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ABSTRACT

The purpose of this study was to develop a comprehensive model for local school technology professional development that facilitated technology integration into the curriculum. The local school technology committee conducted an informal performance analysis to determine a plan of action. As a needs assessment, stakeholders were surveyed to determine requisite technology professional development for the local school staff. From this data, a long-range professional development plan was created, including goals and objectives for each year, an in-depth yearly plan with detailed implementation procedures for each objective, and individual teacher plans. The goal of the professional development plan was to increase staff technology skills by 5% as measured by the Technology Skills Assessment. A comparison of pre- and post-assessments indicated that participants increased technology skills by 29.59%. During the pretest, 50% of the participants scored in the beginner skill level. A posttest comparison revealed that none of the participants scored in the beginner level; all participants scored in the intermediate or advanced category. (Author)

Facilitating Technology Integration Through Effective Professional Development: A Local School Model

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Abstract

The purpose of this study was to develop a comprehensive model for local school technology professional development that facilitated technology integration into the curriculum. The local school technology committee conducted an informal performance analysis to determine a plan of action. As a needs assessment, stakeholders were surveyed to determine requisite technology professional development for the local school staff. From this data, a long-range professional development plan was created, including goals and objectives for each year, an in-depth yearly plan with detailed implementation procedures for each objective, and individual teacher plans. The goal of the professional development plan was to increase staff technology skills by 5% as measured by the Technology Skills Assessment. A comparison of pre- and post-assessments indicated that participants increased technology skills by 29.59%. During the pretest, 50% of the participants scored in the beginner skill level. A posttest comparison revealed that none of the participants scored in the beginner level; all participants scored in the intermediate or advanced category.

As we move forward in the twenty-first century, our world is undergoing a technological revolution much like the industrial revolution of the nineteenth century. Technology is permeating and transforming every part of our society. In the face of these rapid changes in business and at home, technology literacy is more important than ever. In order for our graduates to be prepared to meet the challenges of the business world in the twenty-first century, they must be proficient at accessing, evaluating, and communicating information. As businesses learn to compete in a global environment, students must also become globally aware and able to use technology resources that exist beyond the walls of the classroom. Students preparing for this global workplace must be able to use technology or "face a lifetime of menial work" (U. S. Department of Labor, 1991, p. 15).

The National Center for Educational Statistics (2000) reported that the average number of computers in classrooms in the United States has grown significantly in the last twenty years. This number has grown from one computer for every 125 students in 1983 to one computer for every six students in 1998. In addition, Internet availability in public schools has increased from 35 to 95 percent between 1994 and 1998. Unfortunately, availability has not ensured use.

Policymakers and the public are beginning to question the effectiveness of these substantial investments in equipment and infrastructure and demand evidence that they have been worthwhile (Trotter, 1998). Some suggest that if all the computers were taken from schools tomorrow, it would not make a difference. In contrast, businesses in this country would be immobilized without technology (Peck & Dorricott, 1994). Why is it that "businesses have been building electronic highways while education has been creating an electronic dirt road?" (D'Ignazio, 1993, p.11).

Substantial investments in technology hardware, software, and infrastructure will not impact teaching and learning until teachers have the technology skills and technology integration strategies needed for today's modern classrooms. McKenzie (1999) suggests, "The best way to encourage teachers to embrace these technologies is to give them personal learning experiences which win them over to the worthwhile classroom activities which are now possible" (p.6). Local schools and districts must concentrate on professional development to reap a significant return on these investments (Rettig-Seitam, 2000).

Purpose of the Study

The purpose of this study was to develop and implement a comprehensive model for local school technology professional development that facilitated technology integration into the curriculum. Although states such as Georgia (State Data and Research Center of the Georgia Institute of Technology, 2001), Florida (Swain, 2000), Michigan (Hoffman & Thompson, 2000) and North Carolina (Walbert, 2000) have begun to fill the gap in providing much needed training for teachers, effective local school models are still needed. Many teachers have received little or no technology integration training, because the diffusion process is very slow. Well-designed local school plans can augment state initiatives and provide the professional development teachers need to successfully integrate technology into instruction.

Staff development models that focus on school improvement initiatives are often initiated to address a problem. The successful completion of the initiative may call for teachers to gain specific knowledge or skills. This information may be obtained through reading, discussion, observation, training, or trial and error. In other cases, experiential learning may occur in the development and improvement process. The model developed and implemented in this study is a combination of the knowledge that results from teacher involvement in a development and improvement process (Sparks & Loucks-Horsley, 1989).

The development and implementation of the model was a multi-step process. The first step was to identify the theoretical underpinnings that formed the background for the study and to detail the assumptions on which the model was based. The development of the model and assessment plan included an informal performance analysis, development of needs assessment instruments for all stakeholders, creation of the implementation plan, and development of the pre- and post-assessments.

Assumptions of the model

The first assumption on which this model is based is that adults learn most effectively when they have a need to know or solve a real-life problem (Knowles, 1980). Knowles' theory of adult learning has become well known in recent years and proposes the following assumptions of adult learning:

1. Adults have a need to be self-directing.
2. Adults bring a wealth of experience that should be used in a learning situation.
3. Adults' readiness to learn is based on a need to solve a problem.
4. Adults want to make immediate application of knowledge.

Teachers serving on a school improvement team may need to review research on effective teaching, learn new group and interpersonal skills, or acquire content knowledge for new curriculum initiatives. In each of the above examples, teachers' learning is motivated by the need to solve a problem.

Secondly, this model assumes that those working closest to the problem best understand what is needed to improve their performance. Teachers rely on their teaching experiences to guide them as they identify problems and develop solutions. Given the opportunity, the unique perspective of teachers can add to the school improvement process (Sparks & Loucks-Horsley, 1989).

Finally, this model assumes that teachers obtain important knowledge through their participation in the school improvement process. Teachers' involvement in the process may foster alteration in attitudes or the development of problem-solving skills as individuals or groups work toward the solution of a problem. For example, teachers may begin to appreciate individual differences, improve group leadership skills, or just become more aware of the perspective of other staff members. Although this type of learning may be difficult to predict, it is significant to the teachers (Sparks & Loucks-Horsley, 1989)

Description of the Population

The population involved in this study was the staff of an elementary school in a metropolitan area of a large city in the southeastern United States. The staff had 69 certified teachers, 17 teacher assistants, 2 school counselors, 2 speech and language pathologists, 1 technology support technician, 5 clerical staff, 1 clinic worker, 8 cafeteria staff, 4 custodians and 3 administrators. Among all certified teachers, 32 held a Masters degree or higher, 6 had gifted certification, 3 had ESOL certification and 7 had special education certification. New teachers to the school were provided with a mentor who was available for planning and helping with basic information and procedures. The professional learning community worked together in a collaborative manner to promote teaching and learning and achieve annual school goals.

The school was organized using a leadership model known as Shared Governance. Each grade level, including teacher assistants and clerical personnel, had a chairperson who met with the administrators every month to coordinate and discuss curriculum matters, school organization, areas of concern and monitor the Local School Plan for Improvement (LSPI). Dialogue flowed to and from the individual grade level groups through the communication vehicle of the Shared Leadership Team (SLT). SLT made decisions after careful consideration of colleague feedback and available data.

The school had been honored as a School of Excellence and was committed to the continuous improvement process. The Local School Plan for Improvement (LSPI) was written each year using pertinent data and input from the staff. LSPI goals identified specific improvement efforts. Each staff member set individual goals based on the local school LSPI goals. When staff members successfully completed their individual goals the payoff was seen in improved school-wide LSPI results. Certainly, one of the major benefits of the LSPI was the opportunity for staff development in the identified areas of improvement. Teachers had the opportunity to improve teaching strategies and learn cutting edge research at the local school.

Development of the Professional Development Model And Assessment Plan

With the 1998 completion of the school network, every classroom received a multimedia computer with Internet, email, and a laser printer, and the school had three computer labs with Internet connections. As technology resources increased, teachers requested more on-site technology professional development. To meet the growing demands, the technology coordinator worked the technology committee to develop a comprehensive plan for technology professional development. The development of this plan was based on the principles of instructional system design described by Reigeluth, Benathy, and Olsen (1993) and Mager and Pipe (1997), which included a performance analysis, a needs assessment, the development and implementation of a professional development plan and the assessment of the impact of the professional development plan.

Performance Analysis

Although the school had received a large infusion of technology in the last several years, classroom computers were not being fully utilized and computer labs were mainly being used for drill and practice activities. The school leadership team and technology committee recognized this problem and began to investigate solutions that would foster technology integration into the curriculum. This was important because the district had invested about a million dollars in technology hardware, software, and infrastructure in each elementary school in the district. With the district's focus on accountability for results and continuous improvement, the local schools were being asked to measure the impact of technology on teaching and learning. The technology committee and school leadership team realized that the majority of the teachers did not feel they were adequately prepared to use the new technology tools in instruction.

Needs Assessment

With the completion of the preliminary performance analysis, the technology committee developed several surveys to ensure that the interests, values, and perspectives of all stakeholders would be represented in any instructional design or organizational change. The stakeholders- -all the groups who had a stake in the instructional system being designed- - in this project included teachers, assistant teachers, students, and parents (Reigeluth, 1996). The survey of veteran teachers included questions on staff development preferences such as class organization, session length, optimal time of day for instruction, teacher interests and needs, and obstacles to success. The new teacher survey was designed to identify baseline skills for new staff members. The purpose was to identify any significant training gaps between existing staff and new staff. The survey of the assistant teachers sought to identify essentials skills that support staff needed to effectively aid teachers with instruction. Student surveys were designed to identify technology skills that fourth and fifth grade students could complete independently. The survey included skills identified in the instructional technology competencies developed by the local school district. The parent survey was designed to gain the parents' perspectives and knowledge of local school technology initiatives.

Intervention Selection and Development

Prior to the development of the implementation plan, a careful analysis of data from all the stakeholders' surveys was completed to determine needs and interests of the local school staff. The first step in the process was the development of a long-range plan. This overview included the goal for the professional development plan and objectives for each year. Second, an in-depth yearly plan was developed with detailed implementation procedures for each objective. Each objective listed baseline data, indicators of success, measurement tools, an implementation plan of activities, responsible parties, and completion dates. Next, an individual teacher professional development plan was created. This plan was directly correlated to the yearly implementation plan. The individual teacher plan also included a professional development log and a rubric for administrators to use in evaluating individual teacher professional development plans. Based on data from all the stakeholder surveys, a menu of technology professional development classes was developed to support the implementation plan. Due to the wide range in teacher knowledge and skills, provisions were also made for an independent study option.

Implementation of Professional Development Plan

In the early fall, the technology committee completed surveys of all stakeholders. The data was compiled and analyzed for strengths and weaknesses. The results were used to plan technology professional development for the school year. A menu of 29 classes was created by the end of September. Based on the yearly professional development plan, each teacher developed a personal plan for improvement. In January, the administrator on the technology committee and the technology specialist met with each grade level to informally discuss the progress made on the school goals. In addition, each certified staff member met with the technology administrator in January and February for an interim review of progress on individual teacher goals.

Implementation Assessment

A pretest-posttest design was used to assess the implementation plan. Pretests were administered in August 1999 and posttests were completed in April 2000. Teachers were assigned code numbers to maintain the confidentiality of the pretest and posttest data. Data analysis involved the comparison of pretest and posttest data for each objective of the yearly implementation plan. Analysis of the data was completed for each grade level and for the entire staff. The analysis gave a percentile score and a beginner, intermediate, or advanced skill level for each teacher and an average for the entire staff.

Summary

The development of this plan took several months and implementation spanned an entire school year. Throughout the process, the staff at the local school was given opportunities to evaluate the progress toward the professional development goals. This type of feedback spiral was designed to foster continuous improvement through individual growth, as well as growth of the local school organization (Costa & Kallick, 1995).

Methods

In order to develop the plan and to assess its effectiveness, data was collected at three stages, performance analysis, needs assessment, and assessment of the professional development plan. Data collected at each of the first two stages informed the development of the next stage.

Performance Analysis

The technology committee conducted an informal performance analysis. The committee was composed of an assistant principal, the technology specialist, the media specialist, and one representative from each grade level. The data examined during this process included the amount of money spent on technology resources in the past few years, the usage of classroom computers and labs, and teacher preparedness to use technology tools to enhance instruction.

Needs Assessment

Prior to the development and implementation of the professional development model, survey data was collected from all stakeholders to ensure that the interests and needs of each group would be addressed by the plan. Veteran teachers, new teachers,

and teacher assistants were surveyed about technology professional development needs and interests. Sixty-five veteran teachers, twelve new teachers, and twelve teacher assistants at the local school participated in the needs assessment. In addition, parents and students were surveyed. All surveys were in paper and pencil format and were distributed and collected by members of the technology committee.

Assessment of the Implementation Plan

A self-assessment instrument was developed to gage teacher progress in acquiring technology integration skills. The paper and pencil assessment contained twenty questions to monitor teacher progress. For each question, teachers were to mark their proficiency level from one to five, with level one indicating a minimum skill level and level five indicating a maximum skill level.

Results

Veteran teachers, new teachers, and teacher assistants were surveyed about technology professional development needs and interests. Sixty-five surveys (100%) were received from veteran teachers, 12 surveys (100%) were received from new teachers, and 12 surveys (100%) were received from teacher assistants at the local school. In addition, 303 parents and students were surveyed. The fourth and fifth grade students returned 266 surveys (88%). Parents returned 99 surveys (33%). Due to the low return rate, parent data was not used in the project development.

Teacher Surveys

Veteran teachers were asked to respond to six questions concerning technology professional development needs, interests, and preferences. Table 1 shows the survey results. Percentages were rounded to the nearest whole number.

An analysis of survey data indicated the following staff development preferences: small group classes (72%) and class sessions of 30 minutes to 2 hours (96%). Major areas of interest for technology use included technology to assist in the organization and access of student information (34%), technology used as an integral part of lesson plans (35%), and technology to improve students' writing skills (31%). Teachers indicated that the biggest obstacle to technology integration was lack of time to plan technology-connected units (75%).

Table 1. Teacher Professional Development Preferences
N=65

Teacher Professional Development Preferences	Frequency	Percentage
Technology staff development can best meet my needs when it is		
Taught in small grade level groups	47	72
Taught one on one	6	9
Taught in a large group lab setting	12	18
Technology staff development can best meet my needs when taught in		
Mini class sessions (30 minutes)	30	46
In-depth sessions (1 - 2 hours)	31	48
Very in-depth sessions (1/2 day or 1 day)	4	6
Technology staff development can best meet my needs when offered		
During the contract day - before school	29	45
During the contract day - after school	6	9
During the contract day - during a planning period	6	9
As an SDU class before school - not on contract time	13	20
As an SDU class after school - not on contract time	19	29
Technology staff development can best meet my needs when classes are		
Organized by beginning, intermediate or advanced skill levels	31	48
Organized by topics of interest with mixed technology skill levels	22	34
Are organized according to grade level needs and interests	14	22
I am most interested in learning to use technology		
That can average my grades and print reports for parents	14	22
That will help me to organize and access student information	22	34
To improve communication with parents and students	14	22
As an integral part of my regular lesson plans	23	35

To assist my students in learning the research process	15	23
To assist my students in improving keyboarding skills	8	12
To assist my students in improving writing skills	20	31
The biggest obstacle I face in integrating technology into the curriculum is		
Lack of time to plan technology-connected lesson/units	49	75
Insufficient access to computer hardware/equipment	8	12
Insufficient access to instructional software	10	15
Insufficient training in the use of the technology tools	12	18
Not comfortable using technology with students	1	2

New Teacher Survey

The survey of new teachers included first year teachers and teachers who were new to the local school involved in this project. The survey was designed to identify gaps in teacher technology skills. Table 2 indicates new teacher survey results. Percentages were rounded to the nearest whole number.

Analysis of the results indicated staff development needs in several areas. In basic network navigation, only 25% of teacher could log on or off the network and 17% could save file to the school server. Second, 17% of the teachers reported that they could detach e-mail attachments or create e-mail groups. Other needs identified included using satellite or distance learning resources, using Accelerated Reader to support reading, creating a basic web page, and basic computer troubleshooting skills.

Table 2. New Teacher Technology Professional Development Needs
N=12

New Teacher Technology Skills	Frequency	Percentage
Knows correct way to start up and shut down a computer with Windows 95	12	100
Knows how to log on and log off of Novell Netware	3	25
Knows Windows 95 basics such as minimize, maximize, open, close, & quit	12	100
Knows how to use Windows 95 Explorer to organize personal computer files	2	17
Knows how to save files to the courseware server	2	17
Knows how to back up network files to floppy disk	4	33
Knows word processing basics such as changing fonts, size, and style	10	83
Can save and print word processing files	11	92
Can copy and paste graphics and text in word processing	5	42
Can create tables in word processing	1	8
Can create newsletters in word processing	6	50
Can reply and forward email	10	83
Can send email attachments	4	33
Can detach email attachments and save to the courseware server	2	17
Can create email groups	2	17
Can type in an internet web address and bookmark a web site	7	58
Knows how to use an internet search engine such a Yahoo	8	67
Knows how to make a basic web page	2	17
Knows how to plan and manage taking a class to computer lab	8	67
Can create and teach a technology-connected lesson plan	6	50
Knows how to us satellite resources such as the Peach Star Pipeline to support instruction	2	17
Knows how to use the Accelerated Reader program to support reading instruction	2	17
Knows how to use computer tutorials or the help menu in computer programs	2	17
Can troubleshoot a frozen computer or a jammed printer	2	17

Teacher Assistant Survey Results

The teacher assistant survey was designed to identify gaps in skills needed to support instruction. Table 3 shows data from teacher assistant surveys. Percentages were rounded to the nearest whole number. An analysis of survey data indicated greatest needs for additional training in the areas of e-mail attachments, using the computer for student drill and practice, and basic computer troubleshooting.

Table 3. Teacher Assistant Survey Results

N=12

Technology Skills	Can do task independently	Can do task with assistance	Cannot do this task
	Percentage	Percentage	Percentage
I can start up, log on, log off and shut down an IBM computer.	100	0	0
I know how to search for a book or video on the media center online card catalog.	100	0	0
I can save to the server and print in word processing	43	17	25
I can access my e-mail account	75	0	25
I can reply and forward e-mail	58	17	25
I can troubleshoot a frozen computer.	17	17	50
I can use the classroom computer for student drill & practice, and/or educational games.	8	8	50
I know Windows 95 basics such as minimize, maximize, close and quit	100	0	0
I know word processing basics such as changing fonts, size and style.	42	25	25
I can send e-mail attachments.	8	25	50

Student Technology Survey Results

Student surveys were designed to identify technology skills that fourth and fifth grade students could complete independently. The survey included skills identified in the elementary instructional technology competencies developed by the local school district. Table 4 shows data from the student surveys.

Table 4. Student Technology Survey Results

N = 266

Technology Skills	Can do task independently	Can do task with assistance	Cannot do this task
	Frequency	Frequency	Frequency
I can use the correct finder positions for keyboarding.	137	48	81
I can edit my own writing using spell checker.	153	53	26
I can change fonts and sizes in word processing.	189	27	11
I can save my work.	191	23	9
I can print my work.	182	28	10
I know how to go to or look up web sites on the internet.	129	60	35
I know how to search for information on the internet or CD ROM to complete classroom assignments.	110	77	40
I know how to start, minimize, close, quit and shut down the computer.	158	49	15
I know how to properly load and eject a CD ROM from a computer.	190	26	9
I know how to make a Kid Pix slide show.	94	88	42

Assessment of Implementation Plan

A pretest-posttest design was used to assess the effect the yearly implementation plan. Teachers were assigned code numbers to maintain the confidentiality of the pretest and posttest data. Analysis of the data was completed for each grade level and for the entire staff. The analysis provided a percentage, a skill level for each teacher, and a mean score for the entire staff.

A pretest and posttest was administered to all certified teachers. Scores were reported in percentages. A score between 0 and 39% indicated a beginner skill level, a score between 40 and 79% indicated an intermediate skill level, and a score between 80 and 100% indicated an advanced skill level. Table 5 shows the summary data for the implementation plan.

Table 5. Pretest and posttest summary data

	N	*M*	*SD*	*SE*
Pre	61	43.1	14.7	1.9
Post	61	72.7	13.9	1.8

Tables 6 and 7 compare pretest and posttest skill levels by grade level. On the pretest, only two grade levels had any advanced scores. In comparison, the posttest scores revealed that all grade levels had gained in the advanced skill level except for fourth grade. In addition, all pretest beginners had progressed to intermediate or advanced skill levels.

Table 6. Pretest Staff Skill Levels By Grade Level

Grade	Beginner	Intermediate	Advanced
Kindergarten	6	1	0
1st Grade	4	4	0
2nd Grade	3	5	0
3rd Grade	3	4	1
4th Grade	4	3	0
5th Grade	5	2	0
Teacher Specialists	2	5	0
Special Education	5	5	1
Totals	**32**	**29**	**2**

Table 7. Posttest Staff Skill Levels by Grade Level

Grade	Beginner	Intermediate	Advanced
Kindergarten	0	6	1
1st Grade	0	6	2
2nd Grade	0	3	5
3rd Grade	0	7	1
4th Grade	0	7	0
5th Grade	0	3	4
Teacher Specialists	0	2	5
Special Education	0	5	6
Totals	**0**	**39**	**24**

Discussion

This project attempted to develop and implement a model of local school professional development that facilitated technology integration into the curriculum. Prior to the development of the model, surveys were administered to the stakeholders. The data was compiled and analyzed to identify the needs and concerns that should be addressed by any new professional development initiative.

Through the development and implementation of the model, the participants at the local school recognized that all parties were change agents in the technology integration process. Successful integration of technology in the curriculum required the collaboration, shared responsibilities, cooperation, and investments of time and effort from all involved stakeholders.

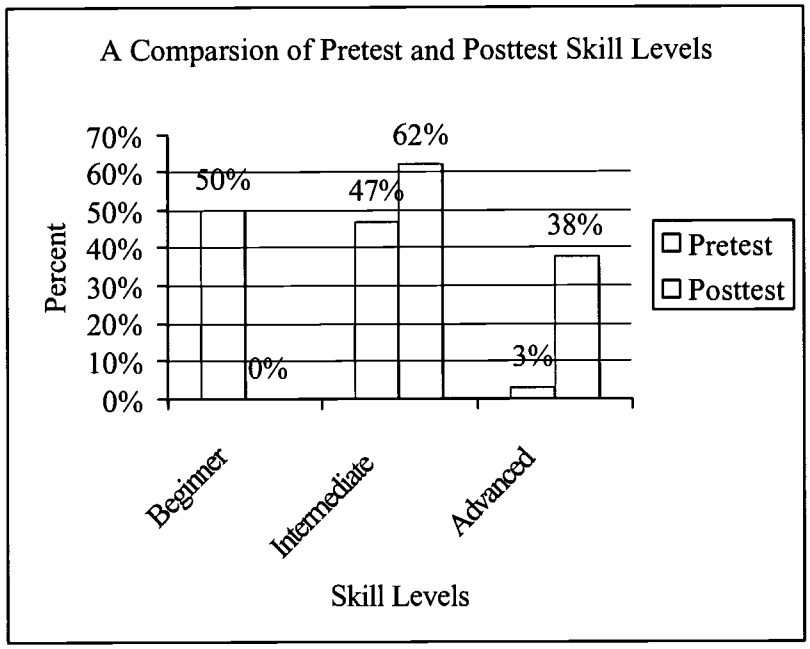
To facilitate the integration of technology into the curriculum, all staff members at the local school were involved comprehensive on-site technology staff development. Professional development was designed to support the local school improvement plan and district continuous improvement initiatives. Staff members responded positively to the convenience of on-

site training, but sometimes training was hampered by local school distractions. The inclusion of an independent study option provided increased flexibility for staff members to pursue some of their own interests for professional growth.

Conclusions

The goal of the professional development plan was to increase staff technology skills by 5% as measured by the Technology Skills Assessment. The mean difference between the pretest and posttest scores was 29.59, which was statistically significant, t_{05}=20.506. In addition, all participants made significant advances in skill level (see Figure 1). During the pretest, 50% of the participants scored in the beginner skill level. A posttest comparison revealed that none of the participants scored in the beginner level. All participants scored in the intermediate or advanced category.

Figure 1. A Comparison of Pretest and Posttest Skill Levels



The main beneficiaries of the extensive focus of technology training were the students. As a result of improved teacher technology skills, students had the opportunity to use technology create multimedia slide shows and web pages, produce live action videos, and use internet and CD ROM resources for research. In addition, several students won county and state media festival awards for multimedia and video projects that were related to the curriculum.

Recommendations

After examining the data from the professional development initiative and reviewing research on effective professional development, the following improvements to the model are recommended for future years of implementation:

1. Offer an on-site menu that includes more choices and less mandated sessions for staff members.
2. Offer options for large group training, small group classes, and one-on-one mentoring to better meet the various learning styles of the staff.
3. Improve and increase follow-up training to ensure successful implementation of the professional development initiative.

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