Identifying the Learning Needs of

Site-based Technology Resource Specialists

Report of a Delphi Study commissioned by the

North-TIER Consortium

Presented by

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Introduction

With the arrival of the 21st century, the need to find a role for technology in education continues to be high on the educational agenda. Recent trends show "a new insistence that teachers must become technologically literate" (Ely, et.al., 1996, p. 33). When introducing a bill to Congress, New Mexico Senator Jeff Bingaman stated, "There is a tremendous effort underway to put computers in classrooms and hook schools across America into the Internet. But until now, the primary focus has been on obtaining equipment - not on training teachers to use it" (Bingaman, 1997).

In a 1995 comprehensive nationwide assessment, the U. S. Congress Office of Technology Assessment (OTA) indicated that, in the process of acquiring hardware and software for students to use, teachers, who are perhaps the most valuable part of the education equation, are often overlooked. On average, districts devoted no more than 15 percent of technology budgets to professional development. The OTA report suggested that this figure should be closer to 30 percent.

Key findings from the OTA Report (1995) regarding professional development include the following:

- Despite having access to technology in schools, a substantial number of teachers report that they do not use computers and other technologies regularly for instruction;

- A majority of teachers report feeling inadequately prepared to use technology resources, particularly computer-based technologies;

- Using technology can change the way teachers teach. Technology can support more student-centered approaches to instruction so that students can conduct their own inquires and engage in collaborative activities while the teacher assumes the role of facilitator;

- Teacher development activities usually focus on mechanics, not on integrating technology into the curriculum;

- Teachers lack an understanding of curricular uses of technology and are unaware of the resources technology can offer them as professionals in carrying out the many aspects of their jobs;

- Districts spend far less on teacher development than on hardware and software; and

- Helping teachers use technology effectively may be the most important step in assuring that current and future investments in technology are realized (p. 1-3).

When reviewing the Apple Classrooms of Tomorrow (ACOT) Teacher Professional Development Center Project, Yocam (1996) reported that students and teachers who use technology as part of the teaching/learning process become a "community of learners." The model, based on some of the latest thinking about staff development, peer coaching, and cognitive apprenticeship revealed several important principles for staff development to be effective. Among the principles reported by Yocam are ones that emphasize that:

- Staff development activities should be situated in classrooms so that participants can observe and interact with teachers and students engaged in changing classroom practice;

- Participant teachers should attend in teams of two to four members from the same school. In this manner, teachers are more likely to support each other and feel less isolated;

- A constructivist learning approach should be used. Presenters should model the facilitative role and provide ample hands-on time;

- Ongoing conversation and reflection about their practice, their students, theories of learning, technology and how classroom practice might be changed should be an integral piece of staff development;

- Participants should develop a lesson or unit that integrates technology and implement it upon their return to their own classroom; and
- Follow-up support should be provided (p. 88-91).

Technology is a powerful tool to support learning that is inquiry-based and constructivist, values conceptual understanding over procedural efficiency, is responsive to students' prior knowledge and experience, builds connections to the outside world, supports development of higher order thinking skills, and prepares for lifelong learning (Norton & Wiburg, 1998). In order to create such environments for their students, teachers need experience with learning in inquiry-based environments. It is only then that teachers can internalize these aims and transform the way they teach (Grant, 1996).

Designing professional development for an information age means moving away from the traditional model of one size fits all, inadequate opportunity to practice new skills, and little ongoing support (Fulton, 1996; Grant, 1996; McKenzie, 1991). Research on professional development suggests that teachers learn best and are more likely to incorporate new approaches into their teaching when they can experiment and reflect in a safe setting (Wiburg, 1997). Teachers must have ample opportunity to discuss and collaborate with their peers and instructors (Fulton, 1996; Grant, 1996; Wiburg; 1997; Yocam, 1996). Professional development must help teachers "move beyond 'mechanical use' of curriculum and technology to become facilitators of inquiry" (Grant, 1996, p. 1).

Research says that professional development has to be directly connected to daily work with students, related to content areas, organized around real problems of practice instead of abstractions, continuous and ongoing, and able to provide teachers with access to outside resources and expertise. Professional development should take place within a professional

community, a team or network, or both. Teachers have to practice change and continually work with others on debugging the problems they encounter (Darling-Hammond, 1997).

In an effort to support teachers' technology integration, a number of schools have paired novice and experienced teachers in an approach referred to as mentoring. There is support in the form of "just-in-time" learning (as learning needs arise), access to a positive role model, and a relationship in which it is safe to share and reflect (Grant, 1996). A key feature of the mentoring approach is that assistance is provided within the context of a personal relationship and focused on the needs of the novice user (MacArthur, et.al., 1993).

Literature suggests that teachers-teaching-teachers is particularly effective in establishing good rapport among peers (McKenzie, 1991). Since teacher/presenters understand classroom culture and the demands of teaching, their guidance is often more relevant and credible to other teachers. Familiar with the regular work in classrooms, these teacher/presenters can help teacher/participants see how technologies can enrich and support learning (Grant, 1996). Teacher/presenters can also play an invaluable role in generating ideas and problem solving with their peers.

The North TIER Project

Recognizing the power of teachers teaching and supporting teachers as they learn to integrate technology for the improvement of learning, 14 Northern Virginia school divisions joined to form the North TIER partnership. The North TIER Partnership is composed of a diverse collection of school divisions and organizations. Located across the northern tier of the Virginia Commonwealth, the partnership formed a Technology Integration Education Region in order to submit a grant proposal to the Virginia State Department of Education. In all, these 14 school divisions encompass 509 schools, employ 37,826 teachers, and educate 358,047 students.

The North TIER Partner school divisions educate 32% of the Commonwealth's K-12 students. The fourteen school divisions represent both small and large divisions, urban, suburban, and rural divisions. They represent areas that are experiencing rapid growth. Some school divisions are considered "High Need" school systems. In addition to the 14 school divisions, the North TIER Partnership also includes George Mason University (GMU) and MHz Networks, the Northern Virginia public television station formerly known as WNVT.

Regardless of size, location, and local school culture, the North TIER Partnership school divisions share a common, pressing need. After years of intensive professional development, a majority of teachers in these school divisions have met the State of Virginia's Technology Standards for Instructional Personnel (TSIP). Large amounts of money have been invested in infrastructure, equipment, and software. The schools are ripe for effective technology integration to be implemented and assessed. However, the teachers are, for the most part, still using technology at the lowest levels of use as described by the LoTi scale and other measures such as the School Technology and Readiness (STaR) Chart.

These school divisions are at the crossroads of technology-enhanced instruction. They have met the challenges of training their teachers on the mastery of applications and are ready to focus on the more cognitively complex levels of technology implementation and guide teachers into developing quality lessons at the higher tiers of technology use. It was decided that the primary change agents would be the school-based instructional technology staff in each division with titles like Instructional Technology Coordinator, School Based Technology Specialist, Network Resource Teacher, Technology Resource Teacher, and Technology Lead Teacher. These positions, created by school divisions to capitalize on the power of teachers-teaching-teachers, were conceptualized by individual school divisions with a wide and varied range of

responsibilities. Yet, a primary goal for all school divisions was that teachers in these positions would be responsible for professional development. These technology resource specialists are charged with providing staff development through workshops, teaching courses, and working individually with teachers to influence their teaching strategies and technology integration choices.

In most cases, teachers are selected for this role because of their strong K-12 instructional background coupled with advanced technology skills. Often their successes in mentoring teachers are more the result of intuition and knowledge about how students learn than their familiarity with adult learning and professional development. District-based needs assessments had indicated an overwhelming need for instructional technology professionals to receive professional development in working with the adult learner, supporting different kinds and stages of staff development, coaching strategies, brain research, good pedagogy and instructional design. Responding to expressed needs, the North TIER project was designed, in part, to create the Technology Integration Educators Institute (TIE-In). TIE-In would provide school-based technology resource specialists the opportunity to participate in activities designed to better prepare them to assist teachers as they learn how to integrate technology into instruction.

This report presents the results of a Delphi study completed to assist the North-TIER consortium in the design and development of the Technology Integration Educators Institute (TIE-In) curriculum. Specifically, the study was designed to provide a broad base of input into the identification and articulation of the learning needs of site-based technology resource specialists. The study sought to answer the question: What do site-based technology specialists need to know about curricular and instructional strategies, instructional planning and

implementation, assessment and evaluation strategies, and working with adult learners in order to help classroom teachers use technology to effectively support instruction?

The Delphi Process

In order to develop a shared framework concerning the perceived learning needs of site-based technology specialists, the opinions of a number of expert stakeholders needed to be collected and synthesized. The need to quickly develop a common framework and the fact that the stakeholders were geographically spread out made this task difficult. Thus, the decision was made to develop a research design using the Delphi technique.

A Delphi can be characterized as a method for structuring a communication process in a group so that the process allows for a group of individuals to deal with a complex problem as a whole (Linstone & Turoff, 2002). It allows for the quick collection of opinions and information and for the development of consensus among individuals and groups (Turoff & Hiltz, in press). The Delphi technique involves a program of sequential interrogations and information feedback on opinions expressed by the participants in previous rounds (Helmer, 1970).

The Delphi technique of structured communication typically involves four rounds. During the first round, the topic under discussion is explored and each of the participants contributes their opinions on various aspects of the topic. In the second round, an understanding of how the group views the issue is sought. The areas of agreement and disagreement are identified. The participants are once again polled and given the opportunity to rate the importance of the issues in light of first round of responses. The responses to the second round are collected and analyzed. If there are areas of significant disagreement then they are explored during the third round of the study. The final round includes an evaluation of all of the previously collected data (Linstone & Turoff, 2002).

Participants

Since 14 school divisions were part of the North-TIER Partnership, representatives from each school division were asked to nominate one study participant from each of four categories: district-level administrator (DLA), site-based administrator (SBA), site-based technology resource specialist (SBT), and classroom teacher (CT). Representatives were clearly informed about the nature of the Delphi process, the goals of the project and the study, and knowledgeable about their individual school division personnel resources. They were asked to identify nominees who they felt were knowledgeable about or sympathetic to the role of technology and technology resource specialists. Many of these representatives consulted additional school division personnel in the selection of nominees.

All 14 school divisions within the North-TIER consortium submitted nominees. Thus, the final pool consisted of 14 participants in each of the four categories or a total of 56 participants (Appendix A). District-level administrators held varied responsibilities such as Director of Staff Development, Director of Technology, and Assistant Superintendent. All site-based administrators were building principals. Depending on school division, some of the site-based technology specialists were assigned full time responsibilities with no classroom responsibilities while others were designated as the technology representative at their school but maintained full classroom responsibilities. Classroom teachers spanned the K-12 spectrum.

Because the time frame for completion of the study was short due to the impending end of the school year, notice of nomination/invitation to participate in the study and the first round survey were sent via email at the same time (Appendix B and C). No participant emailed to decline the invitation. Percentages of participants who responded to each of the rounds are presented in Table 1.

Table 1. Summary of Percentage of Participants by Round

Participants	Decline of Invitation	Round One Respondents	Round Two Respondents	Round Three Respondents
District Level Administration	0%	71%	50%	36%
Site-Based Administrator	0%	29%	29%	21%
Site-Based Technology Resource Specialist	0%	57%	79%	64%
Classroom Teacher	0%	43%	43%	36%

The level of participation was a bit disappointing given that these participants had been nominated by their school divisions and had not declined to participate. Failure to respond to surveys was likely related to pressures on participants' time due to year-end activities. Follow-up emails were sent after each round encouraging participation and extending response deadlines. When returning a completed survey for Round Two, one classroom teacher emailed, "You can imagine how busy we are in these last weeks of school! I cannot access this e-mail from home so everything must be done at school. Thanks for the extension of time!" This sentiment was echoed by a site-based technology resource specialist who emailed the following with their Round Three responses: "Thanks for extending the deadline for Round Three. This week has been incredibly busy!!" Participants who did respond generally found their participation worthwhile. One teacher, for instance, emailed the following with her Round Two responses: "I enjoyed participating in this survey. The statements really caused me to evaluate what I expect/prefer in a technology specialist."

Generally, in the Delphi process, the results of one round are only sent to those who responded in the previous round. However, the decision was made to include all participants in

every round regardless of prior participation. This was done to insure the broadest range of input possible with the hope that participants would provide input even if they had failed to respond to a previous round.

Results

Results by Round

Round One: In early Spring of 2003, the TIE-IN subcommittee charged with developing learning opportunities for technology resource specialists met to discuss the Delphi study. The process was described to the subcommittee. First, the subcommittee was asked to clarify for the researchers the categories of expertise that they deemed as essential to a collective vision of the learning needs of technology resource specialists. The subcommittee agreed that the cumulative expertise of district-level administrators (DLA), site-based administrators (SBA), technology resource specialists (SBT), and classroom teachers (CT) was essential to represent a broad spectrum of perspectives. Thus, four expert panels representing these perspectives became the participants in the study.

Second, members of the subcommittee were asked to clarify their goals for the study. Specifically, they were asked to recommend the initial questions for Round One of the study. These questions were to be designed to open the conversation among the expert panelists and to yield the needed input about the learning needs of technology resource specialists sought by the subcommittee. Five questions were crafted and agreed upon. The five questions that constituted the Round One survey are presented in Table 2. The complete email invitation and first round survey appear in Appendices B and C.

Table 2. Round One Questions

1. What do site based technology specialists need to learn about curricular and instructional strategies to help teachers use technology to effectively support instruction?

2. What do site based technology specialists need to learn about curricular and instructional planning and implementation to help teachers use technology to effectively support instruction?

3. What do site based technology specialists need to learn about assessment and evaluation strategies to help teachers use technology to effectively support instruction?

4. What do site based technology specialists need to learn about working with adult learners to help teachers use technology to effectively support instruction?

5. What strategies would best facilitate meeting the full range of these needs?

Round One email invitations and first round surveys were sent to all 56 participants on May 19th with a request for the return of the Round One survey by May 23rd. Care was taken to insure that participants were identified by their group (DLA, SBA, SBT, or CT). A follow up reminder was sent on May 23rd extending the deadline to the end of the business day on May 27th. Twenty-eight participants submitted their responses. These open-ended responses were compiled (Appendix D), and a content analysis of the responses was performed.

During the content analysis of responses to Round One, it was discovered that statements by participants related to the learning needs of technology resource specialists often appeared in responses to multiple questions or appeared in one question for one participant and in another question for another participant. For example, statements summarized as "Current and future site-based technology specialists need to understand best practices in technology integration and the supporting research" were made by some participants in their responses to the first question while others stated this need in their responses to the second question.

Given discrepancies between the questions and the analysis of responses, it was decided to create statements that reflected participants' input independent of the questions. Thus, the content analysis resulted in 39 statements about the learning needs of technology resource specialists, reflecting the varied voices of participants in Round One (Appendix E). These 39 statements were used to create the Round Two survey.

Round Two: The 39 statements from the content analysis of Round One were used to create a Round Two survey. Each of the items was stated; a rating scale from 5 to 1 (5 being absolutely essential, 4 being very important, 3 being important, 2 being marginally important, and 1 being not important) was provided along with a place for participants to place their rating; and space was provided for additional comments. A sample item from the Round Two survey is presented in Table 3.

Table 3. Sample Round Two Survey Item

1. Current and future site-based technology specialists need to understand how to assist teachers in matching particular instructional tools with specific learning and content goals.

5	**4**	**3**	**2**	**1**	Your Rating
Absolutely Essential	Very Important	Important	Marginally Important	Not Important	

Comments:
•

Participants were emailed the Round Two survey on May 30th (Appendix F and G) and asked to return the survey by June 4th. A follow up reminder was sent extending the return date to end of business June 6th. Care was taken to ensure that emails sent to participants were identified by group (DLA, SBA, SBT, or CT). Again, 28 participants returned surveys although not necessarily the same 28 who responded to Round One.

Responses to the Round Two survey were summarized and means and ranges for each group of participants were computed (Appendix H and I). Each item was examined to determine whether consensus had been reached across groups. Generally, consensus on an item is established using a statistical comparison of group means. However, given the small number of participants in some groups, participant numbers did not meet the criteria for statistical analysis. Therefore, an alternative standard for judging consensus was established by the researchers. An item was deemed to represent a consensus among all four groups when there was less than a 1.0 point difference between the highest group mean and the lowest group mean. Twenty-seven of the 39 items met this standard and were deemed to reflect a consensus on the level of importance of the item. On 12 items, the spread between the highest and lowest group mean exceeded 1.0, reflecting no consensus on these items. These 12 items and the respective means are presented in Table 4.

Table 4. Round Two Items Reflecting No Consensus

10. Current and future site-based technology specialists need to develop strategies that help them stay on the leading edge of innovation while maintaining a strong focus on curricular issues.

DLA	Teachers	SBT	SBA	Overall Mean
3.14	4.00	4.10	4.25	3.87

16. Current and future site-based technology specialists need to be able to advise teachers about teacher education opportunities within school divisions, through universities, and across school divisions.

DLA	Teachers	SBT	SBA	Overall Mean
3.00	4.20	3.20	3.25	3.41

18. Current and future site-based technology specialists need to understand how to design and implement teacher education and teacher support that consider teachers' levels of readiness.

DLA	Teachers	SBT	SBA	Overall Mean
4.29	5.00	4.50	4.00	4.45

23. Current and future site-based technology specialists need to understand appropriate strategies for designing and implementing teacher education opportunities.

DLA	Teachers	SBT	SBA	Overall Mean
4.43	4.20	4.00	3.25	3.97

24. Current and future site-based technology specialists need be able to design teacher education opportunities that model best staff development practices (i.e active, hands on, directly related to classroom practice, role play, collaborative groups, modeling examples, case studies, peer review, extended follow-up).

DLA	Teachers	SBT	SBA	Overall Mean
4.57	4.40	4.30	3.50	4.19

25. Current and future site-based technology specialists need be able to design and implement teacher education that makes provisions for extended (follow-up) activities and learning.

DLA	Teachers	SBT	SBA	Overall Mean
4.43	4.00	3.80	3.00	3.81

29. Current and future site-based technology specialists need to understand how to *maintain reliable technology resources* (i.e.maintaining networks, hardware, and software).

DLA	Teachers	SBT	SBA	Overall Mean
3.33	4.00	3.00	4.50	3.71

31. Current and future site-based technology specialists need to understand and be able to recommend assessments appropriate for varied learning outcomes (i.e. rubrics, electronic portfolios, online testing, checklists, assessment histories, and performance archives).

DLA	Teachers	SBT	SBA	Overall Mean
3.57	4.50	3.30	3.75	3.78

35. Current and future site-based technology specialists need to be familiar with SOL online testing policies and practices.

DLA	Teachers	SBT	SBA	Overall Mean
3.00	4.20	3.80	4.50	3.88

36. Teacher education opportunities for technology specialists should be tailored to particular groups (i.e. cadres related by subject area, cadres related by grade, cadres that include content specialists).

DLA	Teachers	SBT	SBA	Overall Mean
4.00	3.40	3.00	3.50	3.48

39f. Learning opportunities restricted to those in a single school division

DLA	Teachers	SBT	SBA	Overall Mean
4.00	2.60	2.22	2.67	2.87

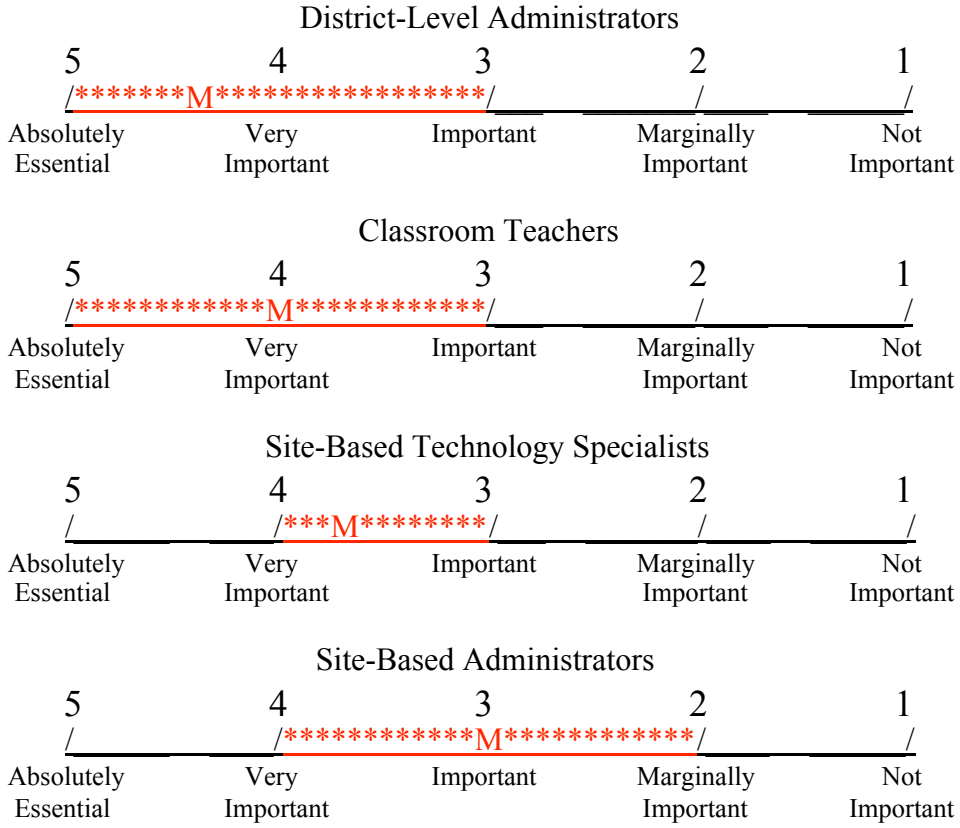
39g. Learning opportunities offered across school divisions

DLA	Teachers	SBT	SBA	Overall Mean
3.86	4.20	3.00	3.25	3.58

Round Three: For Round Three, those 27 items from Round Two that had met the standard for consensus were eliminated. The remaining 12 items were used to create the Round Three survey. The Round Three survey was constructed by presenting the Round Two means and the ranges for each item by group of participants and summarizing comments. A sample Round Three survey item is presented in Table 5.

Table 5. Sample Round Three Survey Item

25. Current and future site-based technology specialists need be able to design and implement teacher education that makes provisions for extended (follow-up) activities and learning.



Your New Rating

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Comments:

- Seems like very little of this is done (or planned for) but it would certainly be helpful. In the past, after leading a staff development workshop I have sent emails to participants when others have share their ideas with me. Most teachers are very appreciative.
- Follow-up is important…but time constraints can cause problems.
- If teachers are not strongly encouraged to share what works, effort will be ineffective.

Participants were emailed the Round Three survey on June 10th (Appendix J and K) and asked to return the survey by June 17th. Participants were asked to rethink the items in light of the mean responses of their group and the other groups and then enter a new rating. A follow-up reminder was sent extending the return date to the end of business June 20th. Care was taken to insure that emails sent to participants were identified by group (DLA, SBA, SBT, or CT). Twenty-two participants returned surveys although not necessarily from among the same 28 who responded to Round One and/or Two.

Responses to the Round Three survey were summarized and means and ranges for each group of participants were computed (Appendix L). Only three of the 12 items met the standard set for consensus (See numbers 10, 18, and 31 in Table 4). On 9 items, the spread between the highest and lowest group mean exceeded 1.0, reflecting no consensus on these items. These nine items are presented as numbers 16, 23, 24, 25, 29, 35, 36, 39f, and 39g in Table 4.

Generally, in the Delphi process, the 9 items that did not meet the standard set for consensus in Round Three would be used to conduct a Round Four survey in an effort to further move the groups toward consensus. However, due to the lateness of the school year, the pressing responsibilities of participants, and the increasingly low response rate, it was decided to end the Delphi process with Round Three.

Results by Category of Concern

As mentioned earlier, the content analysis of participants' responses to the Round One questions suggested the need to abandon the original five questions as an organizational structure since the collected responses did not fit with the five questions. Thus, the 39 items that emerged from the content analysis in Round One were treated as independent items for the purposes of the

remaining rounds. However, as researchers, it was apparent that the 39 items fell into six central areas of concern:

1.) The need for technology resources specialists to be able to work with teachers to support classroom use of technology;

2.) The need for technology resource specialists to be able to facilitate teacher education/staff development;

3.) The need for technology resource specialists to be able to assume leadership roles;

4.) The need for technology resource specialists to be able to manage and maintain technology resources;

5.) The need for technology resource specialists to be able to support assessment of learning; and

6.) Strategies for providing opportunities for technology resource specialists to develop the understanding and skills necessary to perform effectively.

Supporting classroom use of technology to support learning: Eleven items from the 39 Round One Responses specifically targeted the need for technology resources specialists to be able to work closely and directly with classroom teachers in the design and implementation of technology integrated lessons. These items focused on direct classroom support of teachers including promoting best practices, matching tools with learning goals, modeling and encouraging appropriate instructional strategies, supporting adherence to school and school division policies, differentiating instruction, and the plan of lessons to maximize learning. The eleven items in this category are presented in Table 6, rank ordered from highest to lowest level of importance.

All items in this category met the standard for consensus at the end of Round Two. This suggests that all four categories of participants shared similar opinions from the study's outset. Despite this apparent agreement, several important insights emerged from the study. First, district-level administrators unanimously rated the item "Current and future site-based technology specialists need to understand best practices in technology integration and the supporting research" as "absolutely essential." This was one of only two items from the complete list of 39 items receiving an "absolutely essential" rating. Second, on five of the eleven items, site-based administrators mean rating was noticeably lower that the other three groups of participants.

Table 6. Supporting Teachers to Implement Classroom Instruction

Question Current and future site-based technology specialists need to:	Overall Mean	DLA	T	SBT	SBA
6. understand best practices in technology integration and the supporting research.	4.56	5.00	4.60	4.40	4.25
1. be able to assist teachers in matching tools with learning and content goals	4.52	4.86	4.40	4.80	4.00
7. to be able to use a variety of strategies to assist teachers' implementation of technology integrated lessons	4.46	4.29	4.60	4.70	4.25
11. to be able to communicate strategies for integrating technology in a range of physical settings	4.41	4.29	4.60	4.50	4.25
8. to be knowledgeable about district level policies, frameworks, and practice and be able to help teachers implement technology integrated lessons that reflect those policies, frameworks, and practices	4.26	4.29	4.40	4.10	4.25
12. to be able to communicate strategies for integrating technology for a range of instructional formats	4.25	4.14	4.40	4.20	4.25
9. to be able to assist teachers in identifying and implementing technology integration practices that support differentiation of instruction.	4.15	4.43	4.20	4.20	3.75
2. be able to assist teachers with sequencing, pacing, and time considerations associated with integrating technology	4.07	4.14	4.00	4.40	3.75
5. know a range of instructional strategies and how to assist teachers in using those strategies	3.97	4.14	4.00	4.00	3.75
3. have expertise in multiple content areas and grade levels	3.44	3.29	3.50	3.70	3.25
4. be able to assist teachers learning theories and learning styles to effective technology integration	3.38	3.71	3.20	3.60	3.00
Mean of Means	4.13	4.23	4.17	4.24	3.89

Facilitating Teacher Education/Staff Development: Fifteen items from the 39 Round One Responses specifically targeted the need for technology resources specialists to be able design and implement teacher education/staff development. Skills ranked as important included designing teacher education/staff development that is responsive to teachers' developmental and adult learning needs, connected to actual practice, supports teacher collaboration and sharing of experiences, and provides appropriate and robust follow-up experiences. Items also targeted the need for technology resource specialists to be reflective teacher educators and skilled at mentoring. The fifteen items in this category are presented in Table 7.

Table 7. Promoting Teacher Education/Staff Development

Question	Overall Mean	DLA	T	SBT	SBA
Current and future site-based technology specialists need to:					
**18. be able to design and implement teacher education and teacher support that consider teachers' levels of readiness	4.53	4.60	5.00	4.50	4.00
22. be able to reflect upon and assess their own practice as they support teachers	4.49	4.43	4.60	4.70	4.25
14. to be able to design and implement teacher education that is directly connected with actual classroom practice	4.44	4.57	4.60	4.60	4.00
21. understand a range of effective mentoring skills and strategies	4.24	4.43	4.60	4.20	3.75
**24. be able to design teacher education opportunities that model best staff development	4.19	4.80	4.80	4.75	3.67
17. understand teachers' resistance to technology integration and respond appropriately	4.19	4.00	4.40	4.10	4.25
**23. understand appropriate strategies for designing and implementing teacher education opportunities.	4.18	4.40	4.60	4.38	3.23
19. be able to effectively promote and support teacher collaboration in the design and implementation of technology integrated lessons	4.17	4.29	4.00	4.40	4.00
26. understand the characteristics of adult learners and be able to design appropriate teacher education	4.00	4.00	4.20	4.30	3.50
15. be able to facilitate teacher education that incorporates opportunities for teachers to share their classroom experiences and discuss successes and failures	3.98	4.00	4.40	4.00	3.50
13. to be able to design and implement teacher education that considers teachers' needs related to sequencing, pacing, and time constraints	3.96	4.14	4.20	4.00	3.50
20. know how to help teachers promote and support lessons that capitalize on student collaboration.	3.96	4.07	4.00	4.00	3.75
**25. be able to design and implement teacher education that makes provisions for follow-up activities and learning	3.93	4.40	4.20	4.13	3.00

27. know how to bring others into the design and implementation of teacher education opportunities	3.45	3.29	3.70	3.80	3.00
**16. be able to advise teachers about teacher education opportunities	3.25	2.60	3.60	3.13	3.67
Mean of Means	4.06	4.13	4.33	4.2	3.67

* No consensus after Round Two, consensus after Round Three
** No consensus after Round Three

On ten of the fifteen items in this category, site-based administrators rated the items noticeably lower than the other three groups. On five of those ten items, the mean rating of site-based administrators fell within the range set as a standard for consensus after Round Three. Yet, their mean rating remained lower than the other groups. On the five items that failed to meet the standard for consensus, site-based administrators' responses accounted for all of the disagreement while the other three groups demonstrated a high level of agreement. Although this overall trend (site-based administrators' lower rating) is the most important finding in this category, two items are worth pointing out. Item 18 that stated as " Current and future site-based technology specialists need to be able to design and implement teacher education and teacher support that consider teachers' levels of readiness" received a unanimous 5.0 "absolutely essential" rating from teachers.

Item 16 stated as "Current and future site-based technology specialists need to be able to advise teachers about teacher education opportunities" revealed an interesting alliance. District-level administrators and site-based technology specialists partnered with similar ratings which were considerably lower than the 3.6 and 3.67 ratings of classroom teachers and site-based administrators respectively. Thus, on this item instead of site-based administrators differing from the other three groups, there was a partnering between district-level administrators and site-based technology resources partnering and another between site-based administrators and classroom teachers.

Managing and Maintaining Technology Resources: Two items from the 39 Round One Responses specifically targeted the need for technology resources specialists to manage and maintain technology resources particularly the related issues of access and reliability. In this category of concern, there was a clear partnering of district-level administrators and site-based technology specialists, on one hand, and classroom teachers and site-based administrators on the other. District-level administrators and site-based technology specialists rated managing and maintaining technology resources noticeably lower than site-based administrators and classroom teachers. In fact, the gap between these two clusters of respondents could not be bridged. Item 29 - maintaining reliable technology resources - failed to achieve consensus during Round Three. The two items in this category are presented in Table 8.

Table 8. Management and Maintenance of Technology Resources

Question	Overall Mean	DLA	T	SBT	SBA
28. Manage and facilitate efficient and equitable access to the technology	3.97	3.83	4.40	3.40	4.25
**29. Maintain reliable technology resources	3.71	3.33	4.00	3.00	4.50
Mean of Means	3.84	3.58	4.2	3.2	4.38

** No consensus after Round Three

Taking on Leadership Roles: Two items from the 39 Round One Responses specifically targeted the need for technology resources specialists to assume leadership roles of change agent and leading edge innovator. Both items achieved consensus and were not as highly rated as the previous three categories of concern. The items are presented in Table 9.

Table 9. Leadership Roles for Site-Based Technology Specialists

Question	Overall Mean	DLA	T	SBT	SBA
Current and future site-based technology specialists need to:					
*10. stay on the leading edge of innovation while maintaining a strong focus on curricular issue	3.82	3.60	4.00	4.00	3.67
30. understand the change process and be able to implement strategies to productively facilitate that process.	3.49	3.43	3.60	3.44	3.50
Mean of Means	3.66	3.52	3.8	3.72	3.59

* No consensus after Round Two, consensus after Round Three

Supporting Assessment of Learning: Five items from the 39 Round One Responses specifically targeted the need for technology resources specialists to be involved with the assessment of learning. Specifically, participants rated the importance of the technology resource specialist's role in recommending assessment strategies, setting instructional objectives, using technology to create, implement, record, and store assessment data, and being familiar with SOL online testing policies and practices. The five items in this category appear in Table 10.

Table 10. Supporting Assessment of Learning

Question	Overall Mean	DLA	T	SBT	SBA
Current and future site-based technology specialists need to:					
*31. be able to recommend assessments appropriate for varied learning outcomes	3.83	3.80	4.20	3.31	4.00
32. be able to assist teachers with effective questioning strategies and the construction of quality test items	2.94	3.00	2.60	2.90	3.25
**33. be able to assist teachers in the formation of appropriate instructional objectives their effective measurement	3.49	4.14	3.40	3.40	3.00
34. be able to assist teachers in the use of digital tools to create, implement, record, and store assessment data	3.90	3.71	4.20	3.70	4.00
**35. be familiar with SOL online testing policies and practices	4.05	3.40	4.60	3.88	4.33
Mean of Means	3.62	3.61	3.80	3.43	3.72

* No consensus after Round Two, consensus after Round Three
** No consensus after Round Three

Providing Learning Opportunities: Finally, a number of items resulting from 39 Round One responses related to appropriate means for providing technology resource specialists with educational opportunities to develop the knowledge and skills identified in the previous five categories of concern. Items targeted options such as workshops, online courses, stipends, time frames, cohorts, special topics groups, and composition of educational groups. The items in this category are presented in Table 11.

Table 11. Strategies for Meeting Educational Needs of Site-Based Technology Specialists

Question	Overall Mean	DLA	T	SBT	SBA
Current and future site-based technology specialists need to:					
**36. educational opportunities should be tailored to particular groups (i.e. by subject area, grade levels, content specialties	3.48	4.00	3.40	3.00	3.50
37. educational opportunities should promote meeting and sharing with other technology specialists	4.44	4.43	4.75	4.10	4.50
38. educational opportunities should capitalize on cohort-like structures, peer support, opportunities for collaboration, and opportunities for goal setting	4.05	4.14	4.20	3.60	4.25
39. Educational opportunities should be					
a. online	3.67	3.43	3.60	3.90	3.75
a. provide graduate credit options	3.70	3.71	3.40	3.70	4.00
b. Face-to-face Full Day Workshops	3.61	3.57	4.00	3.60	3.25
c. Face-to-face Half-Day Workshops	3.53	3.57	3.60	3.70	3.25
d. offered during contract times	3.73	3.71	3.80	3.90	3.50
e. offered after school or during the summers with stipends associated	3.78	4.00	3.80	3.80	3.50
**f. restricted to those in a single school division	2.61	2.40	2.80	2.56	2.67
**g. offered across school divisions	3.33	2.60	3.80	3.25	3.67

** No consensus after Round Three

Summary of Categories of Concern: While it is occasionally instructive to examine means by individual items as in the previous tables, trends and generalizations may better be derived from the mean of means for each category of concern and group of participants. The means of means are summarized in Table 12. The means clearly identify the need for educational opportunities for technology resource teachers to develop their ability to support classroom instruction and to promote teacher education/staff development. Leadership roles and a role in the assessment of learning were the two lowest priorities.

It is particularly noteworthy that site-based administrators differed markedly in their ratings from the other groups. While supporting classroom instruction and promoting teacher education/staff development were the highest priorities overall, they were rated considerably lower by site-based administrators. Managing and maintaining technology resources was rated the highest priority by site-based administrators and the second highest priority by classroom teachers while district-level administrators rated it second lowest and site-based technology specialists rated it lowest.

Table 12. Summary of Means for Categories of Concern

Categories of Concern	Overall Mean	DLA	T	SBT	SBA
Support Classroom Integration	**4.13***	**4.23**	4.17	**4.24**	3.89
Promoting Teacher Education	4.06	4.13	**4.33**	4.20	3.67
Manage/Maintain Technology Resources	3.84	3.58	4.20	3.20	**4.38**
Leadership	3.66	3.52	3.80	3.72	3.59
Assessment	3.62	3.68	3.70	3.37	3.68

***Bold** signifies the highest ranked category.

Conclusion and Discussion

Results of this study clearly identified the need to provide direct and individual support of classroom technology integration and effective teacher education/staff development as the top learning needs for technology resource specialists. A thoughtful reading of the individual items in each category, however, suggest that in many ways these two identified priorities are simply two sides of the same coin. That is, direct and individual support of classroom curriculum integration and effective teacher education/staff development represent an informal and formal version of the same process. Direct and individual support of classroom curriculum integration depends on an informal process. Skills technology resource specialists would need support learning more about would include strategies for

1.) Engaging individual teachers in conversations about teaching and learning;
2.) Assisting individual teachers in the design and implementation of effective technology integrated curriculum;
3.) Mentoring teachers in reflecting, risk-taking, and critiquing classroom practice;
4.) Modeling technology integration through exemplary demonstration of practice;
5.) Motivating and challenging individual or small teams of teachers to integrate technology;
6.) Structuring robust and thoughtful informal conversations; and
7.) Completing assessments of individual classroom teachers' learning needs and devising appropriate interventions.

Teacher education/staff development, on the other hand, refers to a more formal process. Implementing effective formal learning opportunities for larger groups of teachers depends on technology resource specialists' skills at identifying and developing responses to larger school needs in conjunction with building leadership teams and in response to available and/or obtainable data sets. In addition, technology resource specialists need opportunities to develop, elaborate, or refine their ability to

1.) Work with large groups,
2.) Organize and facilitate more formal learning opportunities,
3.) Use theories about effective staff development to inform practice,
4.) Plan effective staff development workshop and inservices, and
5.) Combine their efforts with the expertise and efforts of others involved in staff development.

In addition to those learning needs linked specifically with informal classroom structures or with formal staff development structures, there is a shared set of skills and knowledge related to the success of technology resource specialists in both the formal and the informal version of the process. Among these are a continual refinement and elaboration of technology specialists' knowledge of

1. Best practices in technology integration and why those practices are powerful learning tools;
2. Teacher developmental levels;
3. Adult learning strategies;
4. The impact of and strategies for coping with and/or using teacher resistance, perceived needs for change, and school and community culture; and
5. School, school division, state, and national public policy as it affects learning, practice, and educational goals.

Second, there is a need for technology resource specialists to develop generalized skills that link emerging knowledge directly to practice. Thus, for example, it is not enough to learn about good staff development practices; it is important to learn to use that knowledge to design and implement good practice. It is not enough to be able to list or identify good mentoring practices; technology resource specialists need opportunities to practice those strategies in safe, low stakes learning environments.

Third, technology resource specialists need opportunities to practice strategies that support linking building and school division needs with decisions and actions related to both informal (direct and individual support of classroom curriculum integration) and formal (teacher education/staff development) processes. Often, a technology resource specialist is the only

educator in their building with technology resource responsibilities. Thus, there is no one to share planning responsibilities, to talk through challenges, or to create a critical mass for an innovation or strategy. Technology resource specialists, therefore, need learning options that include opportunities to collaborate with peers (other technology resource specialists), to reflect on and brainstorm about successes and challenges, and to distribute the workload of designing and implementing of staff development.

The overt results of the study indicate that the answer to the study's central research question – what are the learning needs of technology resource specialists – is to design learning opportunities for technology resource specialists that address strategies for providing direct and individual support of classroom technology integration and effective teacher education/staff development. A more central need emerges from an analysis not of the areas of consensus but of the areas of persistent disagreement. On five of eleven items (45%) in the classroom curriculum integration category and ten of fifteen items (67%) in the teacher education/staff development category, the means for site-based administrators were noticeably lower than the other three groups. When the two categories are combined, over half (58%) of the items were viewed as less important needs by site-based administrators. Thus, three groups value the importance of teacher education/staff development but for slightly different reasons. Classroom teachers want technology resource specialists to be able to support them in their classrooms and with appropriate staff development opportunities. District-level administrators affirm their belief that these responsibilities are central to the intended role of the technology resource specialists. Site-based technology specialists recognized as leaders by their respective school divisions view these categories as defining the successful technology resource specialist. Yet, site-based administrators do not regard these roles as highly. This discrepancy cannot be ignored.

In addition to this discrepancy, study results in the category of managing and maintaining technology resources reveal a related concern. The responses of district-level administrators and site-based technology resource specialists present strong evidence that managing and maintaining technology resources should be a lesser part of the technology resource specialists' role. Conversely, classroom teachers and site-based administrators deem the need to maintain and manage technology resources to be of primary importance. If the mea
ns for each area of concern are examined for each group independently, managing and maintaining technology resources is rated as the most important role of technology resource specialists by classroom teachers and site-based administrators. Conversely, district-level administrators and site-based technology resource specialists rated managing and maintaining technology resources as the least important role. The disparate mean ratings represent a clear conflict in the perceived role of the technology resource teacher.

At first glance, it is tempting to dismiss these conflicts in the perceived role of the technology resource teacher as interesting but not informative to the study's central purpose, that is, identifying the learning needs of technology resource specialists in order to guide the design of curriculum for the proposed Technology Integration Educators Institute (TIE-In). One might view the persistent disagreements of site-based administrators as indicative of the need to design educational opportunities for site-based administrators to assist them in better understanding the role of the technology resource specialist. One might view the persistent disagreement between classroom teachers /site-based administrators and district-level administrators / site-based technology resource specialists in the area of managing and maintaining technology resources as indicative of the need to either provide additional hardware and software maintenance systems or

the need to better educate classroom teachers and site-based administrators about the role of technology resource specialists.

While both of these views might well be important directions for additional actions by decision-makers, these areas of persistent disagreement also point to an important learning need for technology resource specialists. The role of technology resource specialist is or ought to be much more than that of a convenient support position dictated by the whims of day-to-day urgencies. Rather, the role of technology resource specialist is inherently a leadership role. Such a role necessitates that those in or preparing for this role come to perceive themselves as leaders. Technology resource specialists need to understand that they are part of a school's leadership team with substantial responsibilities to help shape decisions in terms of identified areas of need. They must learn to assume leadership not for technology but for instruction. They need to be assisted in developing necessary leadership skills such as understanding how to

1.) Communicate their role and their vision;
2.) Act as an advocate for technology as an integral part of instruction;
3.) Work with site improvement teams to create solutions to instructional problems and devise courses of action for realizing those solutions;
4.) Identify, entice, and mobilize colleagues to solve instructional problems;
5.) Assess their own progress, chart the outcomes of their actions, and revise actions appropriately, and;
6.) Set realistic and appropriate goals consistent with the larger goals of their school and school division, communicate those goals, and then prioritize their activities to meet those goals.

Until technology resource specialists are assisted in understanding their role as a leadership role and developing leadership skills, they will continue to find themselves caught between district-level goals and the urgencies of administrators and between putting out fires and serving as a technician and planning and implementing systematic activities to meet the informal and formal needs of classroom teachers. It is unlikely that learning to better provide direct and individual support of classroom technology integration and effective teacher education/staff development will be demonstrated by changes in practice if technology resource specialists' learning opportunities are not accompanied by or even proceeded by learning about the intricacies of leadership – the need to be a leader, the power of leadership, and the skills to act as a leader.

Finally, results of the study offer advice about how the learning needs of technology specialists might best be met. Overall, participants supported a collaborative approach, encouraging cross-school division collaborations, cross-grade and subject area collaborations, and opportunities for technology resources specialists to meet, share, and learn together. In addition, participants' responses supported multiple educational delivery options, suggesting that a variety of opportunities were needed and desirable. Last, the participants as a whole supported stipends and graduate credit options as recognition of the learning efforts of technology resource specialists.

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