EVALUATION REPORT

The 2020-21 External Evaluation Report of
the American Museum of Natural History
RGGS MAT Earth Science Residency Program

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The AMNH RGGS MAT Earth Science Residency 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. 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 CAEP accredited residency program is followed by multiple 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.

The multi-year external evaluation of the AMNH MAT ESRP is currently being conducted by Silver Analytics Consulting Associates (SACA), a research and evaluation company. SACA is responsible for both the formative and summative evaluations of the project, and evaluation strategies include a variety of quantitative and qualitative tools, including surveys, observations, focus groups, interviews, and document analyses. This mixed-method approach assists the SACA in capturing the complexities of the project, triangulating the evaluation evidence, and providing useable and appropriate formative evaluation feedback to the project staff.

The 2020-21 evaluation evidence indicates that the innovative AMNH MAT Earth Science 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 multi-year Induction program is successfully supporting the beginning teachers. This claim is further supported by hiring principals who rate the AMNH MAT ESRP graduates as being very well prepared for their first teaching assignment.

The evaluation evidence also indicates that the AMNH MAT ESRP, 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 ESRP 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.

2020-21 Annual External Evaluation Report of the American Museum of Natural History RGGS MAT Earth Science Residency Program:

A National Science Foundation (NSF) Noyce Funded Project

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I. Introduction

The American Museum of Natural History RGGS MAT Earth Science Residency Program (AMNH RGGS MAT ESRP) is an innovative teacher preparation program that is designed to prepare Earth Science teachers for high need middle schools and high schools in metropolitan New York City (NYC) and other parts of New York. At present, it is the only teacher preparation residency program nationally located in and implemented by a natural history museum. The program is designed to prepare cohorts of teacher candidates in a residency program to earn a Masters of Arts in Teaching (MAT) degree with a specialization in Earth Science for grades 7-12. The 15-month, 36-credit CAEP accredited residency program is followed by multiple years of induction support for the new teachers.

The AMNH MAT ESRP partners with four high need middle and high schools in New York City and Yonkers to prepare the Earth Science teachers. For 2020-21, these partner schools were 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, AMNH 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 AMNH MAT residents complete two AMNH-based clinical summer residences, one is a museum teaching residency in the summer before entering their teacher preparation partnership schools in the fall, and a second one is a 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

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Natural History. Nine cohorts of students have successfully completed the program, and a tenth cohort is completing the program in 2021-2122.

The evidence from the external evaluation of the initial AMNH-MAT ERSP indicated that the program was successful in designing and implementing this new type of residency teacher preparation program, and copies of these yearly external evaluation reports are available upon request from the American Museum of Natural History. Based in part on this evidence, the AMNH applied for and has been awarded several grants from the National Science Foundation (NSF), and the U.S. Department of Education to continue to develop and refine the preparation program. Currently, the program is partially funded by a NSF Noyce grant.

The AMNH MAT ESRP 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). The early evidence from some of these UTRs 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 MAT ESRP 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 years teaching in high need schools. Thus, the AMNH 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 program is 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

The external evaluation of the program, from inception through Cohort 7, was conducted by the Center for Education Policy, Applied Research and Evaluation at the University of Southern Maine. Currently, Silver Analytics Consulting Associates (SACA), a LLC located in Southern Maine, is responsible for both the formative and summative evaluations of the Noyce-funded 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 and implementation have included a variety of surveys, observations, focus groups, interviews, and document analyses. This mixed-method approach has assisted the evaluator 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 external 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 to examine program impacts; and (3) to provide project staff with quantitative and qualitative data needed to describe, interpret, analyze, and make adjustments if needed, and ultimately report and disseminate findings from this innovative program.

Focus of this External Evaluation Report

During 2020-21, Silver Analytics Consulting Associates (SACA) has continued to monitor project activities and assess the progress that is being made in fulfilling the grant and program goals and objectives. For the 2020-21 year, the external evaluation focused on four key components of the program: (1) program courses and residencies; (2) the mentoring program; (3) the induction program; and (4) program impacts.

II. Course Evaluation Results

As the evaluation evidence has consistently shown, one of the key strengths of the program continues to be the faculty and the program courses. Consistently, when MAT residents have been asked what they think 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. AMNH MAT residents indicated they like and appreciate the focus in the program on "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 the program courses, the MAT residents assess each course through the completion of end-of-course evaluation surveys. Responses are provided anonymously, and all responses are considered confidential. The responses are analyzed and summarized by SACA, and reports are provided to the program faculty teaching a specific course, and to the program co-directors.

Nine course evaluation survey items have been closely monitored by the external evaluator. The nine items include two items that historically have been found to be accurate correlates of successful courses, items dealing with course organization and instructor preparation, and seven items that focus on specific aspects of the program that are key to the innovative nature of the program. These nine items are as follows:

- *The course was well organized.*
- *Instructors were well prepared.*
- *The course increased my ability to work with students with disabilities or unique strengths.*
- *The course increased my ability to work with students from diverse linguistic, cultural, ethnic, and social programs.*
- *The course increased my skills in using instructional technology.*
- *The instructor effectively integrated the use of the museum and its resources.*
- *Instructors provided prompt feedback on written work.*
- *The co-teaching format modeled in this course was effective.*

• *I was able to (or will be able to) transfer what I learned in this course into my residency placement.*

Table 1 reports the average rankings the MAT resident students gave these nine items for the program courses in 2020-21. The item averages could range from 1.00-5.00, with higher averages indicating greater agreement with the substance of the item. Average levels of agreement are represented by a 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										
	SCI 652	SCI 665	SCI 670	SCI 675	EDU 600	EDU 610	EDU 620	EDU 630	EDU 640	EDU 650	EDU/SCI 660
1. The course was well organized.	3.67	4.27	4.20	3.27	4.31	2.53	4.31	3.80	3.50	4.53	4.73
2. Instructors were well prepared.	3.93	4.27	4.67	3.47	4.08	2.80	3.92	4.07	4.00	4.40	5.00
3. Increased ability to work with students with disabilities or unique strengths.	2.00	2.85	2.73	3.21	4.00	3.29	4.00	4.60	3.53	4.07	4.53
4. Increased ability to work with students from diverse linguistic, cultural, ethnic, and social backgrounds.	2.46	2.92	3.13	3.36	3.75	3.73	3.85	4.13	3.63	4.13	4.53
5. Increased skills in using instructional technology.	3.20	4.27	3.40	3.67	3.36	3.13	3.67	3.87	3.40	3.36	4.60
6. The instructor effectively integrated the use of the museum and its resources.	2.46	3.87	4.40	3.40	3.64	3.93	3.85	3.42	4.19	3.43	4.87
7. Instructors provided prompt feedback on written work.	4.27	4.93	4.00	3.87	4.63	3.71	4.30	2.87	3.85	4.27	5.92
8. The co-teaching format modeled in this course was effective.	2.85	4.07	3.40	2.87	4.00	3.00	4.08	3.93	3.50	4.13	4.86
9. I was able to (or will be able to) transfer what I learned in this course into my residency placement.	3.38	3.67	3.53	3.50	4.20	3.73	4.23	4.33	3.67	4.21	4.80

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As may be seen from the evidence in the table, the program courses continue to be a strong component of the program, even as the delivery of some of the courses had to be modified in response to the COV-ID 19 pandemic. An overwhelming majority of the rankings were very positive. Whereas in 2019-20, 95% of the item averages were over 3.00, 89% of the item averages were above 3.00 in 2020-21. The item average ratings of 4.00 or above fell off some in 2020-21 (58% of the ratings were over 4.00 in 2019-20, and 36% in 2020-21), but still were very positive overall. Interviews and a preliminary analysis of the course surveys revealed that some of the strategies used in the courses in previous years did not translate and transfer as well to the online and hybrid-models of course delivery during the pandemic. However, a secondary analysis of the surveys indicated that the MAT residency students were very appreciative, and understanding, of the modifications faculty had to make in the delivery of some of the courses. In fact, many of the students indicated that one of the major positive outcomes in the modified course delivery was that they learned additional and different strategies they could use in their own teaching in the future.

Thus, as the evaluation evidence clearly indicates, the program courses continue to be one of the real strengths of the program. Overall, course evaluations are very positive, and are substantially positive across the science content courses as well as the pedagogical courses. Candidates believe they are learning good science content and learning about effective pedagogical strategies for teaching science. It is also noteworthy that even in the cases where the delivery of the courses had to be changed from in-person delivery to online or hybrid delivery modes because of COVID-19, course rating remained very positive. This speaks to the commitment of the program directors and faculty in providing a high quality program and courses.

The quantitative ratings for the courses are reinforced by the comments the MAT residents made about the various courses and course components. For 2020-21, some representative comments were as follows:

> *This class really stressed the importance of utilizing informal science environments to engage students of all walks of life within the science community. It provides valuable examples of how we can engage our future students who may not necessarily come into our classes with an interest in science.*

Multilingual classrooms are obviously of great importance in diverse school settings, but what I found most useful was the discussion on the blurry intermix of language and culture. I also found the virtual museum expedition a great assignment, since it showed ways to engage with broader resources even during the pandemic, as well as the importance of coordination to take full advantage of the opportunity.

I really enjoyed this course and pulled a lot from it. By far, this has been one of the most informative and helpful courses I've had so far.

I really enjoyed this class and felt like it covered a lot of important topics in teaching. I also felt that there was good discourse between instructors and students which helped me see things from many different angles.

Learning about the Formative assessment strategies has been a big help in understanding how to shape a lesson/check for student understanding.

I really enjoyed this course! Both instructors made me feel excited for getting into the classroom this fall!

This course helped me think about different instructional strategies that I can implement in labs that make science meaningful for all students. I especially enjoyed engaging in these investigations and understand what the students vs. the teacher will do in the different activities.

I think the major thing I pulled from this course was how important the community is to integrate into the classroom and drawing those connections between subject and community.

Being taught more complex ideas gave me ideas of what I can bring into my classroom. Astronomy is not my strongest subject, but there were a lot of connections to geophysics that I appreciated a lot. When it comes time for me to teach an astronomy unit I know what I would like to tell my students about, and I have the resources to do so.

Another feature of the program courses is the development of specific teaching practices. One of the important features of the new Noyce grant awarded to the AMNH RGGS MAT ESRP has been a renewed focus on developing culturally responsive teaching (CRT) practices and core high-leverage practices (HLP) throughout the program and courses. During 2019-20, the program directors and faculty made a concerted effort to begin infusing these practices in program courses. This infusion began with four courses. During the 2020-21 year, the focus on infusion continued and expanded to include all program courses.

Table 2 reports the students' assessments of the effectiveness of the focus on the two types of specific teaching practices. The ratings shown in the table indicate the program made substantial progress in almost all the courses in effectively helping students to both increase their ability to understand CRT and HLP, and in helping students increase their skills in using these practices in their teaching in the residency placements (i.e., 89% of the ratings over 3.00). The only course with ratings below average, and, thus, a course that may need some attention and course modifications is SCI 652 The Solar System.

Table 2: Candidates' Assessments of CRT and HLP Components in Selected Program (N=15)

Evaluation Item	MAT Courses										
	SCI 652	SCI 665	SCI 670	SCI 675	EDU 600	EDU 610	EDU 620	EDU 630	EDU 640	EDU 650	EDU/SCI 660
10. This course increased my understanding of CRT practices.	2.71	3.14	3.27	3.21	3.85	3.14	3.92	3.93	3.40	4.00	4.60
11. This course increased my ability to use CRT practices in my own teaching.	2.54	2.92	3.27	3.29	3.67	3.29	3.75	3.93	3.40	4.00	4.60
12. This course increased my understanding of High Leverage teaching strategies.	2.67	3.27	3.71	3.43	3.55	3.09	3.92	4.00	3.81	4.00	4.87
13. This course increased my ability to use High Leverage teaching strategies in my own teaching.	2.50	3.27	3.43	3.43	3.70	3.18	3.92	4.00	3.88	3.93	4.87

Additionally, in terms of delivery of the program courses, and has been mentioned above, some courses had to be moved to an online or hybrid format because of the impacts with the onset of COVID-19. Students in these courses were surveyed in late spring about the effects of these changes on their learning and skill development. Students were asked to provide an overall assessment of the effectiveness of the online instruction they were provided by the course faculty. Perceived effectiveness varied somewhat for different instructors, but still remained positive for all faculty. This suggests that, while transitioning to online and hybrid instruction may have been difficult, students still report receiving effective instruction.

To explore students' experiences a little more deeply, particularly in the online or hybrid courses, students were asked: *How effective have the teaching strategies used in this online (hybrid) course been in helping you to continue your preparation as a teacher*? Student made comments such as:

> *I think just utilizing many different learning methods such as discussions, videos, interviews, etc. is something I can takeaway with me if and when I teach on Zoom in the future.*

> *I learned about the six strands of science learning. Although they are designed for informal science education, there are aspects that can be used in a classroom. Alternatively, it is important to remember these if after fulfilling my obligation I end up working at a science museum.*

> *They have been very effective! I feel more confident in conducting research and also using the strands of informal science teaching to guide my pedagogical practices and make learning fun for my students.*

> *Many of the teaching strategies modeled in this online course has integrated into my residency and preparation as a teacher.*

> *Teaching strategies in this course gave me a better understanding of ambitious science teaching and what that means in teaching/learning.*

> *They have been very helpful-- the discussions and readings in ambitious science teaching have shaped how I want to approach teaching in my classroom-- always striving for engagement, interest, and improvement.*

> *They have been helpful in that they've allowed me to see how to blend science and sociopolitical issues.*

> *Very effective in giving different strategies, resources, and tools for teaching.*

> *The teaching strategies were very effective because there were several opportunities for us to think like teacher but also think like students. I liked this approach because we dissect both parts and understand the pedagogy better as well as how to teach if to different students.*

As may be seen in these representative comments, the online and hybrid courses help students explore and learn about additional teaching strategies.

Another key feature of the AMNH MAT program, and one closely tied to the courses, is the residency placements. Students spend four days each week working in a partnership school and practice transferring what they are learning in the courses into practice with

close supervision by their mentor and a program Senior Specialists. On the end-of-year survey, a majority (64%) of the students reported that assignments in the MAT program courses were well connected to their Residency experiences, and over 85% of the students indicated they felt the MAT program prepared them to work in schools like those in their Residency placements. These assessments were very similar to those of Cohort 8 students in 2019-20.

A final component of the program is SCI 680, a science research practicum. In this research practicum course, the MAT resident students develop firsthand knowledge of the practice of science through a variety of methods, including fieldwork expeditions, investigations in laboratory settings, and engagement in secondary research methods. Year in and year out, students find this research experience very valuable. Consistently, all aspects of the practicum receive positive ratings from the students. Of particular note is the finding that by the end of the research practicum, approximately 85% of the students report that they are more confident in their ability to conduct Earth Science research.

Finally, during the 2020-21 year, a focus group was conducted with the Cohort 9 students, and their comments reinforce that the courses and faculty are real strengths of the program. The members of the cohort had many positive things to say about the program. As in previous years, they particularly appreciated: (1) the support they receive from the program staff and faculty; (2) the access to museum resources; (3) the resources they receive from the program; and (4) the efforts on the part of faculty to provide effective instruction during the pandemic. The MAT resident students also mentioned the co-teaching model as a key positive component of the program. They like to see and learn from the co-teaching of scientists and education specialists together, and like being given opportunities and instruction to co-teach with their cohort members. Several also mentioned they like the classes where they played the role of middle and high school students. They particularly appreciated where the instructor spent considerable time debriefing these class sessions.

To summarize the evaluation evidence on the program courses and residency placements, the course evaluation data, both in terms of survey item ratings and focus

group discussions, indicate that the program courses and residency placements continue to be key positive components of the program. Based on this evidence, this external evaluator makes only one recommendation in this area. It is:

1. *The program directors are encouraged to work with the SCI 652 The Solar System instructor (s) to make course modifications for purposes of increasing the inclusion of CRT and HLPs teaching strategies into the course.*

III. Mentoring Program

A second focus of the 2020-21 continuing external evaluation of the AMNH RGGS MAT ESRP was the Mentoring Program. The Mentoring Program consisted of three core components: (1) a multi-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.

Regarding the first component of the Mentoring Program, each year the MAT program conducts a multi-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 AMNH MAT residents, and provide them with useful formative feedback for improvements.

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 a mid-year focus group with mentors, and an end-of year mentor survey.

As mentioned above, the Mentor Academy is designed to provide professional development for the program mentors by increasing their skills to mentor the MAT Noyce 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 3 reports an average of the mentors' assessments of the professional development activities over the

length of the Mentor Academy for 2020-21. On average, sixteen (16) mentors provided their assessments for each session of the Mentor Academy, and as may be seen from the assessments, all the mentors found the sessions helpful, and in multiple ways. These results were similar to those reported in 2019-20, and the results are more positive than previous years. A greater percent of the mentors indicated they "Strongly Agreed" that all the activities were helpful.

Table 3: 2019-20 Mentors' Assessment of the Mentor Academy Sessions (N=16)

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%	48%	52%
The content of this professional learning session gave me valuable tools and strategies.	0%	0%	0%	0%	43%	57%
This professional learning session deepened my thinking about mentoring and the MAT program.	0%	0%	0%	0%	45%	55%
I will use what I learned in my ongoing professional practice.	0%	0%	0%	0%	31%	69%
I feel included and heard in the MAT mentoring community.	0%	0%	0%	0%	33%	67%

These ratings were reinforced in comments made by the mentors in the mid-year focus group. Mentors were asked, *"What parts of the Mentor Academy and program have been most beneficial to you? And why?"* A key benefit mentioned by many mentors was the increased opportunities they had to meet with their mentors and to talk with them about their assignments. Mentors say they had more involvement with their first semester's mentor in 2020-21 and say that it is was helpful to know more about the residents before they started, and it gave them opportunity to think about how to positively support them.

Another change the mentors mentioned as beneficial was Breakout sessions where they have had the opportunity to have mentor led mini-workshop sessions where they pick what strategies they want to learn about.

The format and substance of the monthly school meetings was also changed in 2020-21, so the mentors were asked, "*Have the monthly after school meetings with the Senior Specialists been useful this year? Why or why not?*" The mentors reported they were much more useful because they are not just going over the rubric. However, several mentors did report that they still thought many of the meetings were repetitious for veteran mentors. They did reiterate once again that they would like 1-1 time with the Sr. Specialist to talk about resident.

Another question the mentors were asked was "*Has you work as an AMNH MAT mentor and involvement with the MAT program had an impact on you, your teaching, or your school? In what ways?* The mentors reported many benefits. Among them were:

- *Residents brought fresh ideas, new labs, different instructional strategies into their classrooms.*
- *They were helpful in managing the virtual delivery of instruction.*
- *They were helpful with breakout rooms/sessions and interacting with students.*
- *They provided opportunities for the mentors to self-reflect on their own teaching strategies.*
- *It has led to greater self-reflection. For example, completing the disposition tool on the resident led one mentor to reflect upon her own dispositions.*
- *Students are more excited and engaged in science because there is a scientist in the room.*

Clearly, the mentors thought the Mentor Academy was beneficial. And as reported in Table 3, <u>all</u> the mentors reported that the Academy had provided them valuable tools and strategies, and that they planned to use what they learned in the Academy in their own professional practice.

However, at first blush, this transfer from the Mentor Academy to their own practice did not appear it be always the case. On the end-of-year survey mentors were asked a series of questions with regards to the transfer and use levels of tools and strategies explored in the professional development sessions of the Academy. In past years the issue of transferability has been a concern of this external evaluator. In too many cases it appeared that the levels of transferability varied considerably among the mentors, with 5-

15% indicating that the transfer survey items were not applicable to them. And in 2020-21 this percentage increased substantially.

An initial analysis of mentors' survey responses revealed that in many cases over 75% of the mentors checked "Not Applicable" when asked about transfer and use levels, and consequently including these responses skewed the results. Accordingly, a secondary analysis was conducted on the survey respondents, and this analysis revealed that a majority of the mentors who checked "Not Applicable" were mentors who taught special needs and/or ELL students.

Based on this evidence, this external evaluator concluded that many of the difference in transfer and use levels are between mentors with different teaching assignments. This is important for two reasons because it provides different pictures for content mentors and specialist mentors.

Turning first to an examination of transfer and use levels among content mentors, Table 4 reports which tools, and how often, the tools were used by the content mentors in 2020-21. Use levels for the MAT Observation Rubric, Disposition Tool, and CAL appear to be what might be expected, but use of the other tools appears to be minimal or never. It will be important to explore these differences in future designs of the Mentor Academy.

Table 4: Transfer and Use Levels of Mentoring Tools by Content Mentors (N=10)

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
I used the MAT Observation Rubric to observe my MAT teacher resident.	0.0%	30.0%	70.0%	0.0%	0.0%	0.0%
I used the MAT Disposition Tool with my MAT teacher resident.	0.0%	50.0%	50.0%	0.0%	0.0%	0.0%
I used the CAL (Collaborative Assessment Log) with my MAT teacher resident.	0.0%	50.0%	40.0%	0.0%	10.0%	0.0%
I used the ASW (Analyzing Student Work) Tool with my MAT teacher resident.	30.0%	50.0%	20.0%	0.0%	0.0%	0.0%
I used the Seating Chart Tool with my MAT teacher resident.	40.0%	10.0%	10.0%	0.0%	0.0%	40.0%
I used the Getting to Know Students with my MAT teacher resident.	30.0%	50.0%	0.0%	0.0%	0.0%	20.0%
I used the Instructional Groups tool with my MAT teacher resident.	30.0%	60.0%	0.0%	0.0%	0.0%	10.0%

Table 5 asked the content mentors about the transfer and use of specific mentoring strategies. The evidence indicates that all the content mentors co-developed and co-taught lesson with their MAT teacher residents on a frequent basis, and 9 out of 10 mentors reported providing feedback to their MAT teacher residents frequently during the weeks the students were in residency. These are important findings, and, in all likelihood, provide a more accurate picture than what has been reported in previous years of the ways and extent of the strategies content mentors are using with the MAT teacher candidates.

Table 5: Transfer and Use of Mentoring Strategies by Content Mentors (N=10)

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
I co-developed lesson plans with my MAT teacher resident.	0.0%	0.0%	30.0%	50.0%	20.0%	0.0%
I co-taught lessons with my MAT teacher resident.	0.0%	0.0%	10.0%	50.0%	40.0%	0.0%
I provided feedback to my MAT teacher resident.	0.0%	0.0%	11.1%	66.7%	22.2%	0.0%
I used museum and/or other informal learning resources with my MAT teacher resident.	0.0%	10.0%	70.0%	20.0%	0.0%	0.0%
I helped my MAT teacher resident prepare for job searches.	0.0%	20.0%	50.0%	20.0%	0.0%	10.0%

Returning to the evidence with regards to the specialist mentors, it appears that there is very little transfer and use of mentoring tools and strategies by the specialist mentors. As mentioned above, 75+% of these mentors indicated they did not use the mentoring tools they learned about in the Mentor Academy. Additionally, only one-half of these mentors co-developed lessons with their MAT teacher resident, and 85% reported that they did not co-teach lessons with their MAT teacher resident. Some of these findings may be expected, given when and how long the teacher residents actually work with specialist mentors during their residency placements. But in light of the additional evidence from the mentor focus group, in which specialist mentors report that they do not feel a great deal of the Mentor Academy content is applicable to them and their teaching roles, the professional development content in the Academy may need to be re-examined once again. Based on evaluation evidence in this area from previous years, the program

directors and staff have made some modifications in the Academy content and delivery. However, the evidence from 2020-21 suggest the need for additional modifications to ensure that the Mentor Academy is meeting the needs of the specialist mentors.

To summarize the evaluation evidence on the Mentoring Program, the Mentor Academy is viewed as an important component of the program. Many 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 some of the tools and strategies learned in the Mentor Academy during the residencies. But the evidence also reveals that some of the mentoring tools are not being as widely used as others, and that the tools and mentoring strategies embedded in the Mentor Academy are only minimally being used by the specialist mentors.

Based on these finding, this external evaluator makes the following recommendations:

2. *The different levels of use of the mentoring tools should be explored and, if necessary, the curriculum of the Mentor Academy should be modified accordingly.*

3. *The professional development curriculum offered specialist mentor in the Mentor Academy should be review and modified to more accurately meet the mentoring needs of the specialist mentors.*

IV. MAT Induction Program

A third focus of the continuing external evaluation in 2020-21 was the monitoring and assessment of the Induction component of the MAT program. Key strategies included in the first two-years of the Induction Program are monthly meetings of the MAT resident graduate teachers, planning forums, selected school visits and classroom observations, and opportunities for participation in other professional development activities offered by the museum. In 2020-21 an additional component was added to the Induction Program, which was a 3-day Induction Workshop in late summer 2021, as the teachers were preparing for the beginning of the in-person school year. Both Cohort 7 and Cohort 8 participated in the Induction Program during 2020-21. Although all these activities are voluntary, it should be noted that the monthly meetings and planning forums were well attended, both by Cohort 7 and Cohort 8 MAT beginning teachers.

As in past years, the AMNH 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 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.

The external evaluator conducted a mid-year focus group with teachers participating in the Induction Program. The two cohorts were asked to respond to the following question: *"What are the benefits to them for participating in the Induction Program"?* The overwhelming response from all the Cohort 8 members was that the greatest benefit was "Support"! Many remarked that the support they receive from Induction personnel was invaluable in helping them finding ways to confront many of the problems they encounter as beginning teachers. The teacher graduates also appreciate the support they receive from their cohort peers. They remarked that they benefit from sharing ideas and resources, and feel they are not alone in facing issues and problems they encounter, particularly this year during the pandemic. Other ways they mentioned that the Induction program was a positive experience for them included the Planning Forums, the helpful discussions of CRT strategies, and the opportunity to meet with MAT program alumni.

When members of the Cohort 7 were asked the same question about the benefits for them for participating in the Induction Program, they also mentioned Support, first and foremost. Like second year teachers in previous year, they indicated they feel more confident and better able to respond to classroom issues, and more confident in their lesson planning and delivery. As previous cohorts have said, the Cohort 7 graduates indicated that the primary reasons they attend the Meet Ups is to be with members of their cohort, to exchange ideas, lessons, and teaching strategies, and that this has been particularly important during the pandemic. And they indicated that these types of support are important because many times they feel isolated in their schools.

It is clear the Induction Program is viewed very positively by the graduates and that it is providing these teachers effective support in their beginning years of teaching. The same may be said for the late summer Induction Workshop.

The Induction Workshop was designed to provide additional professional development to 1st and 2nd year teachers as they plan for and begin in-person instruction in Fall 2021. The workshop was organized around three goals: (1) To collaborate with colleagues to plan for student-centered learning routines and structures to affirm student identities in your science classroom; (2) To support planning for effective classroom discussion, dialogue and participation that is inclusive of all voices in the science classroom; and (3) To plan routines for science activities/labs that bring rigor, critical thinking and reflection on student's lives that support inclusive environments. Over the course of the three days, activities were designed to address each goal, and provide the participating teachers time to plan with and learn from their colleagues.

At the end of each day, the 20+ participating teachers were asked if the day's objectives and goals had been met, and 80-95% of the participants indicated they had been met. In addition, this external evaluator conducted a focus group with each cohort group in fall 2021 to determine the impacts of the workshop on their practice during the new school year. Cohort members reported using several of the strategies they learned in the workshop with their students in the fall. These included: ice breakers, pacing strategies, mystery bags, See-Think-Wonder strategy, norm setting and ground rules, and lab and activities. Cohort member reported being very pleased to have these strategies in their repertoire, and report they were particularly helpful in setting the norms and stage for the coming year. Members specifically highlighted the See-Think-Wonder strategy as being helpful in beginning to get their students to think like scientists. Also, a strategy that proved particularly helpful was the use of non-science examples to get students asking good questions, and getting them to think like a scientist.

A second key benefit of the workshop mentioned by many participants was that the format of the workshop really facilitated opportunities to share and learn from their colleagues, and that it was very helpful to talk with other cohort members who were teaching the

same courses. Particularly appreciated by the participants was the ability to see each other's folders of work. As one participant remarked, "Having access to folders from other cohort members felt like being at a buffet! You could pick and choose to fit your needs!".

Based on these analyses, the external evaluator recommends the following:

4. The current curriculum and practices used in the Induction Program should be continued.

5. The late summer Induction Workshop served several purposes and should become an integral part of the ongoing Induction Program.

V. MAT Program Impacts

The external evaluation has continued to conducted 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; and (4) 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 assessments of how well they thought the AMNH RGGS MAT ESRP had prepared them to begin teaching in high need schools. The beginning teachers were asked to provide this assessment by reflecting on their preparation program at the end of their first year of teaching. The teachers were asked: *Overall, how well prepared were you for teaching upon completion of the AMNH-MAT program?* Nine (9) teacher graduates from Cohort 8, which represented approximately 60% of the teachers in the cohort, completed the survey at the end of their first year of teaching. This return rate was lower than in previous years.

The evidence from this self-assessment indicated that a majority of the respondents felt well prepared for their first year of teaching. All the teachers (100%) indicated they felt "Adequately" to "Very well" prepared for their 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 6 reports the teacher graduates' self-assessments for each of the eight preparation areas. For comparison purposes, the self-assessments provide by Cohort 6 and Cohort 7 are also include in the table. 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, all eight area averages in 2020-21 were above 3.00 indicating that the teacher graduates felt that they were Well Prepared in these areas. Of note is the fact that all the averages are substantially higher for Cohort 8.

Table 6: Teacher Graduates' Self-Assessment of the MAT Program (N=9)

Area	Cohort 6	Cohort 7	Cohort 8
1. Science content knowledge	3.31	3.35	3.63
2. Student needs	2.69	2.93	3.58
3. Instructional planning	3.15	3.05	3.69
4. Learning environment	2.86	3.08	3.86
5. Instructional strategies	3.06	3.13	3.78
6. Safety	2.80	3.33	3.89
7. School & community relations	2.87	2.91	3.53
8. Professionalism	3.10	3.53	3.71

A second assessment of the impacts of the AMNH MAT program was provided by hiring principals, principals who had hired Cohort 8 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. Eleven (11) principals completed the survey, for a return rate of approximately 75%, a percentage substantially higher than in recent years.

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. All of the hiring principals (100%) rated their satisfaction with MAT teachers to be "Satisfied" or "Very Satisfied", ratings similar to the previous year.

As in the case with the graduates, 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 7 reports the principals' assessments for each of the eight preparation areas, and comparative results from principals' assessment of Cohort 6 and Cohort 7 graduates. 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

Table 7: Principal's Assessment of MAT Graduates (N= 11)

Area	Cohort 6	Cohort 7	Cohort 8
1. Science content knowledge	3.41	3.56	3.73
2. Student needs	2.70	3.08	3.53
3. Instructional planning	3.27	3.18	3.48
4. Learning environment	2.45	2.92	3.64
5. Instructional strategies	3.00	2.85	3.54
6. Safety	3.48	3.59	3.36
7. School & community relations	2.79	3.33	4.09
8. Professionalism	3.35	3.39	3.56

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 the

table, all of the averages are well above 3.00 indicating that the principals felt that the MAT teachers were Well Prepared in these areas. Additionally, it is important to note that the averages have consistently improved over the past three years.

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 RGGS 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 RGGS MAT ESRP has examined the impacts on students 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. 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 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 continues to be very important in assessing the impacts of the AMNH RGGS MAT ESRP.

The research evidence analyzed by the New York University researcher has shown that the AMNH RGGS MAT ESRP 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 June 2021 New York University Institute for Education and Social Policy draft report:

The year 7 report re-analyzes data from the year 6 report on the first six cohorts of AMNH's MAT in Earth Science program using a comparison sample matched to MAT students using student, teacher, and school characteristics. Findings include the following:

- **MAT teachers continue to teach students who are disadvantaged**. In 2019-20, over 80% of students were eligible for free and reduced price lunch, 22% were students with disabilities, 57% were Latino and 24% were Black. MAT students were also low performing in science, with a mean z-score of .23sd on the 8th grade Intermediate Science exam with only 47% meeting the standards.
- **MAT students score higher on the Earth Science Regents compared to the matched comparison group.** MAT students begin to outperform other students beginning in 2016. In 2019, MAT students performed .118sd higher than non-MAT students.
- **MAT students are more likely to pass at 65 and 85 or higher than non-MAT students**. In 2019, MAT students are 2.9 percentage points (pp) and 3.2pp more likely to pass the Earth Science Regents at 65 and 85 or higher, respectively.
- **Students of Cohort 2 teachers score higher compared to their matched counterparts, while results are mixed for students of teacher of other cohorts.** Beginning in 2017, students of Cohort 2 teachers outperform their matched counterparts on the Regents. They are also more likely to pass at 65 or higher in 2016 and after, and pass at 85 or higher beginning in 2018.

Thus, the results from this analysis of the impacts of the MAT teachers' on their high school students indicate that the MAT teachers continue to teach more disadvantaged students, and that these students out perform a matched comparison group on the Earth Science Regents. Additionally, the MAT students have higher pass rates on the Regents exam.

As in previous years, one final impact area that was explored in 2020-21 was the impacts of the program on the mentors and their classrooms. Mentors were asked about

the impact of the program on their own practice and on their schools. Twenty (20) mentors completed and submitted the survey, and this evidence appears in Table 8.

Table 8: Impacts on Mentors and Their Classrooms (N=20)

	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%	5.0%	0.0%	20.0%	55.0%	20.0%
Student behavior was improved by having the Candidate(s) in my classroom.	0.0%	0.0%	0.0%	15.0%	5.0%	15.0%	35.0%	30.0%
Co-teaching with the AMNH Candidate(s) was a positive experience overall.	0.0%	0.0%	0.0%	0.0%	0.0%	25.0%	50.0%	25.0%
I have taken my class(es) on field trips to AMNH in addition to the Fall course requirement.	10.0%	10.0%	0.0%	5.0%	5.0%	10.0%	15.0%	45.0%
The connection to AMNH has brought helpful resources to my classroom.	0.0%	0.0%	0.0%	5.0%	5.0%	20.0%	65.0%	5.0%
I have changed some of my own classroom practices as a result of my involvement in the MAT program.	0.0%	0.0%	0.0%	5.0%	5.0%	30.0%	55.0%	5.0%
I have seen positive changes in my school as a result of involvement in the MAT program.	0.0%	0.0%	0.0%	5.0%	5.0%	25.0%	60.0%	5.0%

As may be seen from the data in the table, the AMNH RGGS MAT ESRP has had many positive impacts on the mentors, their classrooms, and their schools. Approximately 75% of the mentors indicated they had thought that their students had benefited academically from having the MAT teacher residents in their classroom. Ninety percent of the mentors reported they had changed some of their own classroom practices as a result of participating in the MAT program, and 85% indicated that they have seen positive changes in their school as a result of their involvement in the MAT program. Clearly, the program was not only impactful on the preparation of beginning teachers, but that it also continues to have significant impacts on the mentors and partnership schools.

Summary Evaluation Assessment

In summary, and taken collectively, the evidence from the external evaluation of the AMNH RGGS MAT ESRP clearly indicates that the innovative AMNH RGGS MAT residency program is continuing to be successful in preparing beginning Earth Science teachers to

teach in high need schools, and it 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 students of MAT teachers continue to perform on the Earth Science Regents as well as, or better than, 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 evaluation evidence in this report further substantiates that 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 indicates that the AMNH RGGS MAT ESRP is a strong program. To expand upon this already strong program, this external evaluator has offered a small number of recommendations that he believes may 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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