. Several positive impacts are apparent from the evidence in Table 7 on the next page, but mentor responses to three specific key survey items are particularly noteworthy. Approximately 90% of the mentors indicated they had thought that their students had benefited academically from having the MAT teacher residents in their classroom. Furthermore, over 80% of the mentors reported they had changed some of their own classroom practices as a result of participating in the MAT program, and over 90% indicated that they have seen positive changes in their school as a result of their involvement in the MAT program. Thus, the evidence reveals that the program was not only impactful on the preparation of beginning teachers, but that it also has had significant impacts on the partnership schools.

Table 7: Impacts on Mentors and Their Classrooms (N=22)

	Strongly disagree	Disagree	Slightly disagree	Neutral (neither agree nor disagree)	Slightly agree	Agree	Strongly agree	Not applicable
My students benefited academically from having the Candidate(s) in my classroom.	0.0%	0.0%	0.0%	5.3%	0.0%	52.6%	31.6%	10.5%
Student behavior was improved by having the Candidate(s) in my classroom.	0.0%	0.0%	5.3%	36.8%	10.5%	21.1%	10.5%	15.8%
Co-teaching with the AMNH Candidate(s) was a positive experience overall.	0.0%	0.0%	10.5%	0.0%	10.5%	31.6%	26.3%	21.1%
The Senior Specialist at our school is knowledgeable.	0.0%	0.0%	0.0%	0.0%	0.0%	26.3%	68.4%	5.3%
The Senior Specialist is helpful when I have questions about the program.	0.0%	0.0%	0.0%	0.0%	0.0%	15.8%	68.4%	15.8%
Monthly mentor teacher meetings with the Senior Specialist are helpful.	5.3%	5.3%	10.5%	0.0%	42.1%	15.8%	15.8%	5.3%
The mentor led special topic sessions in the Mentor Academy were helpful.	0.0%	0.0%	0.0%	10.5%	5.3%	21.1%	47.4%	15.8%
The Mentor Academy activities related to diversity, equity, and inclusion were helpful in my mentoring.	0.0%	0.0%	0.0%	10.5%	15.8%	36.8%	26.3%	10.5%
I have taken my class(es) on field trips to AMNH in addition to the Fall course requirement.	5.3%	10.5%	5.3%	5.3%	10.5%	10.5%	26.3%	26.3%
The connection to AMNH has brought helpful resources to my classroom.	0.0%	0.0%	0.0%	5.3%	0.0%	26.3%	63.1%	5.3%
I have changed some of my own classroom practices.	0.0%	0.0%	0.0%	0.0%	10.5%	47.4%	42.1%	0.0%
I have seen positive changes in my school as a result of involvement in the MAT program.	0.0%	0.0%	0.0%	10.5%	5.3%	26.3%	57.9%	0.0%

Summary Evaluation Assessment

To summarize the evidence from the external evaluation of the AMNH RGGs MAT program, the evidence collected indicates that the innovative AMNH RGGs MAT residency

program continues to be successful in preparing beginning Earth Science teachers to teach in high need schools, and continues to have positive impacts on middle and high students in these schools and on mentors in partnership schools. The evidence from the course evaluations supports the claim that the MAT residents are receiving good instruction and the knowledge, skills and practice to become well prepared beginning teachers. This claim is further supported by hiring principals who rate the MAT graduates as being very well prepared for their first teaching assignment.

There is also strong evidence that the MAT teachers who have graduated from the program are having positive impacts on the learning of their high school students. MAT teachers continue to teach more high need students in high need schools, and their students are taking Earth Science courses and the Earth Science Regents examination. Further, students of MAT teachers continue to perform on the Earth Science Regents as well as students of other teachers with similar experience and certification.

Additionally, the evaluation evidence indicates that the MAT program, and its structure and processes are having positive impacts on the teacher partnership schools and their teachers. Mentors report that working with the MAT residents has improved their classroom instruction and had positive impacts on their students' academic learning.

In conclusion, the external evaluators believe the program continues to be very successful in preparing beginning Earth Science teachers, and in improving the high need schools working with the program. The evidence clearly indicates that the AMNH RGGGS MAT program is a strong program. At the same time, the external evaluators have offered a series of recommendations that we believe will lead to further enhancements of the preparation program and thereby contribute to greater success for high need students in high need schools.

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