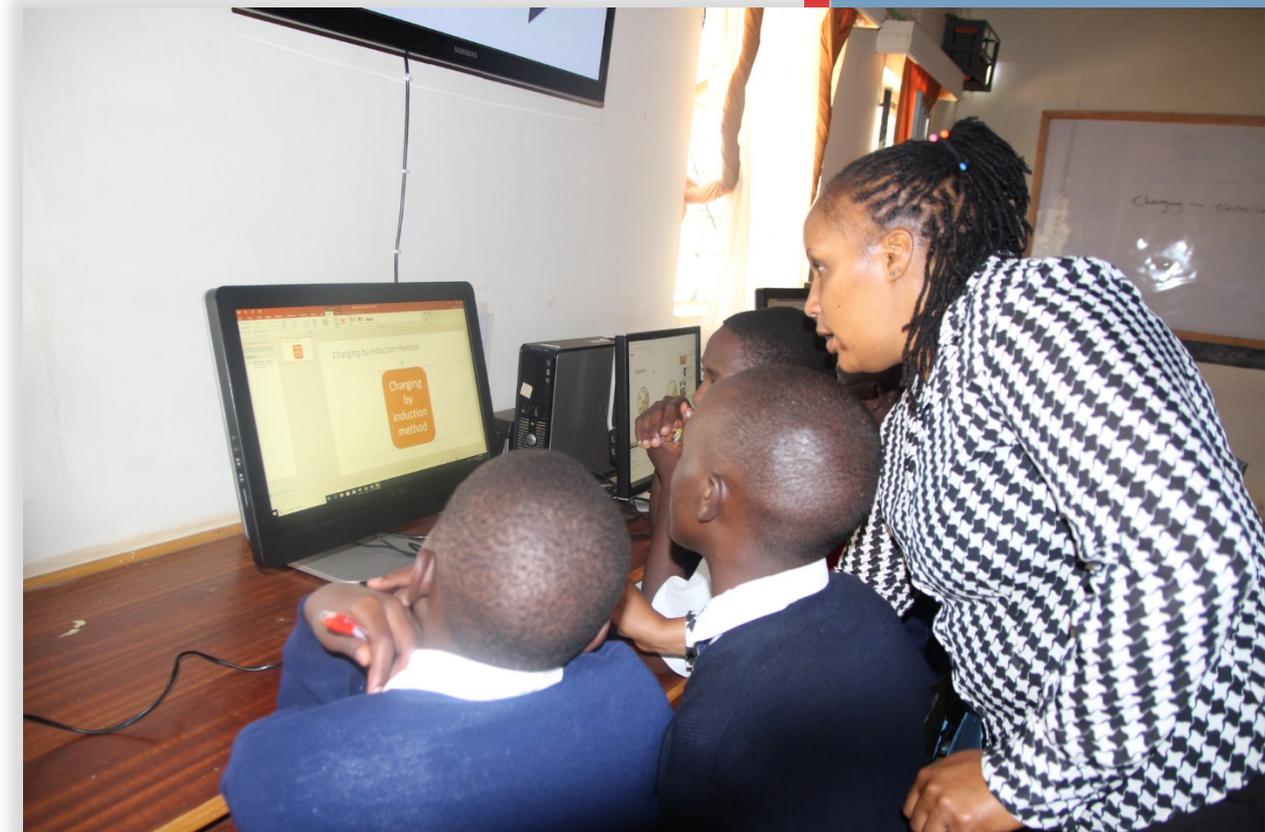


Africa Digital Schools Initiative (ADSI)-Kenya

Midline Evaluation Report



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February 2019

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We hope that the findings of this report will help inform learning and betterment of the ADSI and any future related project in Kenya.

Abbreviations and acronyms

ADSI	-	African Digital Schools Initiative
BOM	-	Board of Management
CDE	-	County Director of Education
CEMASTE	-	Center for Mathematics, Science and Technology Education in Africa
DSD	-	Digital Schools of Distinction
FGDs	-	Focus Group Discussions
GESCI	-	Global eSchools and Communities Initiative
ICT	-	Information Communication Technology
KIIs	-	Key Informants Interview
SMMASSE	-	Strengthening of Mathematics and Science in Secondary Education
MoE	-	Ministry of Education
OERs	-	Online Education Resources
PBL	-	Project-Based Learning
SMASSE	-	Strengthening of Mathematics and Science in Secondary Education
STEM	-	Science Technology English Mathematics
TPACK	-	Technological Pedagogical Content Knowledge
TPAD	-	Teacher Performance Appraisal and Development (TPAD)
TSC	-	Teachers Service Commission

Executive summary

The ADSI Kenya midline study aimed to collect data and evidence on ADSI implementation progress, effects and impact. A mixed methods approach was used for the study and data was collected from 15 MoE officials, 40 schools, 80 school leaders, 243 teachers and 1600 students. Data collection took place between the month of September and October 2018.

The study has generated findings and critical insights into the progress and impact made since baseline as well as challenges and barriers that may need to be addressed in the remaining life of the project. The following is just the highlights of the findings, however one may need to read the whole report in order to fully appreciate the basis of some of the conclusions. The following is a summary **of the findings**.

- **The status of institutionalization of ADSI and ICT integration:** ADSI has succeeded in supporting the entrenchment of ICT integration at the school level. About 90% of the schools now have either developed new ICT integration policies or improved on the existing ones. The finding also showed that the various policies were deemed useful and effective as they had helped in building support, buy-in and corporation among members of the school community on the importance of ICT. The policies are also said to have generally motivated the school leadership to invest in the growth of ICT infrastructure and equipment and most importantly helped streamline the use and sharing of ICT resources and protecting misuse of the facilities. However, more needs to be done to strengthen commitment to these policies and to support progress towards more tangible outcomes such as inclusion of ICT budgets in school plans and shifting of education policies to be more ICT integration- friendly.
- **The status of Digital Schools Development:** There is evidence to suggest that the programme has made significant progress towards making the participating schools Digital Schools of Distinction. Across board, it emerged that there is generally a very strong belief and recognition that ICT has great potential to improve teaching and learning but also in enhancing performance. There is also evidence of good buy-in and support by school leaders, an improved ICT integration environment, growth of ICT infrastructure and equipment, better resourcing for ICT infrastructure as well as improvements in the schools ICT culture. In addition, ADSI schools have developed stronger systems for acquisition and management of ICT resources and improved the use of ICT in the management and communication among school community. However, the levels of progress is still disparate amongst the schools and there is need to motivate schools that may be lagging behind to catch up.
- **The status of Teacher Professional Development:** The vast majority of teachers in the programme have positive reviews of their experience saying the project had greatly improved their skills both in ICT as well as modern teaching. Evidence suggests that the project has done the following to the teachers; improved their access to ICT both in schools and other environments, helped them develop deeper understanding of the potential of ICT in improving teaching, build their confidence in using ICT tools and equipment, also helped the teachers acquire knowledge on the modern 21st Century teaching. Teachers also are using ICT in lessons more regularly and have influenced their peers who are not in the project to do the same. In addition, they strongly believe that the project is contributing significantly to the acquisition on 21st Century skills amongst the learners. Evidence gathered also suggest that there is a great collaboration happening among teachers and a community of practice that allows participating teachers to shares knowledge and information amongst themselves is emerging. In terms of how the project is managed, the teachers rate the ADSI team especially the PCs very highly and report that their expectations have been met and that the SBCs had proven to be very supportive. However, it is apparent that there are still many barriers and challenges that may need to be addressed for the success of the project including;

shortage of equipment, lack of time, internet connectivity issue, lack of support from some principals.

- **Status of student learning:** ADSI appears to be doing well in supporting the acquisition of learner 21st century skills and improving learner achievements not just in STEM subjects but others as well. Feedback from the study suggest that the project has greatly increased access and use of ICT among students both in and out of school, improved the skills, confidence and frequency of using computers for personal and school-related tasks, improved their perceptions on the potential of computers to support learning. They also report that generally using a computer in learning has many benefits namely; helping them remember easily what they have learnt, understand easily what they are learning, concentrate more on what they are learning, work better with other students, feel more independent in their learning, improving the class atmosphere, making difficult concepts easy to understand, making learning fun, helping them recall what they had learnt, making them more active and engaged in learning, making work easy for the teachers and generally making them understand abstract concepts through the power of audiovisual presentations. Other reasons given were that ICT had given them opportunities to research and find out more information beyond what the teacher covered. A few also reported that their interest and performance in the subjects which ICT is being used had improved. They also expressed strong preference for lesson where ICT is integrated to conventional lessons with over a third of them saying they highly liked the lesson in which ICT is integrated. However, student population ratio to the equipment remains a major challenge to integration of ICT in learning.
- **Policymakers' views on ADSI:** At the policymakers level, the project is considered highly relevant and well **aligned to national goals and initiatives** with government plans and policies and the policymakers like the close collaboration in implementation. Across the three counties, there are very few other ICT integration in education initiatives apart from ADSI. Officials speak highly about ADSI project; they feel the project is well aligned to government policies and plans, they feel it is a timely and relevant project which was changing the way learning happens, improving learning outcomes, going beyond the conventional coursework to help the students acquire skills to prepare them for the future. Officials also report that they like the ADSI approaches which combines equipment support and teacher professional development and which engages different actors in implementation. In addition, the officials had very positive reviews on the ADSI project and the project team and that the project has that the project has great potential for sustainability.

Despite the largely positive feedback on the effects of ADSI, this study also collected views on some of the challenges and barriers to the implementation of ADSI as well as some of the things that various project stakeholders disliked. Among the challenges are;

- Across the board, inadequate infrastructure, facilities and equipment were mentioned as a major barrier. Inadequate computers/laptops and projectors and poor and inconsistent internet connectivity was reported to be making it difficult for teachers and students to integrate ICT as much as they would love to.
- One of the major concerns among the teachers was the fact that most of the trainings were often short and hurried and with so much to cover within a short time. Teachers are also concerned of the timings of the trainings and that chats which often clashed with other school commitments.
- In some schools the issue of principal transfers had slowed down activities and in isolated cases, it was reported that the principals do not support the initiative fully making it difficult to roll out activities specifically those that needed financial resources.

- Some teachers who had been in the service for longer were said to be struggling with ICT integration and while there were individual cases of schools that had managed to shift these attitudes, there were reportedly cases where this had not happened.

1.0 Background

The Global E-Schools and Communities initiative (GESCI) has worked since 2005 to provide capacity building, technical and strategic advice to countries seeking to harness the potential of ICTs in order to increase access to, and to improve the quality and effectiveness of education. GESCI in partnership with the Mastercard Foundation and the Ministries of Education in Kenya, Tanzania and Côte d'Ivoire is embarking on a five year African Digital Schools Initiative (ADSI) (2016-2020) - a comprehensive multi-country multi-year programme to implement an effective, sustainable and replicable model of digital whole school development in secondary education that will lead to improved student 21st century skills development, learning outcomes and readiness for the knowledge economy workplace.

The goal of the ADSI programme is to consolidate and develop a holistic expansion of the demonstrably successful aspects of its Strengthening Innovative Practice in Secondary Education (SIPSE) pilot model (2013-2015) in relation to its innovation practice, whole school approach, horizontal (geographic) and vertical (institutional) outreach and impact, and shared ownership. The ADSI model presents a portfolio of system-wide ICT innovation elements that can address policy coherence needs for ICT integration in teaching and learning - inclusive of: a blended learning teacher development approach, whole school involvement, school leadership capacity building, converging technologies of e- and m-learning, use and development of open education resources, an online repository of materials, digital school awards, accreditation and certification to incentivize ICT integration and progression, policy dialogues to raise awareness and influence new policy formulation and institutionalization of new/good practice. Currently, ADSI covers 80 schools (20 in each of the four counties of Kiambu, Nyamira, Narok & Taita Taveta), 80 secondary school principals, 800 teachers and 80 Boards of Management chairpersons and 80 parents association chairpersons.

In Kenya, a baseline study was carried out in quarters 3 & 4 of 2016 to inform the project and set the benchmarks upon which the project would be monitored and evaluated. After one and a half year (representing the midpoint), a midline study was conducted to help ADSI with the evidences, insights on the extent of achievement of objectives, factors that facilitate and impede the progress, and provide recommendations for midcourse corrections, if any.

2.0 Midline study objectives

The overall objective of the midline study was to assess whether and/or the extent to which targets have been achieved thus far in the project, understand the determinants enabling and/or disabling achievement of targets, the extent of ownership built among the target groups, capture key learnings from the implementation experience and recommend doable actions for the remaining project period.

Specific evaluation objectives were to:

- Assess the project progress/changes (since baseline) of the project so far and its likelihood of achieving its stated objectives (more than a year since implementation began) on the following aspects;
 - **Institutionalization:** Investigate the current level of institutionalization of national strategies for the pedagogical integration of ICT use in STEM and other subject teaching as related to

policy in teacher development, curriculum, pre and –in service, school support and management practices;

- **Digital Schools Development:** Establish the current conditions, needs, resources and priorities of the schools in relation to ICT in STEM teaching and learning.
 - **Teacher Development:** Establish changes in teacher competencies and practices for ICT use in STEM since baseline.
 - **Student Learning:** Measure learner 21st century skills and other learner achievements in relation to STEM subjects and gather feedback on their experiences and attitudes towards the use of ICT in STEM learning inside and outside of schools.
- Assess the ADSI programme in terms of relevance, effectiveness, efficiency of project implementation and level of ownership by project beneficiaries and other actors
 - Assess the ADSI programme in terms of effectiveness of networking with the different stakeholders for optimal leveraging of resources and sustainability benefits.
 - Document lessons on what works/doesn't work in the implementation of ADSI approach and Theory of Change.
 - Generate practical, action-able recommendations that can be implemented by the project actors in the remaining phase of the project.

3.0 Research Methodology and Approach

As was the case with the baseline, a mixed methods approach employing both qualitative and quantitative techniques were used including; Quantitative survey with a representative sample of the population of students, principals and teachers; Focus Group Discussions with teachers and students and key Informants In-Depth Interviews with government officials. Where necessary or appropriate other methods such as observation were used specially to verify some of the responses.

3.1 The sample

To limit biases, there were varied methods used to arrive at the respondents. Therefore, sampling was done at different levels as follows;

First 50% (40) of the ADSI schools were randomly selected but ensuring that the number was equally distributed across the 4 Counties. This therefore meant that 10 schools were targeted per county.

- In each of the selected schools, the Principal was automatically targeted.
- Then there was a provision to interview either the Chairperson of the Board of Management or Chairperson of Parent Teacher Association. In cases where we could not get either during the research period, the Deputy of either was interviewed.
- As for the ADSI teachers' survey, 6 out of the 10 ADSI teachers were selected for interview in every school.
- As for the FGDs, in each County, (8-10) teachers were selected from at least 4 of the ADSI schools across the county to make up 3 Distinct groups (1 for teachers of Maths/Physics/Computer studies, 1 for teachers of Chemistry/Biology and 1 for other subjects such as languages, humanities and industrial arts)
- For the students' survey, 10 students were randomly selected in each of form 1, 2, 3 and 4 to make a sample of 40 students who were given the questionnaires to complete. In schools with more than 1 stream, a stream was first selected (per grade) randomly and then the student selection done.
- For the Student FGDs, with the help of the Project Coordinators, schools were put into 3 categories (where ADSI seems to be succeeding, where its average and where very little traction has been gained). In each of the schools, a group was randomly constituted for with Lower

forms (form 1 & 2) or upper forms(3&4). There were a few instances where we sampled mixed schools where boys learn separately from their female counterparts. In such cases, two groups were interviewed in the same school.

3.2 Data collection

The study was led by the GESCI MERL Specialist and a group of carefully selected freelance Research Assistants. Face to face interviews were carried out with school leaders, teachers as well as county officials. The student survey was a self-completion questionnaire which was distributed to 40 (10 from each grade/form) randomly selected students in each of the schools. FGDs were conducted with carefully selected representatives of the ADSI teachers and students and the sampling aimed to have as wide a representation as possible. The teacher FGDs were all moderated by the GESCI MERL Specialist while the student ones were conducted by 3 different Research Assistants using a discussion guide and the discussions were digitally recorded. Similarly, the KIIs were all carried out with government officials at the county level using a discussion guide and the discussion recorded.

3.3 Research instruments

A total of 7 research instruments were used in the Midline study. As much as possible, the instruments were designed to mirror those used for the baseline to enable comparability of results. Training of Research Assistants was carried out and included the pretesting of the tool across 2 ADSI schools after which the tools were refined and approved for use.

Table 1: The following is the breakdown of sample and research instruments used

Target group	Method/approach	Target sample	Sample achieved	Data collection instruments
ADSI Teachers	Survey	240	243	Structured questionnaire
	FGDs	96	114	Discussion guide
School leaders	Survey	40 Principals	40	Structured questionnaire
	Survey	40 BoM/PTA Chairpersons	38	Structured questionnaire
Students	Survey	1600	1600	Self-completion questionnaire
	FGDs	120	140	Discussion guide
Government officials	KIIs/Depth interviews	12	16	KII discussions guide
Total sample			2,211	

3.4 Analysis

Quantitative data cleaning and entry was a continuous process undertaken daily in the course of fieldwork. Data was collected and digitized by being entered into survey monkey on a daily basis. While the survey monkey was able to provide basic analysis, data was then transferred into Statistical Package for the Social Sciences (SPSS) for further analysis. It was then cleaned to take care of inconsistencies and errors, which may have occurred during coding and entry. Analysis was undertaken by computing the necessary statistics such as means, frequencies and percentages and in some cases cross-tabulations. These were then presented in descriptive formats such as tables, graphs or narrations.

Qualitative interviews were recorded using digital voice recorders. They were then transcribed into word documents then entered into NVIVO qualitative data analysis software for coding. The data was then thematically analysed and interpreted into findings. The findings were then presented through inferential narratives illustrated using verbatim quotes.

3.5 Limitations

This study has encountered and addressed a few limitations as listed below;

- First, the study was only conducted within the ADSI intervention schools therefore no data to compare with other schools in the county.
- Second, for the large part the study relied on retrospective self-reported data. There is therefore the possibility that some participants had difficulties recalling important information or providing accurate information specifically in cases where they were asked to state timelines and frequency.
- Third, the study was carried out in the period proceeding the National examinations therefore the time allowed in schools was restricted. This hampered the use of observation to verify some facts.

4.0 Main Findings

4.1 The status of institutionalization of ADSI and ICT integration

The first aim of the midline study was to investigate the levels of institutionalization of ICT integration in education. The main questions checked the existence and knowledge of school ICT policy among the participating schools, alignment to national goals and ICT visions.

4.1.1 Existence, knowledge and awareness of ICT policies and integration in school goals and planning

The study first checked whether there had been any changes in the goals for development and improvement. Here, three aspects were checked: existence of school vision, policies and guidelines on ICT integration and whether there were any national development goals the schools on ICT integration that they were working on. Additionally, whether the schools were participating in any other (apart from ADSI) educational innovation programs.

One of the main objectives of ADSI was to support and encourage schools to have an ICT integration and use policy for their schools. As such, the Principals were first asked if they had ICT policy/visions in their schools. Among the Principals interviewed, 85% said yes, 10% said no and 5 % said they were in the process of making the policies. The majority of the schools reported having made adjustments to their development goals mainly to incorporate the ICT integration pillar. Others had come up with new ICT policies while others made improvements to the existing ones.

“The school strategic plan has indicated a part of the development on ICT and other areas. The policy has not been changed since its formation to manage ICT in the school” Principal, Nyamira

“Our vision to be a leader ICT integration has been incorporated in the strategic plan to be implemented in the next 3 years and it includes among other things to increase the ICT equipment in the school and additional human resource” Principal Taita Taveta

Similarly, the teachers were also asked if they were aware of any policies on ICT integration in their schools. 82% said yes, 15% said no while 3% were not sure whether or not such a policy existed in their schools. Among those who said they knew of a policy, 92% said they could describe the policy while 8% couldn't. Qualitative interviews with teachers revealed that most schools not only had the ICT policies but that awareness on the contents of these policies was also strong among the teachers. Asked what the policies were about, the majority said the policies spelt-out the ICT integration visions of the schools, use and management of ICT equipment and infrastructure, user guidelines and others bordered on protection of students. A few schools had policies that made it compulsory for every teacher to integrate ICT in their teaching at least for a given number of lessons in a school term.

“It spells out the school vision of ICT objectives to the girls towards digital ICT skills and ICT integration in teaching, When the SBC teacher gives directions they are supposed to follow” Teacher, Kiambu

“There is a policy because it was one of the requirements by ADSI we have developed and implemented. It has a week of ICT for every teacher, it also contains rules and regulations on borrowing, security of ICT equipment. It contains a lot of content in it and we have implemented it even though every new thing has challenges” Teacher, Nyamira

“The policy states that, the administration has provided necessary support by providing additional equipment and internet. Teachers are encouraged to adopt use of technology in teaching and students are guided on how to use the internet responsibly” Teacher, Nyamira

“One of the highlights concerns other ICT tools like phones which are prohibited in school. Only computer and laptops are in operation but under supervision of teachers. Students cannot just have them, say they are going for a science congress and they want to do a presentation it does not happen. They have to seek permission to use them in the presentation or the research they want to do” Teacher. Narok

This study found out that having a school ICT policy had benefits to the schools beyond just being one of the ADSI goals. Teachers listed several factors that they believed were the key strengths and benefits of their school ICT policies and guidelines. They reported that the policies had helped in;

- Building support, buy-in and corporation among members of the school on the importance of ICT.
- Motivating the school leadership to invest in the growth of ICT infrastructure and equipment.
- Helped streamline the use and sharing of ICT resources and protecting misuse of the facilities.

“It [policy] makes learners and teachers to visionize it, own and embrace ICT and in integrating ICT in leaning and teaching” Teacher

“The policy encourages STEM and Non-STEM teachers to use ICT in teaching and learning as it’s also a government requirement that students have basic ICT skills” Teacher

“The policy has been able to control the students because they follow the guidelines that control their behavior when using the ICT tools” Teacher

“The policy guides how the equipment is used, it has also led the school to get additional computers and ICT equipment; 2 additional computers, an S.M.S system, finance system, a library management system and CCTV in all offices” Teacher

4.1.2 ADSI alignment to national goals and initiatives

The school leaders were asked whether there were any national goals for school development and innovation that they were working on. The findings reveal that almost all the schools were working on at least one national development goal and programme. Most notable ones being the national goals on ICT integration in the curriculum, government policy on increasing ICT literacy, and the Teacher Performance Appraisal and Development (TPAD) guidelines which require every teacher to integrate technology in their teaching. Others reported that they were strengthening the use of technology in school management processes.

“Yes, we do have national goals that the school is working towards, especially ensuring that all learners, irrespective of their backgrounds, acquire secondary education. Another one is making ICT part of life” Principal

“Yes, the policy of ICT integration in the Kenyan curriculum. We train teachers through the ADSI program, we also involve the workers that is the clerks and secretary in transmission on information to stakeholders like parents” Principal

Apart from ADSI, several educational innovation initiatives were reportedly taking place among some of the schools and counties namely; national initiatives such as Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA) and Strengthening of Mathematics and Science in Secondary Education (SMASSE) that help train teachers on how to improve in teaching STEM subjects. There were also reportedly initiatives from other development partners that either provided equipment or were working to train and strengthen capacity of teachers but also students.

“Yes, the policy of ICT integration in the Kenyan curriculum. We train teachers through the ADSI program, we also involve the workers that is the clerks and secretary in transmission on information to stakeholders like parents” Principal

“ICT Literacy, ensuring that all communication in the school is centralized and is through ICT(We use SMS to communicate to parents about meetings) , we have also installed a biometric system in the school for students, we also encourage parents to make fees payments using their mobile phones or through technology” Principal

“CEMASTEA, School Exchange Programme-YES. We normally have volunteers from Germany who expose our students to different cultures and also participate in educational activities. TIMAZI too, which focuses on reading books and encouraging reading. E-Kitabu which is a mobile book provider, though we haven't accessed the content yet. We want to begin accessing such content this term, but it has financial implications. We are therefore waiting for finances to access the materials” Principal

“Yes, SMASSE and leadership program to make our students understand some roles out in the community. Our vision is to produce a student who can manage himself out there and not really must be employed. Equating education with money are things which we'd want to come out of people's mind” Principal

4.1.3 Planning and implementation of ADSI

The study also collected feedback from the school leaders on their experiences and approaches in the implementation of ICT integration. Here the following 3 indicators were explored; How planning for ICT integration is done and if there have been any recent changes to their systems, structures and processes that were in place before ADSI; any additional resources they had put in place; strategies used to communicate ICT plans to various groups; and the level of infrastructure.

In terms of planning, there were varied approaches reported by different schools with most working more closely with teachers (especially ADSI ones) to come up with plans, others using the Boards of Management (BoMs). However, there was very little evidence that the schools were involving students and parents in their planning.

*“As the Board, we have discovered the importance of exposing our children to ICT. We therefore have supported infrastructural development and allocated funds to ensure smooth implementation”
BoM Chairperson.*

*“The school allows teachers to participate in planning of these programs; There is also a plan to install CCTV in the school. The parents also support the school in buying data for internet use”
Principal*

In

regards to how ICT plans are communicated to the various players, there were varied methods reported across the schools. Generally, though, meetings (staff, AGMs, parents’ meetings) were mostly used to communicate about schools’ ICT plans to teachers, parents and other stakeholders. There were also reports of some schools that utilized modern technology in discussion plans namely; SMS platforms WhatsApp and emails.

*“ICT plans are communicated to staff and BoM through meetings and staff briefs. They form part of the agenda for the meetings. We also capitalize on TPAD. It's now a requirement from our employer. We refer to it when we want it to be done. We also share experiences from class, eg from using simulations. Such learning is exported to other classes”
Principal*

*“We use teachers meetings with the school principal, Meetings and presentations by dean of students in PA and BoM meetings and projecting on screen to show them the need of ICT. Discussions at board levels and presenting the information to the school staff”
BoM/PA Chairperson*

4.1.4 Perceptions on the success of implementing ADSI

Most of the school leaders rated themselves very highly in regards to the level of success in the implementation. Those who rated themselves mainly invoked their participation in ADSI as having catalyzed their planning, acceptability and integration. Others mainly cited cooperation from teachers, others the fact that students and parents had embraced ICT integration while others talked about having devised their ways to improve the acquisition of additional resources.

*“ICT integration has been a success in the school courtesy of the teachers in the program. The school has acquired additional computers to fill of the gap of insufficiency of computers”
Principals*

*“We have been very successful in the implementation because all teachers and students have very positively accepted it and are always eager to learn. We have succeeded in creating a positive attitude in learning, especially to teachers. We have increased the number of ICT facilities-computers. We didn't have a computer lab but now we have one. We have formally-trained teachers on ICT in partnership with KTTTC. We have also made examinations digital. Teachers type examinations”
Principal*

4.2 Status of Digital Schools Development

One of the key products of ADSI is the ICT integration roadmap which defines the pathways towards making a school a Digital School of Distinction. As at the midline study, 72 out of the 80 schools had already achieved the e-enabled status (progress from e-initial at baseline). However, this study collected information on the factors that had contributed to this progress towards making participating schools Digital Schools of Distinction. To do this, the study checked the current conditions, needs, resources and priorities of the schools in relation to ICT in STEM teaching and learning.

4.2.1 School support towards ICT Integration

First was to check whether there was sufficient support within the schools towards implementation ADSI and ICT integration. Here, the following aspects were explored; Support for curriculum (rules, regulations), support for pedagogy (tools and approaches to teaching and learning), organization and management, professional learning support.

Support for ICT Integration in the curriculum

Under this theme, the study checked the curriculum in use and whether there had been any changes, whether the computers in use were loaded with content for STEM subject use, whether there were platforms to access resources, if there were set rules in using ICT in the classroom and percentage of time dedicated for ICT integration in teaching and learning and whether national examinations had an impact on ICT use in classroom practice. All the schools reported that they were working strictly with the approved KICD curriculum in all the subjects as well as guidelines from the Kenya National Examinations Council curriculum which influenced what was taught for the Computer studies subject.

“The school uses the KICD curriculum that has not changed over the past year. The computers for all subjects are loaded with content. The ICT policy guides ICT use in the school. 70% of teaching happens on the ICT platform. Use of ICT in teaching and learning prepares the students better for national exams” Principal

“We have the KNEC ICT curriculum. No curriculum changes in the last one year. Not all computers are loaded with content for ICT use in STEM subject teaching. 5 laptops are loaded with the content, and probably personal laptops owned by the teachers. We also have the digital curriculum in form of CDs especially for the STEM subjects. We don't have a common portal for teachers and students to access.” Principal

Support for ICT use in pedagogy

Under this theme, the study first explored the rules and beliefs about teaching and learning in the school, about developing student knowledge and performance. Across the board, it emerged that there is generally a very strong belief and recognition that ICT has great potential to improve teaching and learning but also in enhancing performance.

“Our belief as a school is that ICT can improve teaching and learning. Teaching using ICT is interesting and that has been mostly proven to be right. Yes, our teachers are comfortable using ICT. Yes, they use it in STEM, Geography, English(But with English, it's not really the grammar part, but the literature books-plays and novels etc.). Activities for which the students and teachers use ICT include researching on the part of the teachers, lesson-preparation and many more” Principal

“The belief we have is that ICT makes learning easy and collaborative from the teachers and all students in a class setup. Our teachers are comfortable using computers that's why they are complaining the laptops are not enough. And before we had the secretary type and print exams but nowadays teachers do it on their own. ICT is mainly used in Biology, Geography, Business, Chemistry and languages mostly when they want to explain a concept not easily understood by the students making the learn” BoM/PTA

Principals also reported that most of the teachers especially those in the ADSI programme were more comfortable in using ICT for teaching and interacting with students. This is reported to have made learning more interesting, efficient and teaching easier. As expected, most of the teachers who were integrating ICT were from the STEM subjects but of course the practice was reportedly gaining traction in all the other subjects. There was also greater use of ICT by teachers in managing their work, examinations and communicating with parents and students during the school holiday.

“Teachers use the ICT devices differently depending on the lesson content. ICT is used in all subjects however, some teachers prefer to have some lessons delivered regularly” Principal

“The belief we have is that ICT is really making learning interesting and the outcome is learners get to understand faster. Some are scared but very few in number. Good enough I have a young generation who embrace it well It's more of teachers as we don't have a lab for students to be able to access the computers. They use it in almost all the subjects. Some for power point presentations, showing pictorials of phenomena like in Geography” Principal

“Yes, very comfortable in teaching and learning, preparation of exams, exchange of ideas and also on general communication” Principal

“ICT use in the school supports efficacy in learning and teaching. Teachers are all comfortable in using ICT apart from a few who use regular methods in teaching. Both teachers and students use ICT in learning: research, study and illustrations during lessons” Principal

Support for ICT use in Organization and Management support

In this theme, the following aspects were explored by this study; what were the procedures for administration of ICT facilities, acquisitions and budget; specific roles and responsibilities for various

people in ICT integration and what support teachers have in troubleshooting and solving technical problems.

In terms of the procedures for requisition, administration and resourcing for ICT facilities, it emerged that most of the schools had developed internal guidelines and procedures for procuring ICT equipment. Most of the procedures required individual teachers, Heads of Departments (HoDs) and in some schools the ADSI School Based Coordinators (SBCs) to make requisition of any equipment or expenditure. These requests were then discussed in management meetings and approvals made before the purchase of the same. For smaller items such as internet bundles, the teachers were expected to submit requests to the principals for consideration.

*“In our school, teachers raise requisitions for approval at management sitting. The ICT equipment acquired is maintained by the school computer technician”
Principal*

*“Departmental requisitions, budget generation, approval and implementation of plans is usually the procedures of acquisition of ICT equipment. All school actors have a role to play in ensuring that integration of ICT in teaching and learning is successful. In solving technical ICT issues, there is an external consultant who helps in solving problems and troubleshooting”
Principal*

There

is a strong recognition among school leaders that every member of the school community has a role to play. The principals said they had a role in ensuring a good environment for ICT integration, enforcing policies and supporting teachers. For the BoM/PTA their role was said to be that of supporting the acquisition of resources while for the teachers (especially ICT teachers) it was implementing programs and taking care of the equipment and monitoring student use of ICT. The ADSI SBCs emerged strongly as the driving force in ICT integration across most of the schools.

*“Acquisition of ICT equipment starts at the departmental levels. We assess requirements and give proposals to my office, which synthesizes and integrates all of them and allocates resources as per the fees for that and thereafter the board discusses and once it discusses it and approves it, it becomes a working statement to be implemented the following year. ICT coordinator helps to create discussions on ICT policy, needs, coordinates ICT lessons, manages ICT resources and coordinates with external organizations that do the servicing”
Principal*

*“The BoM provides the needed goodwill and finances to implement the ICT projects in the school. The school allocates budgets, then tendering is done. The departments give out their purchase requests and the school does the budgeting”
BoM Chairperson*

“The ADSI SBC meets with the teachers regularly to discuss their use of ICTs in teaching but they do not have a scheduled day/time; they do it as per their availability” Principal

“We have a booklet where the SBC is in charge, a ledger for the laptops and a movement book on all ICT resources to show who takes it at what time and when it is returned. The ICT coordinator updates the teachers verbally what the requirements of ADSI are, reminds them on the chats, assists the teachers who have a problem in ICT and also reminds them the School organizations goals on ICT. The teachers ensure they are up-to-date on achieving their deadlines and also by attending the trainings” Principal

4.2.2 Levels of school ICT resources in ADSI schools

As expected, ADSI had provided equipment (3 laptops, 2 projectors and 2 internet routers) to each of the participating schools as a basic ICT configuration/package. The study however, checked the current level of equipment across the schools. The findings revealed generally big positive changes in school ICT infrastructure and the increase of resources even though the levels remained disparate across individual schools.

However, this study found that most of the schools covered in this study had implemented some positive changes in the school ICT infrastructure. The changes in infrastructure ranged from building/improving computer laboratories, purchasing more laptops/ computers and projectors, installing white boards, installing sockets in the classrooms, purchasing internet equipment, developed school websites/portal, bulk SMS platforms etc.

“I have made all classrooms to have sockets around the blackboards so that it’s not only easy to plug in equipment but also so that it becomes very difficult for the students to tamper with them as they can be seen. The Communications authority donated a dish for internet which we have been using even though connections are still poor. This year we signed up with telecom but still having challenges” Principal

“We have created 2 extra rooms for ICT use, apart from the computer lab. We use them as teaching rooms, so 3 lessons can go on conveniently. We bought an additional laptop and installed a high-speed printer to help in the development of educational materials” Principals

“In school been set for Currently, There has lack of a lab. There computers

“We are a STEM model school. We have had our teachers trained by the Ministry of Education on STEM. We also intend to have a Science competition organized by the school to invite other schools from the neighboring to come and present their scientific and engineering innovations. This will call for more funding” Principal

Others had reportedly increased their human resources, yet others had increased budgetary allocation to the ICT integration components in their schools. Several initiatives were also reported where schools

"We have partnered with Friends of Conservation, a local organization that is working towards empowerment of the Maasai girl child; the organization has provided several laptops and a printer, they also impact other skills on the girls students like drawing and beading, 3. We will need finances from parents, political goodwill from local leaders "Being a native I have enjoyed support from the local leadership and community" Principal

"We have done a lot; reaching out to NGO's, donors and old boys, also writing and approaching the ministry for ICT teachers absorption. We have a computer lab with about 16 computers. We have computers in the secretary office, Digital camera, photocopiers, projectors, laptops, school intra phone connection school based, WIFI connections. We have a portal where we post and access on matters arising events, announcements, exams timetables and updates" BoM/PA Chairperson

were receiving additional support from government as well as development partners. Others had also reportedly diversified their sources of funding for ICT infrastructure with a few already having received donations from the school community and leadership.

4.2.3 ICT procurement and inventory

The study also explored the practice around ICT equipment maintenance, troubleshooting and solving technical problem across the schools.

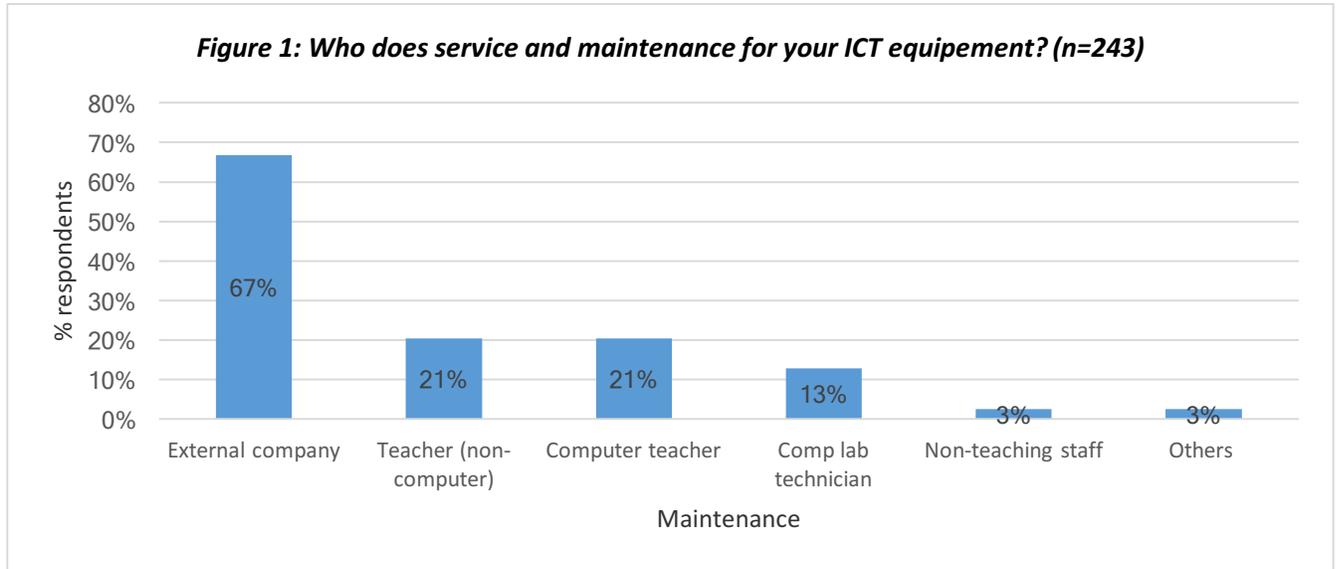
First, the study checked how schools go about purchasing ICT equipment. For the schools with computer studies as a subject, the school leaders mostly relied on respective ICT teachers to advise on equipment needs and specifications. However, for majority of the schools, the ADSI SBC reportedly plays a central role in assessing equipment needs and helping in deciding what equipment was need and what exactly to purchase. Another unexpected finding was that among most of the schools, the SBCs role had gone beyond juts helping steer the project to becoming kind of the representative and spokespersons for others teachers whenever they need school leadership to do some things.

"I can say that this ICT integration in the school is improving the school management. Like in our school, it is the SBC who advices the principal on how to install the CCTVs so that it improves security in the school compound. Like, he advised on the concept of biometric logging-in and out. So I can say that this ICT integration has contributed to those kinds of benefits" Teacher, Narok

"In our school, we are lucky that our SBC is very knowledgeable in ICT technical issues. So we usually refer any problems to him and he has been able to help us with technical problems and even when are unable to log into the online platforms" Teacher, Nyamira

Second, the teachers were asked who carries out

maintenance, service and repair of their equipment from time to time. As can be seen in figure 1 below, the majority of the schools have engaged external companies or consultants in managing their computers and a big number uses the teachers with IT knowledge to carry out routine maintenance



services.

“The ICT coordinator coordinates all ICT related activities in the school. He monitors activities in the lab and is a link between teachers and the school administration. He is also responsible for any repairs to be done on ICT equipment in the school. Heads of Departments are the ones to inculcate in their department's membership, the need to make ICT a reality in their departments through promoting such activities as typing notes, making schemes of work etc. There is maintenance support available from outside” Principals

“The administration usually receives requests from teachers for inclusion in the budget. Through the school vision and goals, everybody supports use of ICT in teaching and learning. A consultant contracted by the school usually maintains the ICT equipment” Principals

4.2.4 School ICT integration environment and culture

Another aspect that was explored among the teachers in the qualitative interviews, was the changes in school environment and culture in regards to ICT integration. Findings revealed that the project has occasioned many varied changes from school to school. For most schools, ICT integration into teaching had been made mandatory for all teachers with most cases where the Principals and Heads of Departments enforcing those through either teacher records or classroom observations.

"We have a timetable where each teacher has been assigned a lesson once in a week for ICT and we have the students being exposed to the computation and sometimes our SBC also calls us and informs us about the ADSI. Even the other teachers who are not part of the ADSI have had the chance to impact students"
Teacher, Narok

"In my school we have made it mandatory for each class to go to the computer lab every week to learn basic skills even though we do not have computer as a subject. We have a timetable which is being followed and the STEM teachers are the ones driving it"
Teacher, Nyamira

4.2.5 ICT buy-in usage and results

To understand the levels of ICT buy-in, usage and results, the following aspects were explored in detail; buy-in on the objectives of ICT integration, ICT usage outputs, results and critical success factors and the challenges encountered.

ICT buy-in

To check the levels of ICT buy-in among the schools, the following aspects were explored; what is the general perception among students and staff about ICT, how have the teachers and students responded so far to ICT and how have the parents reacted.

The school leaders reported that there were widespread positive perceptions among teachers and students about ICT integration. They described teachers as motivated to use ICT for teaching and said students have expressed excitement and enthusiasm and a liking for the lessons that are delivered using ICT.

"The students themselves are asking for computer lessons. The teachers feel I should buy more laptops and desktops. On parents they are not that informed but still they find it necessary to use ICT"
Principal

"All school stakeholders have a buy-in and supports the program. There are positive and encouraging responses from teachers and students regarding use of ICT in the school"
BoM Chairperson

"Teachers are very positive about it. They are enjoying teaching using ICT as it becomes enjoyable. The response is good. It has created some enthusiasm especially in some subjects which are using ICT. We've not known much from the parents"
BoM Chairperson

"The perception has been positive because ICT is applicable in their homes, place of work and their lives. It's inevitable. They all have responded very well. In terms of making teaching interesting. They also have a positive attitude because within the classroom and without, currently the examination department is using ICT infrastructure to release exam results, where individual and class performances are projected. Parents have taken this positively. Going forward, we are going to use ICT even more"
Principal

ICT usage

In regards to ICT usage (outputs), the school leaders reported having seen great progress in the computer use in the classroom. Asked what they have been observing or would expect to see (among teachers and students) in classrooms where the teacher was appropriately using technology in teaching. Most said they have seen and would expect to see more participatory learning with students getting involved in the learning process, paying attention, researching and enthusiastic.

“We see a more energized teaching and learning, students are more attentive and interested to learn” Principal

“I would expect to see an active class, with students actively involved. I would also expect to see the teachers' work being made easier. The students use ICT in research. They undertake any assignments given to them by teachers” Principal

“I would expect to see a lot of interactions and students being involved in the teachings. The teachers are doing well despite the limitations. We did well as our students were number two in the recent ADSI competition in Voi, which means they really love the ICT

“I would expect to see a work sheet, simulations, seeing students contributing by discovering something new which they will ask. The teachers are above average on the integration of ICT in STEM. It has brought an impact and a positive one for that matter because before the introduction of ADSI our students have changed much” Principal

4.3 Status of Teacher Professional Development

The Midline study also sought to collect information, feedback and data from the ADSI teachers on the following issues;

1. Teachers' experience with ADSI project
2. Teachers' ICT access, use and training
3. Teachers' general ICT Knowledge, attitudes and practices
4. ADSI effects on specific ICT competencies and use in classroom practices
5. Teachers' perceptions on ADSI effect on 21st Century skills for students
6. General feedback on ADSI programme.

4.3.1 Teachers' experience with ADSI project

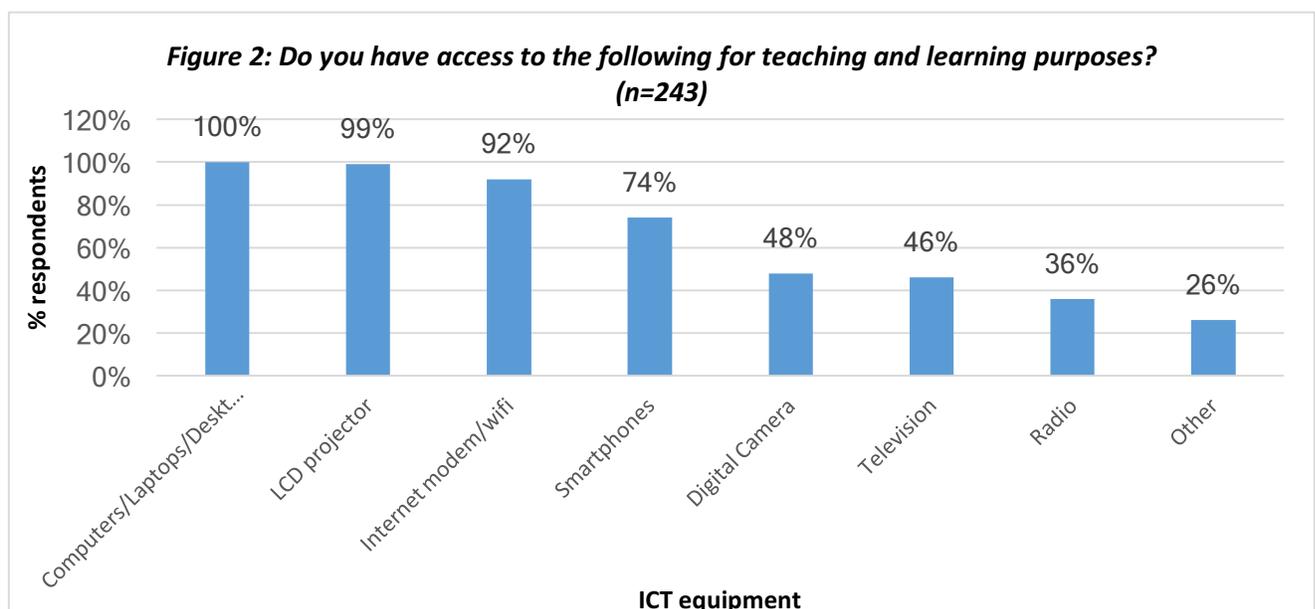
First, the study collected feedback from the teachers on what their experiences had been. The majority of the teachers reported that they had had positive experiences and gave positive views of the project with many acknowledging that at the beginning most were skeptical and had negative attitudes but were able to buy in and understand the importance and pick up the implementation. The majority had positive reviews of their experience saying the project had greatly improved their skills both in ICT as well as modern teaching.

"It has been a wonderful experience. Of course if I compare when I was not training in GESCI and after the training I feel that my teaching and learning has improved a lot since I can be able to access information easily and even assist the students to do research and that has made the learning very interesting" Teacher, Taita Taveta

"Mine has been a learning experience I have learnt teaching methods through use of things like simulations, the concept mapping so I think I have learnt a lot. And from the student side the reception has been good. I don't have a challenge with the students because most of them have access to the computers and PCs" Teacher, Narok

4.3.2 Teachers' ICT access, use and training

On this aspect, the study explored the level of access teachers had on various ICT equipment and resources for teaching and learning purposes. As shown in figure 2 below, 100% had access to at least a computer/laptop/desktop, 99% had access to a projector, 92% internet, 74% Smartphone, 48% digital



camera, 46% television, 36% radio & 26% other equipment such as white boards, Digital video recorders etc.

4.3.3 Teachers' ownership of ICT equipment

The study also checked the levels of ownership of personal computers among teachers and smartphones. It emerged that;

- 70% reported in the affirmative while 30% said they didn't own a computer at home. Asked whether they had access to internet on their personal computers, 79% said yes while 21% said

no. Further, 32% said they used internet always on their personal computers, 15% 3-4 times a week, 16% 2-3 times a week, 15% at least once a week and 20% rarely or never used internet on their computers.

- 100% of teachers had a mobile phone and 99% of these were smartphones. Further, it was reported that 99% of the teachers accessed internet through their phones. In terms of frequency of access to internet on personal phones, 95% reported doing so always, 3% 3-4 times a week, and 2% once a week

4.3.4 Teachers' usage of ICT for teaching and teaching-related activities

The teachers were asked to state how often they used computers or laptops in teaching and learning. It emerged that;

- 24% said they always used a computer, 14% used it 3-4 times a week, 25% 2-3 times a week and 36% once a week.
- The study also checked the frequency with which teachers used the various computer software and ADSI Open Educational Resources (OERs). Table 2, below illustrates the percentage of teachers who said they either used these resources to either a high or great extent.

Table 2: The extent of teachers use of resources in teaching

To what extent do you...	High or great extent
a. Use a word processor	66%
b. Use presentation software	47%
c. Use web browser	68%
d. Use an email address	62%
e. Open Educational resources	56%
f. Social media (eg facebook, twitter)	85%

4.3.5 Teachers' participation in ICT integration trainings

The study also checked whether the teachers had participated in any other ICT integration in education related training apart from the training offered by ADSI. 53% of the teachers reported that they had participated in at least one training on ICT integration in education while 48% hadn't. Among those who had participated in the training, 85% had gone through formal training while 15% went through informal training.

4.3.6 Teachers' general ICT Knowledge, attitudes and practices

To assess teachers' attitudes towards the use of ICT in teaching and learning, several statements were posed to the teachers who were asked to state the extent to which they either agreed or disagreed with each of the statements. While some of the statements were denoting positive attitudes (green) around the use of ICT, therefore most of the respondents were expected to agree with, some of the statements were denoting negative attitudes (red) towards ICT therefore most respondents were expected to disagree (very few agreeing). Table 3 below, illustrates the number of those who either agreed or agreed strongly.

Table 3: Teachers attitudes towards ICT use in teaching

Attitudinal statements		Agree or agree strongly
a	Students' use of ICTs can support student-centred learning	88%
b	ICTs provide valuable resources and tools to support student learning	87%
c	ICTs can be mainly used for efficient presentations	75%
d	ICTs has limited capacity to provide benefits in the classroom	29%
e	Enables students to access better sources of information	82%
f	Helps students to consolidate and process information more effectively	81%
g	Results in poorer note taking among students	34%
h	Helps students to learn to collaborate with other students	83%
i	Helps students to develop a greater interest in learning	86%
j	Impedes concept understanding better done with real objects	42%
k	Limits the amount of personal communication among students	24%
l	Helps students work at a level appropriate to their learning needs	69%
m	Results in poorer calculation and estimation skills among students	22%
n	Only encourages students to copy material from internet sources	28%
o	Helps students in planning and self-regulation of their work	68%
p	Only distracts students from learning	16%
q	Enables students to communicate more effectively with others	77%
r	Helps students develop skills in planning and self-regulation of their work	84%
s	Improves academic performance of students	79%

4.3.7 Teachers' use of ICT in the curriculum and pedagogy

In checking practice, first the teachers were asked about three themes; how often they employed ICT in the classroom or in teaching and the following were the findings;

- 51% said they often or always used ICTs with students in the context of teaching subjects.
- About 46% often or always used educational software related to their subject matter with their students.
- Only 24% said they often or always used digital artifacts from student assignments as evidence of student achievements.
- 47% often or always used ICT applications to monitor, evaluate and report on student achievement.

Then the study also checked the extent to which teachers incorporate ICT in pedagogy. The following were the findings;

- 88% reported used presentation software in lessons often or always
- 91% reported often or always used digital resources in their lessons
- 65% reported often or always designing lesson plans incorporating digital resources
- 75% reported often or always sharing their experience of using ICT use with other teachers during normal meetings
- 51% reported often or always sharing their experience with their principals

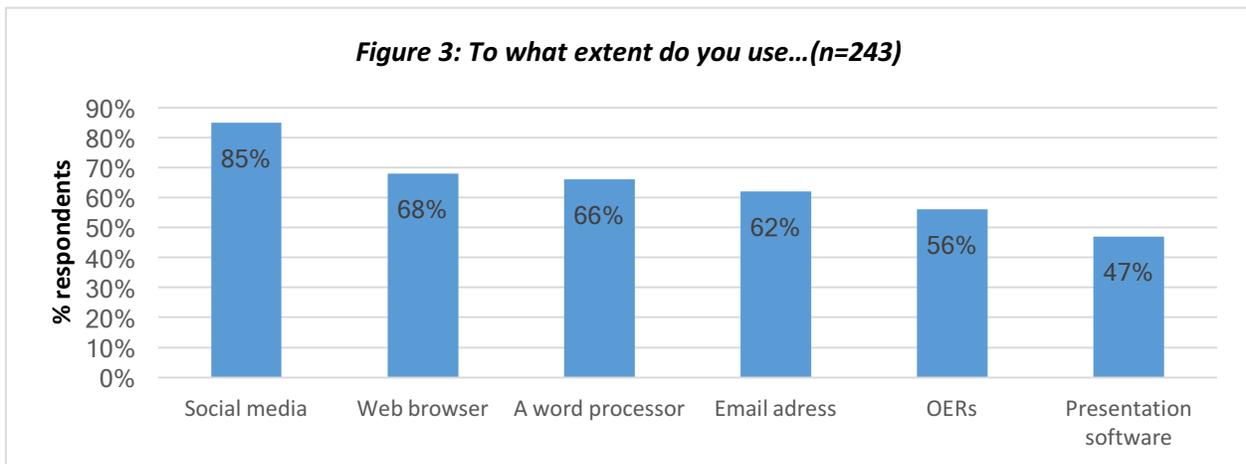
The study also checked the extent to which teachers incorporated ICT in classroom organization and management. The following were the findings;

- 73% reported often or always using computer lab for teaching activities

- 83% reported often or always using ICTs in the classroom
- 62% reported often or always using ICTs with students for presentations, without altering the classroom setting.
- 28% reported often or always using ICTs in the classroom for individual study.
- 64% reported often or always ICTs in the classroom for small group activities.

In regards to incorporation of ICT in school management and the improvement of ICT integration in the school, the following were the findings;

- 93% reported often or always using digital resources to enhance school productivity.
- 98% reported often or always using digital resources to understand subject matter.
- 91% reported often or always sharing ideas and good practice with other teachers
- 53% reported often or always sharing ideas and good practice with other teachers



4.3.8 Teacher ICT competencies

One of the main aims of the study was to check whether and how ADSI may have affected the competencies of teacher on specific ICT use aspects. Several tasks were read to respondents and then asked to state whether they think they cannot do it, somewhat can do it and if they were sure they knew how to carry out these tasks. As can be seen in the table 4 below, most teachers reported that they could carry out most of the tasks. The only skill that had the lowest number of teachers who thought they could perform was installing software (60%).

Table 4: Teachers ICT competencies

How well can you do these tasks on the computer?		I know how to do this
a.	Producing a letter using a word processing programme	95%
b.	Emailing a file as an attachment	90%
c.	Storing your digital photos on a computer	95%
d.	Filing digital documents in folders	97%
e.	Monitoring students' progress	80%
f.	Using a spreadsheet	79%
g.	Contributing to a discussion forum on the internet	92%
h.	Producing presentations	97%
i.	Using the internet/ mobile phone for online purchases and payments	90%

j.	Preparing lessons that involve the use of ICT by students	95%
k.	Finding useful teaching resources on the internet	97%
l.	Assessing student learning	82%
m.	Collaborating with others using shared resources such as google docs	82%
n.	Installing software	60%

Then the teachers were asked to state the frequency with which they used ICT in some practices where teaching their subjects. The options were never, sometimes and very often/frequent. As can be seen in table 5 below; some of the practices where teachers reported using ICT most were; Reinforcing learning of skills through repetition of examples (59%), supporting collaboration among students (59%), assessing students' learning through tests (53%), providing feedback to students (55%) and using problem-based approach in your classroom teaching (50%).

Table 5: Teachers frequency of ICT use in teaching

How often do you use ICT in the following practices when teaching your subject?		Very often/frequent
a.	Presenting information through direct class instruction	49%
b.	Providing remedial or enrichment support to individual students or small groups of students	31%
c.	Enabling student-led whole-class discussions and presentations	39%
d.	Assessing students' learning through tests	53%
e.	Providing feedback to students	55%
f.	Reinforcing learning of skills through repetition of examples	59%
g.	Supporting collaboration among students	59%
h.	Enabling students to collaborate with other students (within or outside school)	46%
i.	Collaborating with parents or guardians in supporting students' learning	31%
j.	Supporting inquiry learning	46%
k.	Use problem-based approach in your classroom teaching	50%
l.	Use project-based/webquests approach in your classroom teaching?	31%
m.	Use concept mapping software	44%

The study also checked the level of confidence among the teachers in carrying out some tasks. It emerged that teachers were most confident in the following; Using digital resources, using presentation software, helping students to use ICT resources for their learning, guiding the students to think critically when using ICT, Sharing my experience of ICT use with other teachers? Incorporating digital resources in the design of my lesson plans and Leading a discussion on the importance of ICT amongst my peers.

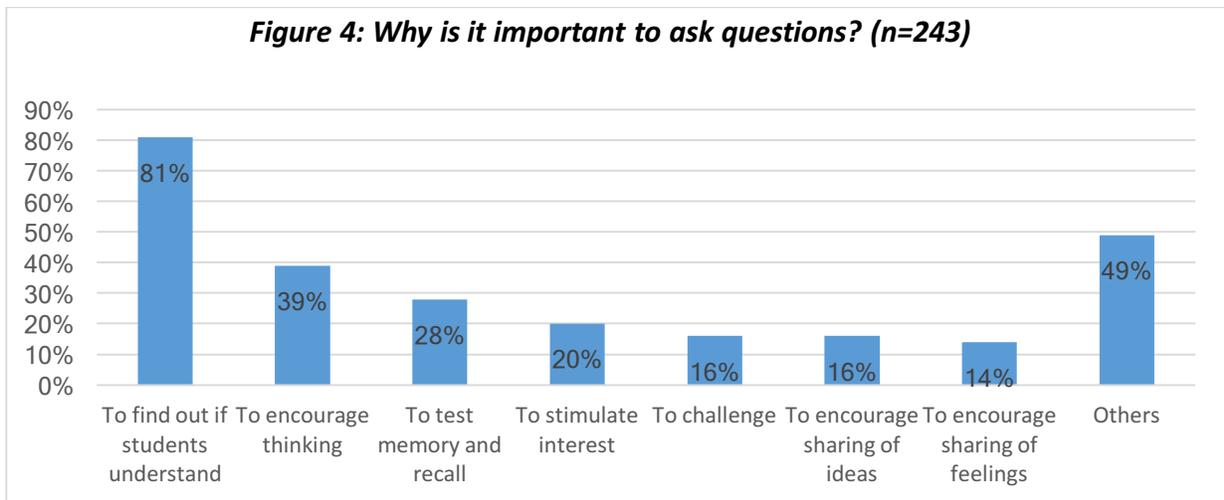
Table 6: Teachers' self-confidence rating

I feel confident in.....		
a.	Using presentation software in my lessons?	97%
b.	Using digital resources in my lessons?	99%
c.	Incorporating digital resources in the design of my lesson plans	93%
d.	Sharing my experience of ICT use with other teachers?	94%
e.	Helping students to use ICT resources for their learning	97%
f.	In guiding the students to think critically when using ICT	95%

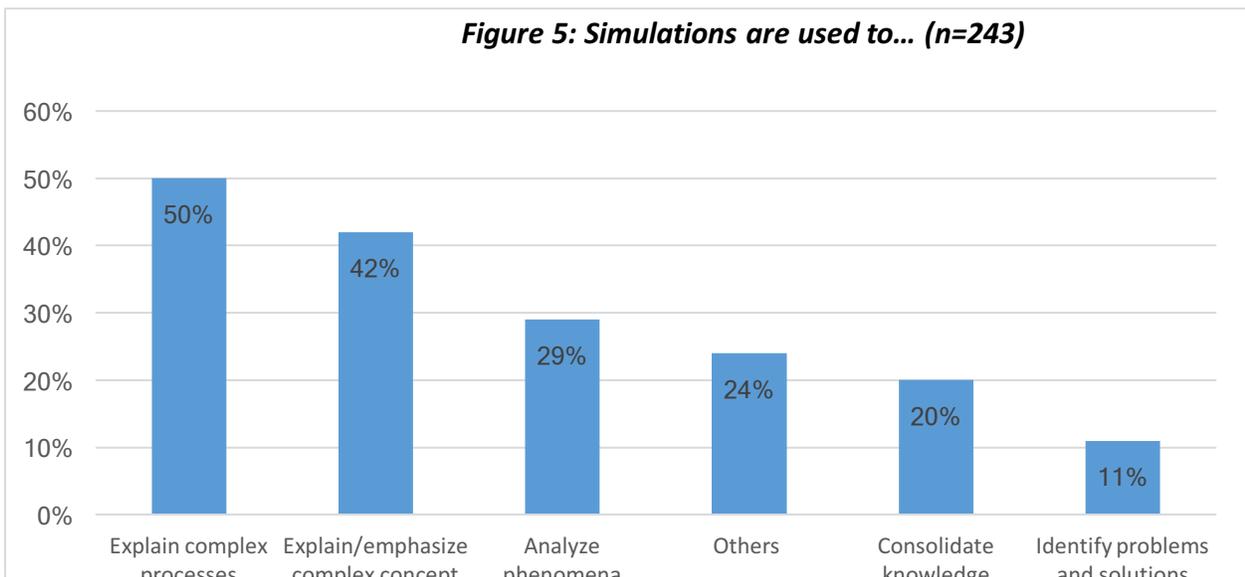
g.	in guiding the students in the development of artefacts	77%
h.	In guiding group learning	95%
i.	In using problem-based learning approaches	90%
j.	In using project based learning approaches	88%
k.	Leading a discussion on the importance of ICT amongst my peers	92%
l.	Leading discussions/meetings on importance of ICT in my school	87%
m.	Using Concept Mapping software to promote problem-based learning.	90%
n.	Using Simulations to simplify complex concepts into classroom teaching	87%

4.3.9 Teacher classroom practices

One of the main objectives of ADSI is to transform teacher classroom practice. The ADSI modules have covered different aspects of modern classroom practice. Teacher recall was tested on the following; why is it important to ask questions in a class, the importance of using simulations in teaching and project-based learning. Figure 4 below, illustrates some of the main responses that were given. Under the 'other' category, people mentioned reasons such as to sustain attention, give students opportunity to express themselves or build their communication skills, encourage student participation, assess and evaluate learning, evaluate self as a teacher.



Another topic where teachers' knowledge was tested was with regards to use for simulations in



teaching. As illustrated in the figure below, most teachers knew the factual reasons why simulations are used namely; explaining complex concepts and processes.

Another knowledge area that was explored was the one to do with the skills in project-based learning. Teachers were asked to define project based learning and most were able to describe it accurately. Most of the respondents said it was a teaching approach where teachers pose a problem to the students who are then expected to research, find and present answers with the teacher just playing a facilitation role. Some of the descriptions provided are listed below.

"It enables learners to do research on their own and come up with a solution. Case where you identify a problem and come up with ways of solving it using ICT" Teacher

"You pose a question for students to research on. It may not take time; you pick an area within a topic, formulate it in form of a question and let students go and answer. They normally answer in groups. There is a lot of collaboration/teamwork and they present using a gallery walk-manila paper for example" Teacher

"You give students a task, which they solve by themselves. They get content from the internet etc. I develop a concept as a teacher and get them to provide a solution to it and they own the problem, as they are part of it" Teacher

"It is where the students are given a problem to research on and analyze their findings and present their results. The assignment is guided by the teacher" Teacher

The teachers were then asked to state where they see the problem-based approaches fitting in their subject areas and several answers were provided with the main ones being that, PBL is good to use when handling abstract topics, in handling topics with very few local examples, handling STEM practical lessons and when you want students to be actively engaged in learning.

"PBL fits into topics that deal with information from outer space-- Those for which you cannot get local examples, e.g. topics like the earth and the solar system, glaciation, since where we are, we don't have glaciers. We can only make the learner understand through examples from the internet" Teacher

"I like using it when we are doing practical work in Chemistry, and sometimes in maths, when students study ahead at home and we follow up what they have done. That is, the holiday assignments" Teacher

"PBL fits very well in maths and biology. I develop a problem then pose it to them and let them work on it first before I see how to approach it" Teacher

"In both Physics and Maths. In Physics, we have so many practical that come with theories which question the working of the same on problems e.g. the Archimedes Principle. In Mathematics, it would fit in such areas as Calculus, Linear Motion and Matrices" Teacher

Further, the teachers were asked to list some of the characteristics of Project-based learning and most of the teachers would recall at least two characteristics.

Table 7: Characteristics of PBL

What would you say are some of the key characteristics of Problem-Based Learning		
a.	Learning is driven by challenging, open-ended problems with no one “right” answer	27%
b.	Problems/cases are context specific	39%
c.	Students work as self-directed, active investigators and problem-solvers in small collaborative groups (typically of about five students)	48%
d.	A key problem is identified and a solution is agreed upon and implemented	36%
e.	Teachers adopt the role as facilitators of learning, guiding the learning process and promoting an environment of inquiry	41%
f.	Others	28%

The teachers then listed the benefits and the effects that the Project-based learning approach had had on the way students learn and their knowledge. Some of the main benefits mentioned were that it helps in enhancing curiosity, supporting creativity and critical thinking, building research skills, enhancing confidence and self-esteem. The approach was also said to be very effective in enhancing student participation in learning as well as collaboration.

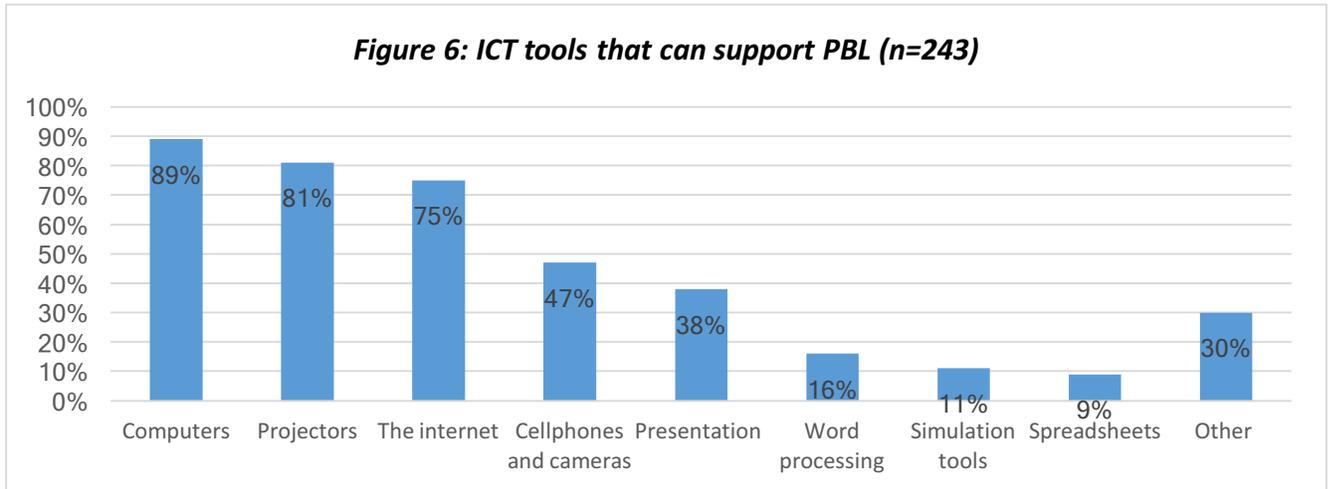
“It has improved the confidence of learners in tackling subjects through research. It has also made it easy for teacher to handle difficult topics. It also widens the scope of research from text books. Overall this has led to a positive attitude towards science subjects” Teacher

“It has made students realize that they can solve problems collaboratively and use different methods in solving the problems and find communication from the teacher, in hard areas and this has made learning interesting and easy, and has encouraged a learner-centered approach. It has reinforced what the teacher has taught in class” Teacher

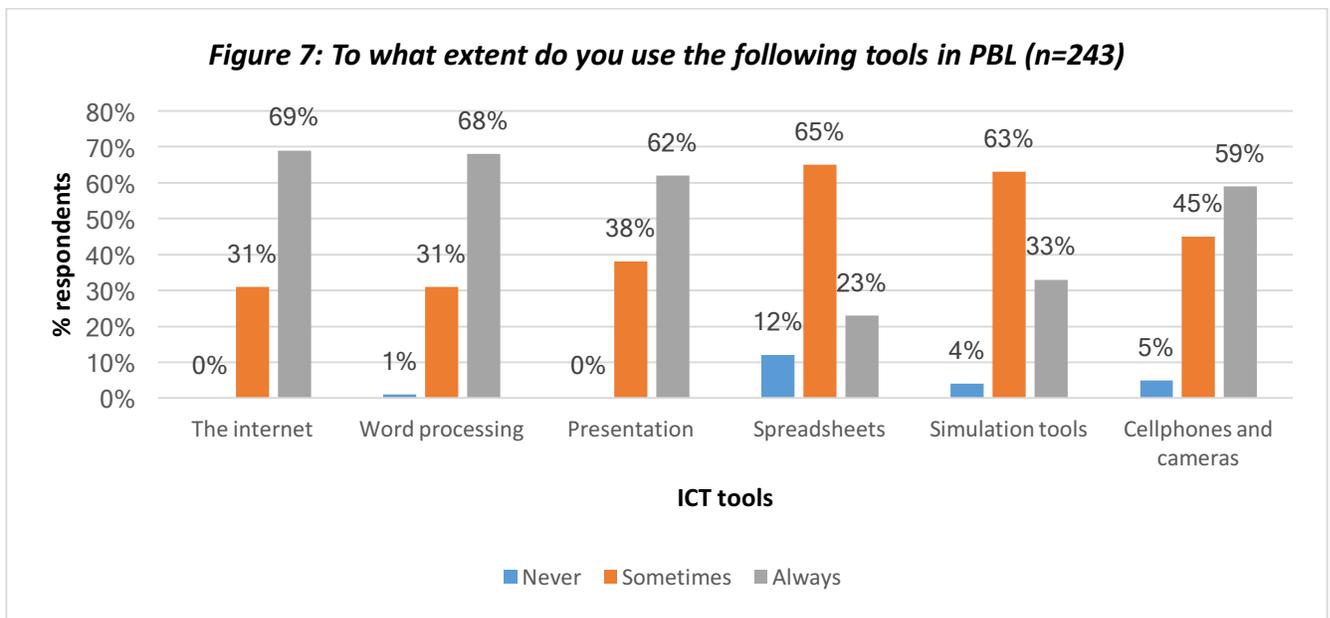
“In terms of sciences, Physics and Maths students are now becoming critical thinkers. On attitude, the students have become solution providers. They identify a problem and try to get a solution to it. For example, we had a problem with our school bell and students created an electrical one for us” Teacher

“Arouses creativity and innovation on the side of the learners. Learners discover things by themselves and come up with new ideas. It has allowed learners to acquire knowledge/skills within their own circles. They can rely on themselves nowadays” Teacher

The teachers were then asked to list some of the ICT tools that can be used to support project-based learning. Computers were mentioned by most teacher (89%), projectors (81%) and the internet (75%) as illustrated in the figure 6 bellow.



The teachers were then asked to state the extent to which they use some ICT tools in to support project-based learning. As can be seen in figure 7 below, the most used tools are internet, word processing, presentation and cellphones/cameras.



To check teachers' recall and knowledge on collaboration in project-based learning, they were asked to list some strategies that can be used.

Table 8: Strategies for collaboration in PBL

What would you say are the key Strategies for collaboration/cooperation in Groups in project based learning?		
a.	Groups are formed and are made up of diverse (mixed abilities) students.	68%
b.	Positive interdependence is structured through shared goals and rewards.	24%
c.	Management systems are introduced to increase group learning.	30%

d.	The room is arranged to make it possible to have small group activities.	33%
e.	Students are taught skills necessary for effective collaboration	33%
f.	The structure of each cooperative learning activity is chosen to match the goal of the lesson.	24%
g.	Others (specify)	32%%
h.	I don't know	6%

4.3.10 Professional learning support

To understand the level of professional learning support available across the schools, the following aspects were explored; whether teachers collaborate/support one another in implementing technology in the classroom, whether teachers and students collaborate to undertake projects together, opinions on the greatest barriers to ICT integration and what ICT TPD training support the teachers had had.

In terms of collaboration, the Principals across the board reported a strong culture of knowledge sharing and collaboration among the teachers. Some also reported that they had organized various sessions where the ADSI teachers would share what they had learnt with others and there were reportedly department meetings to share content and experiences.

"The school led by the SBC sometimes organizes learning sessions for collaboration. The only barrier cited by the teacher is that the program really takes time especially during preparation of the content/lessons" Principal

It was

"Science teachers undertake common lesson studies and also sometimes undertake mock teaching sessions. They collaborate in undertaking engineering projects mostly under the young scientists club, financial challenges, space, capacity of personnel in ICT, negative attitude by some teachers in utilization of ICT" Principal

also reported that ADSI had fostered a strong collaboration among teachers themselves but also with students working together, creating projects jointly and generally collaborating in the learning and teaching process. The main constraint reported here was the inadequate number of equipment, time and small classroom spaces. The ADSI competition was also mentioned as a major motivator for teachers and students working together to develop projects that they showcase in the competitions helping them learn and discover more things on their own and fro one another.

" Apart from sharing with teachers I also share with my students so that with the powerpoint presentation I will teach them how to do that so that next time they go to the lab they will prepare a discussion out of PowerPoint discussion" Teacher, Narok

" Chatting ,apart from chatting for project we also chat among ourselves, we are using the platforms like whatsapp to communicate to our colleagues. Use of internet even on our phones to get answers to some question the students ask in class or knowledge on what you don't know" Teacher, Nyamira

Teachers have also been sharing materials they produce with one another but also providing comments and input on what others have created. In some schools, it was reported that the ADSI teachers had independently organized learning sessions as well as lesson observation to mentor and strengthen one their skills.

*“Yes so like me I am given a non ADSI and we made sure that we go to the ICT lab, they bring their students there and I kind of observe. Silently I will be there. We have brought them on board so the skills we have obtained from the 10 teachers we have comfortably passed to another 10 teachers”
Teacher, Kiambu*

*“You know, when you make a material today you will not use it today you store it. And when your colleague is going to teach the same topic, you just give it to them to use”
Teacher, Nyamira*

When it comes to ICT TPD, it emerged that there were seemingly very few other initiatives working on ICT TPD. Apart from self-planned trainings, there were reports of teachers who had participated in a few other available programmes such as SMASSE, Teachers Service Commission (TSC) trainings.

*“Yes, the teachers collaborate in ADSI teams. They prepare lessons and teach collaboratively. Yes, teachers and students collaborate together. Barriers to ICT use in this school include; small classroom spaces, inadequate computers, unavailability of the digital curriculum which is an area not properly researched on. STEM subjects have a very good digital curriculum but beyond that, nothing”
Principal*

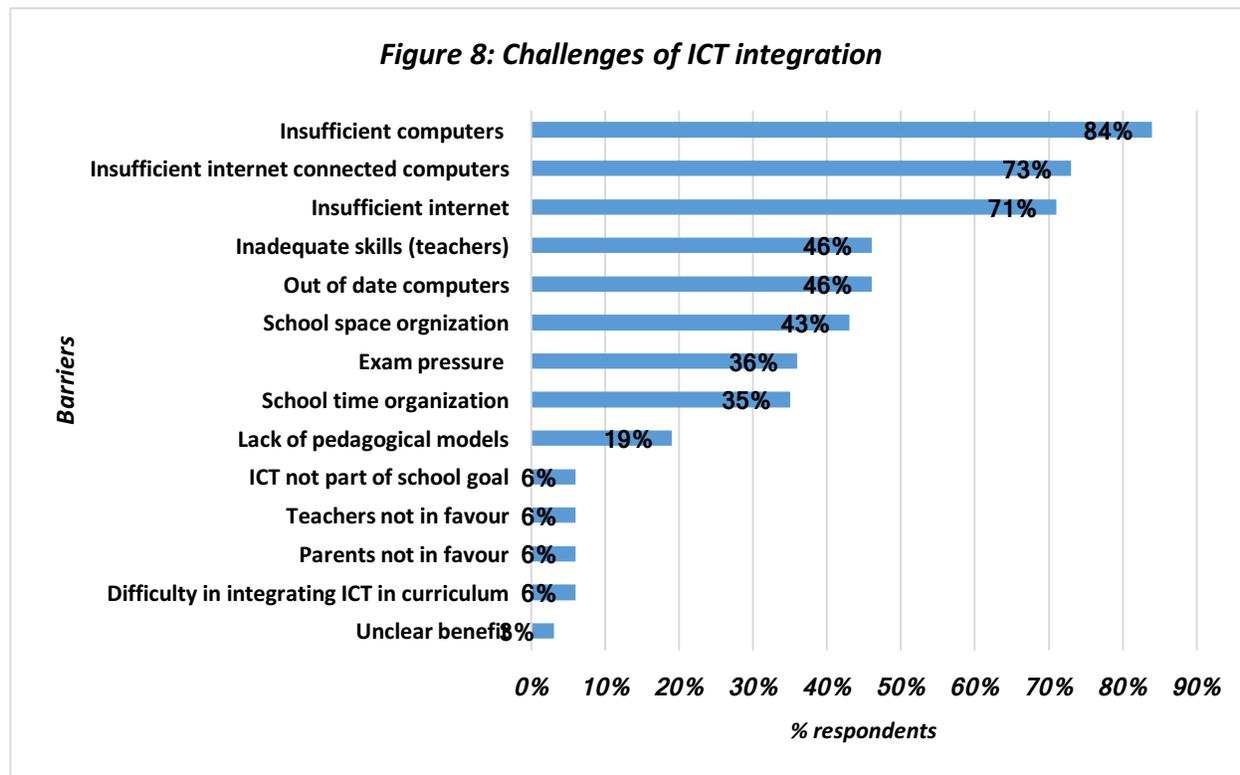
*“Yes they [teachers] work as a team when making materials. We were in SMASSE in August. SMASSE is a government program and they have trained the science teachers in ICT for teaching and learning”
Principal*

“They do this in the evening, as they work as a team in helping one another in making. Students and teachers collaborate well. Limited facilities in the school is the main issue. ICT TPD we have had basic trainings on ICT for all teachers”

4.3.11 Teachers’ views on barriers to Teacher Professional Development

The study also gathered opinions of the school leaders on what would be the biggest barriers for ICT integration in their schools. First, they were asked the extent to which the following factors were

barriers to ICT integration. Inadequate equipment emerged as the top most barrier as shown in the figure below.



Infrastructure appeared to be the biggest challenge for teachers. As such, the study also checked with teachers to see the status of ICT infrastructure in their schools. To do this several statements were read out to the teachers and they were asked to state the extent to which they agreed or disagreed with the statements. Most of the statements were those that were meant to describe an unfavourable level of infrastructure so the fact that very few agreed or disagreed meant that they were not major problems. However, as can be seen below, many teachers (65%) agreed that internet was a problem and half of the teachers said insufficient ICT equipment was a problem.

Table 9: Teachers' feedback on ICT in their schools

Across the qualitative interviews several challenges and barriers were highlighted by the teachers in regards to ICT integration in teaching and learning. One was the issue of time. Teachers mentioned the

ICT in your school		Agree and disagree
a.	ICT is not considered a priority for use in teaching	19%
b.	My school does not have sufficient ICT equipment (e.g. computers, laptops)	50%
c.	My school does not have access to digital learning resources	17%
d.	My school has limited connectivity (slow or unstable speed to the internet)	65%
e.	The computer equipment in our school is for the most part not working	13%
f.	There is not sufficient support for me to develop expertise in ICT	16%
g.	There is not sufficient technical support to maintain ICT resources	21%

big workload that they have, competing priorities and obligation from the schools and the syllabus as

well as the time-intensive nature of the process of generating content using ICT as well as planning for the lesson. Some teachers reported that teaching an ICT integrated lesson was also reported to be time consuming especially bearing in mind the movement and setting up of equipment that is involved. Others also cited the challenges of controlling how students used the internet.

"Yes, so as much as this method is good you find that you give up on it because of the time.....because students are not conscious of time they drag and get what youthen there other limitations....30 students.....but maybe with the new system...we don't know if it will find us there. Their approach is different they will be able to understand. Their approach is actually student centered" Teacher, Kiambu

"The timeframe, like when they have to develop the project like what we are doing with webquest and concept maps. Developing requires time and with the current syllabus allocation and all the content, talking about my school environment and experience timing is a limiting factor" Teacher, Narok

"Currently I have 24 and those lessons require planning. You can do the simulations and those simple ones you can use them to teach because it is just a part of lesson. But when you go to other things like webquest which require much of the time it becomes a challenge. Two, most of our schools do not provide the internet. The connectivity is an issue. And probably when it is available they fear that it will be misused or something so it is not even available. When you want to use it is limited to either specific month or time. That continuity of the same lacks" Teacher, Narok

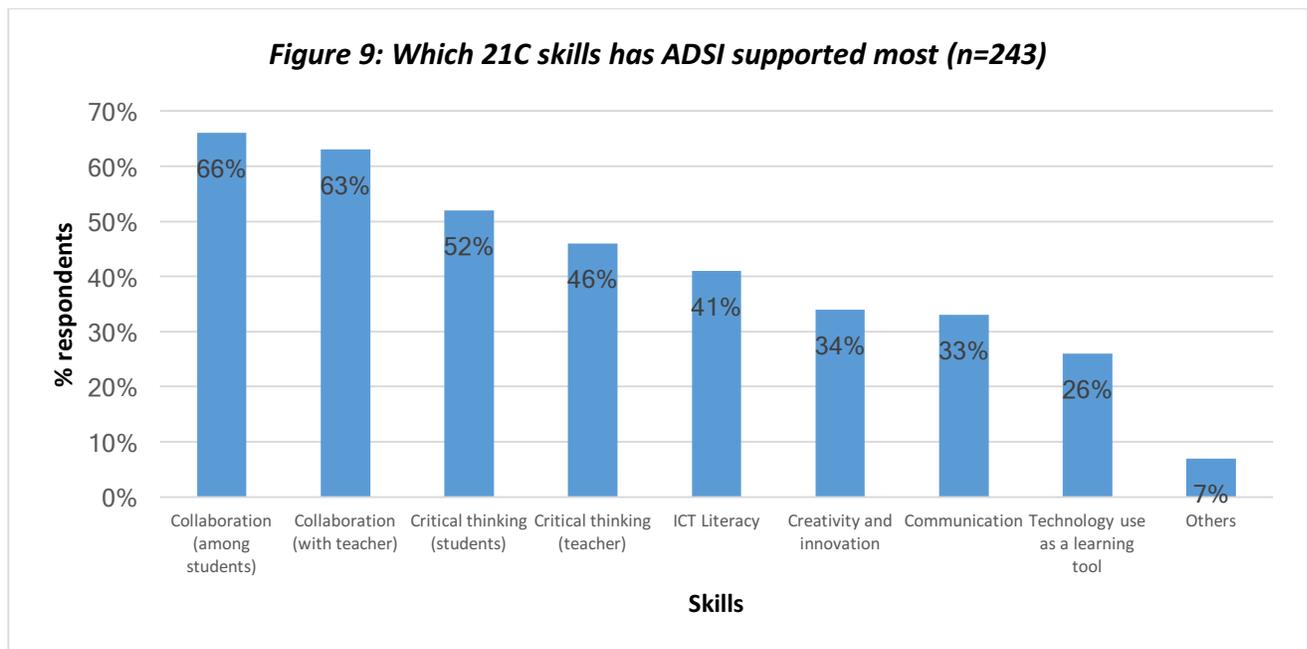
"You know if you leave the students with the computer they will visit all the sites they want so we control them. So I feel we are moving somewhere and again we are many and there is some change when you are doing your...Like I have said I have only been there for 2 months when we came one day we were taught whatever was taught last year" Teacher, Taita Taveta

A number of technical challenges were also cited mainly equipment break downs and infection with computer viruses. Others blamed poor internet connection for impeding their access to Online Educational Resources.

“We have some challenges also ...a teacher takes a laptop. Takes a document with the flash disk and puts it in his laptop it gets the virus because maybe it is not updated with antivirus, then he brings back the infected laptop which in turn infects the others. It becomes a big challenge. Like in our case we had this simulation and animation and we used the disk. All of a sudden it became black. On inquiry I realized that one of the personal computers had a virus. It damaged my phone and all my memory ...I bought mine recently....it is more of a challenge” Teacher, Narok

4.3.12 Teachers’ perceptions on whether ADSI was supporting the acquisition of 21st Century skills

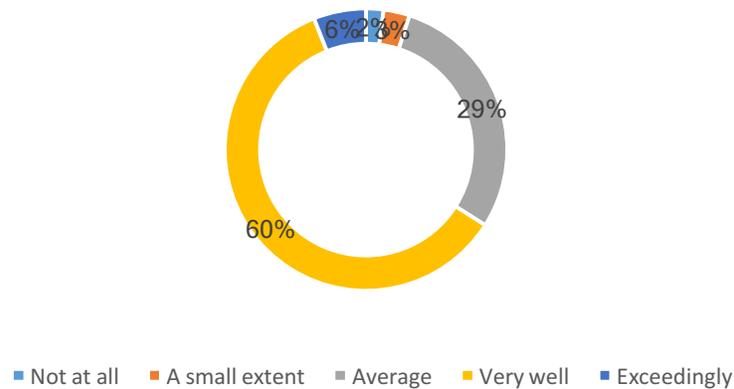
The study also asked the teachers to list the 21C skills which they thought ADSI had contributed most in nurturing. Collaboration, critical thinking and ICT literacy were the ones mentioned the most as can be seen in figure 9, below.



4.3.13 Teachers’ general feedback on the ADSI programme

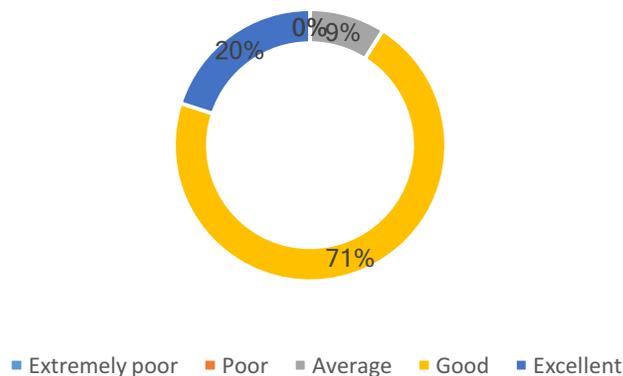
Another aim of the study was to collect teachers’ general feedback on the ADSI programme. First they were asked to state the extent to which the project had met their expectations.

Figure 10: What extent has your expectations been met?



Secondly, the teachers were asked to rate the support that they had been receiving from the Project Coordinators and 71% said it was good, 20% said it was excellent while the remaining said it was average.

Figure 11: Quality of support from ADSI Team



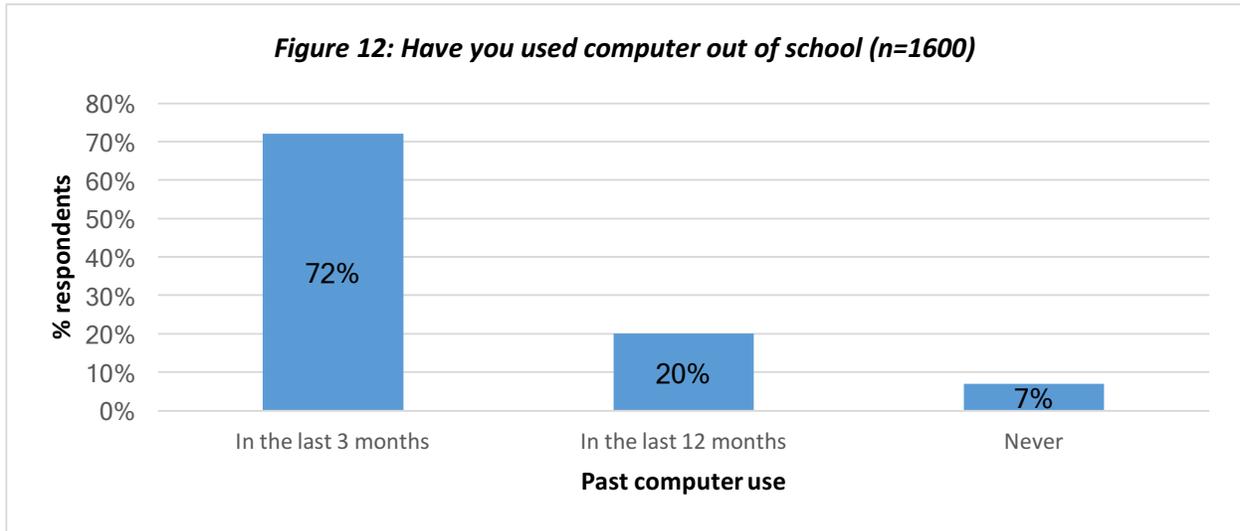
4.4 Status of student learning

This midline also sought to assess the role of ADSI in supporting the acquisition of learner 21st century skills and other learner achievements in relation to STEM subjects and gather feedback on their experiences and attitudes towards the use of ICT in STEM learning inside and outside of schools. To gather this information, both the students and teachers were interviewed.

4.4.1 Student access to ICT at home

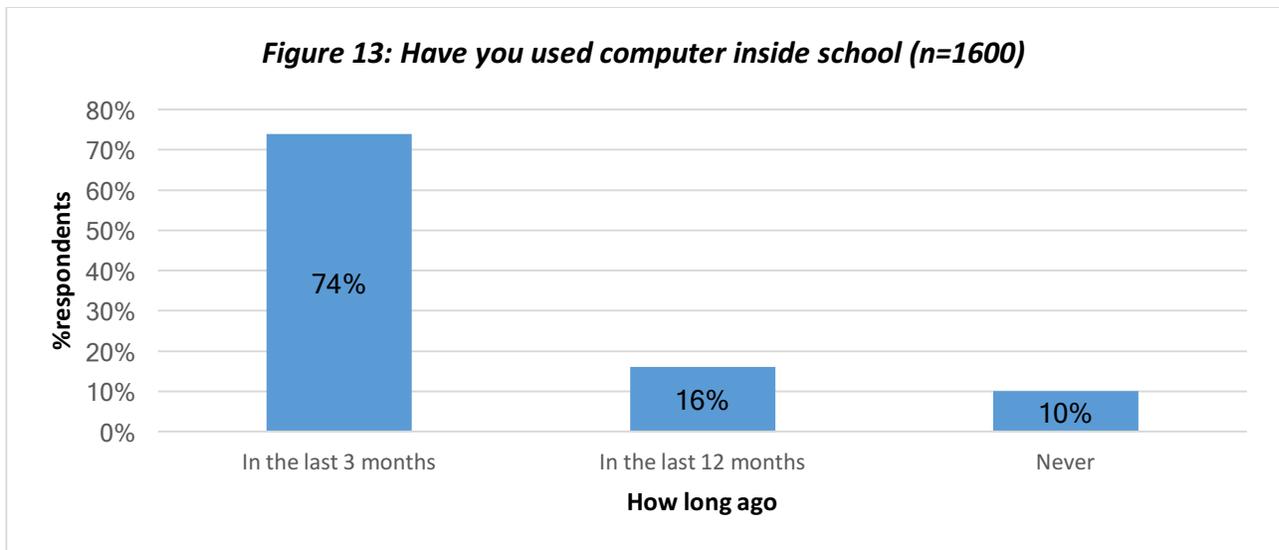
First, the study checked the level of access to ICT by students. So, they were asked whether they had used a computer or laptop/notebook/smartphone, tablets outside school (i.e. at home, at friends' or family member's home, in a public library, an Internet café, etc.). 72% said they had accessed at least

one of these ICT equipment in the last 3 months, 21% said in the last 12 months while 8% had never done so.



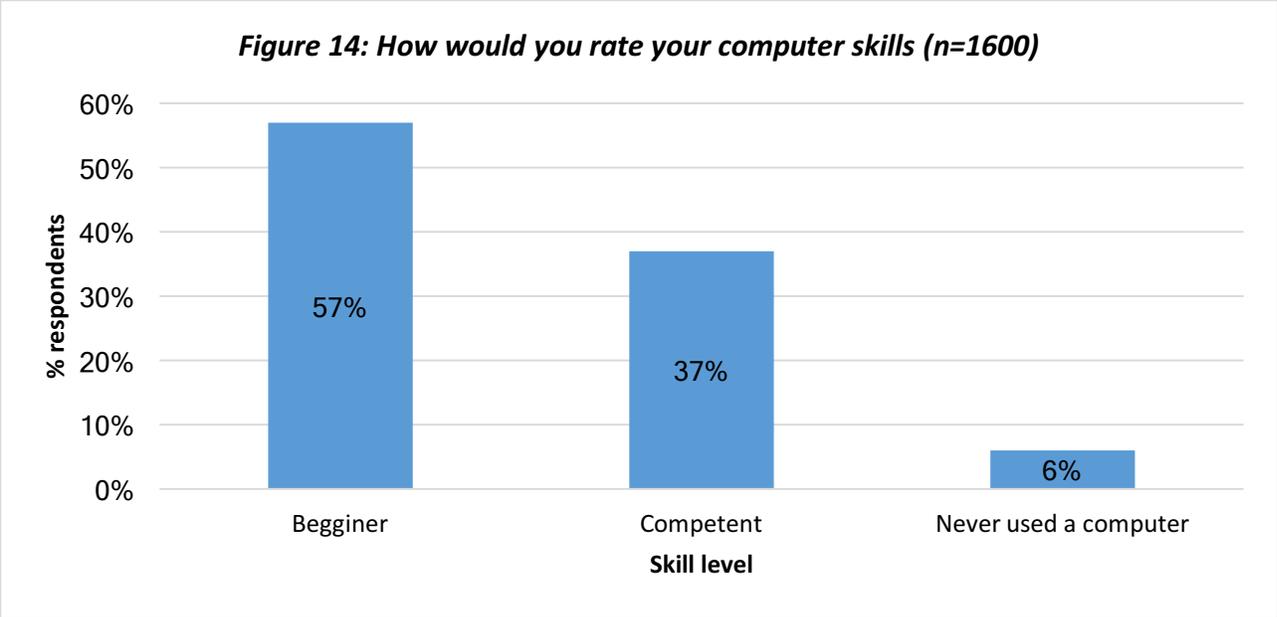
4.4.2 Student access to ICT at school

Similarly, the students were asked if they had used a computer or laptop/notebook inside school (i.e. in class, computer lab/ library etc.). 74% said they had used the above in the last 3 months, 16% in the last 12 months while 10% had never.



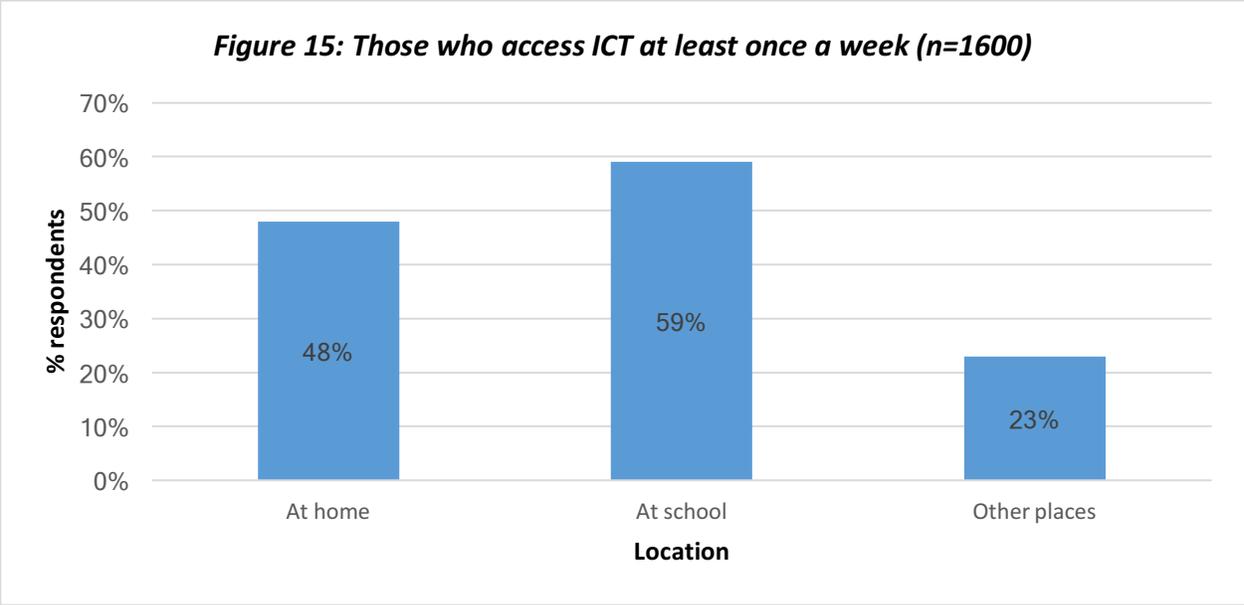
4.4.3 Student ICT skills rating

The students were then asked to rate themselves on their skills in using a computer. 37% rated themselves as competent, 57% as beginners while 6% said they had never used a computer.



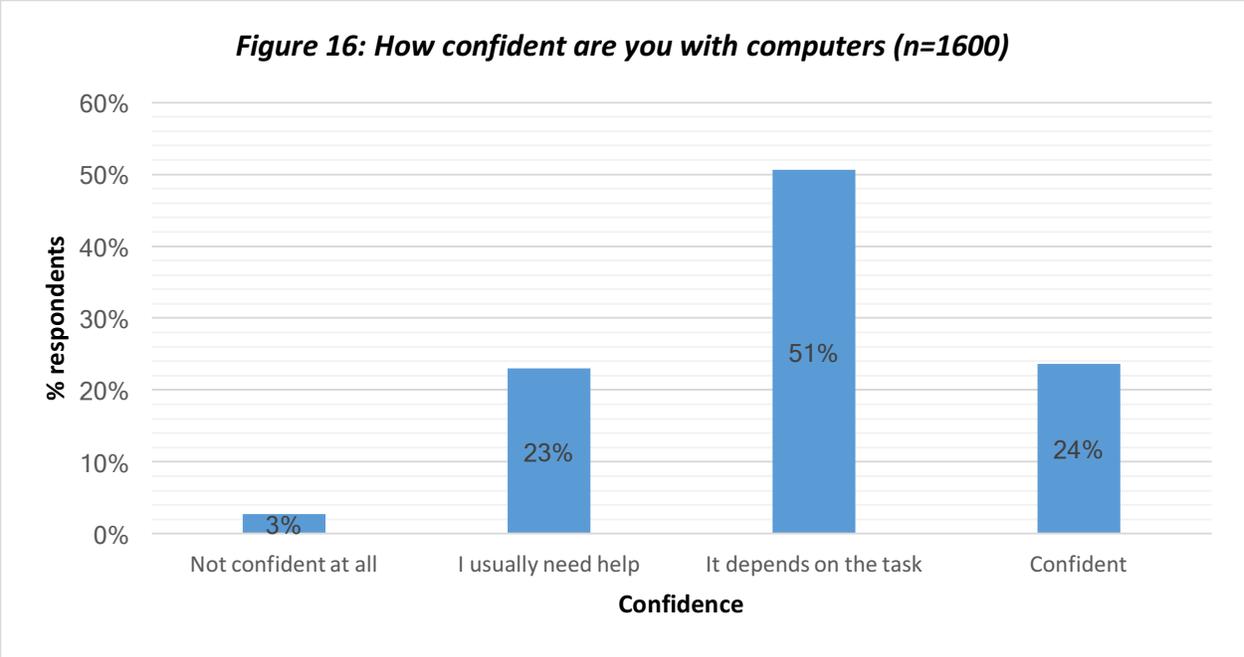
4.4.4 Frequency of use

The study also wanted to check the frequency of access of ICT from the different places. Students reported that they use ICT more frequently at school with 59% saying they access computers at school at least once a week, 48% at home at least once a week and 23% saying they accessed ICT frequently from other places (e.g. public library, internet cafe).

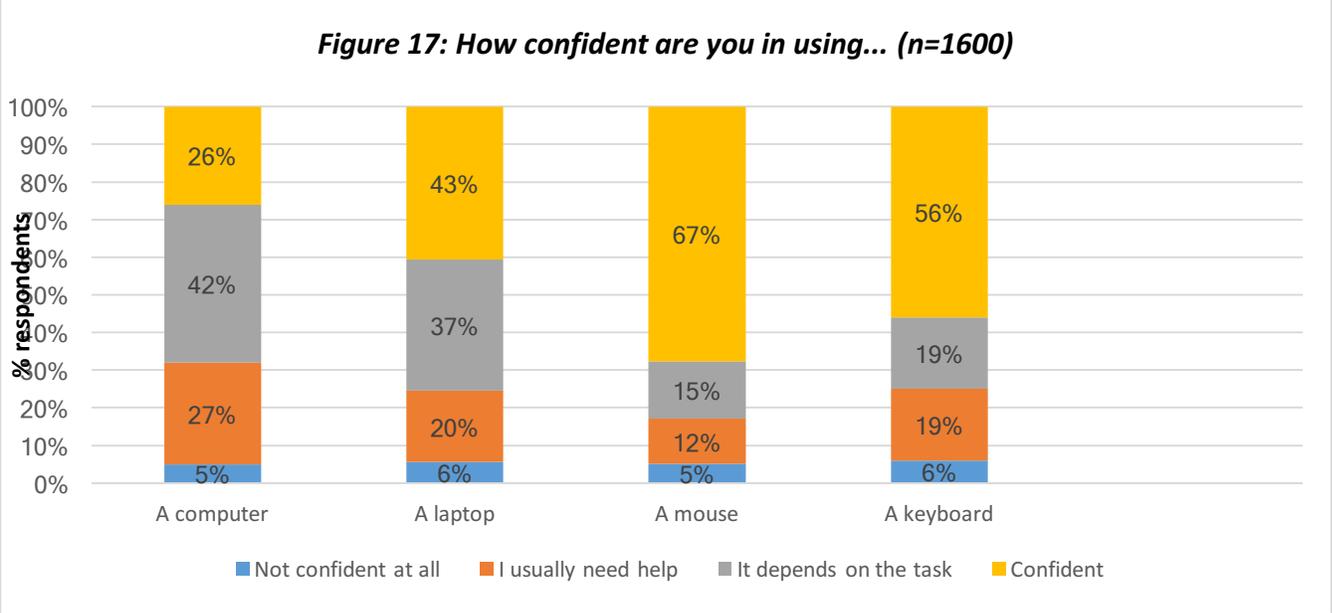


4.4.5 Students' confidence in using computers

Students were asked to rate themselves in regards to their confidence in using computers generally. About 24% said they felt confident, 51% said it depended on the task, 23% usually need help when using computers while 3% were not confident at all.



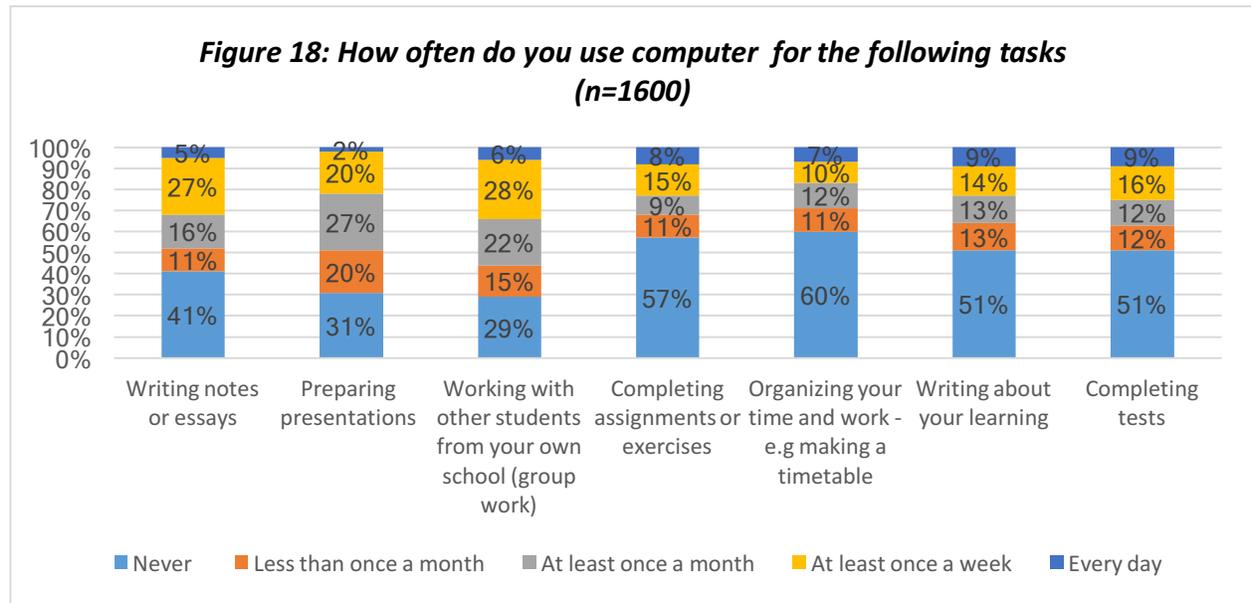
The students were then asked to state how confident they were in using different types of computers and computer components. As shown in figure 17 below, majority said they were confident using a mouse and keyboard. In comparison, many students 43% were confident in using a laptop as compared to 26% who were confident using a desktop.



4.4.6 Levels of computer use for school-related work

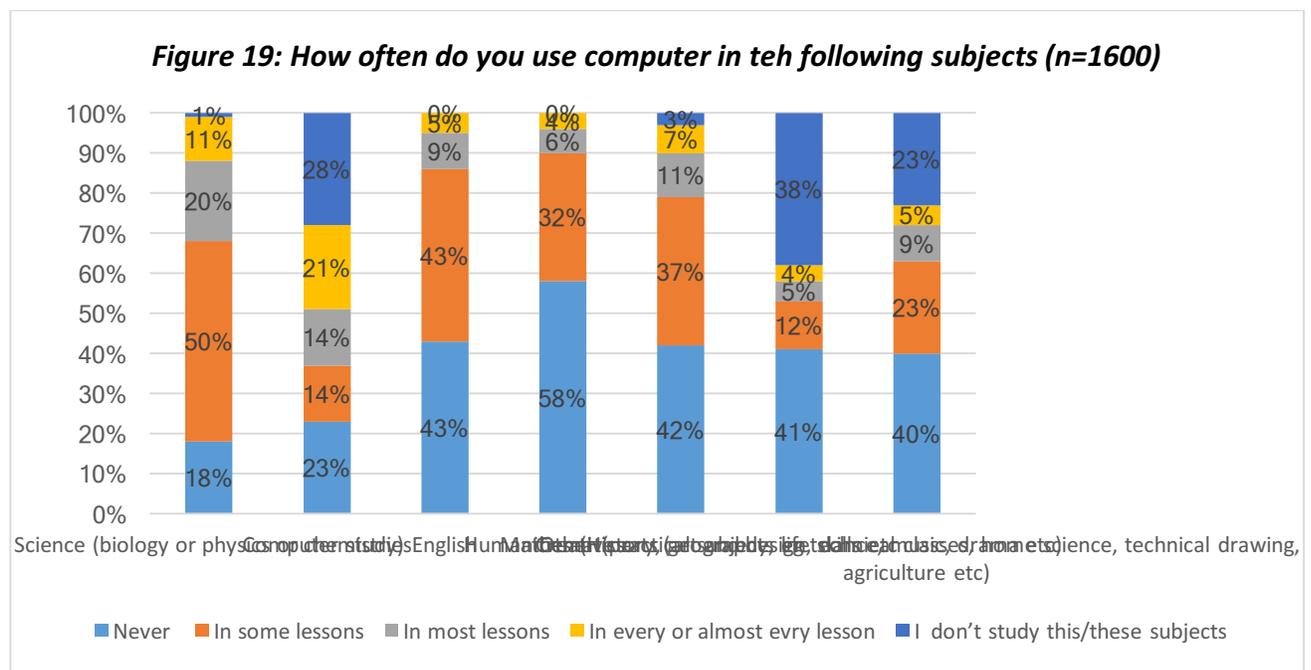
The students were asked to state how often they used computers for different school related purposes. It emerged that most students had used computers for group work, preparing presentations and writing

notes or essays. Very few however had used computers in making timetables, completing assignments, writing about learning and completing tests.



4.4.7 Levels of computer use for different subjects

The study checked how often the students used computers in the different subjects. As expected, ICT integration frequency was highest among the ADSI target subjects. Highest frequency of ICT use was reported in science (biology, chemistry and physics), followed by English, then humanities, mathematics and computer studies. The subject with the lowest frequencies of ICT integration were creative arts, technical subjects.



4.4.8 ICT skills acquired through ADSI

The students were given a list of some of the essential skills in ICT use then asked to say which ones they had been taught as part of ADSI. Those who reported to have been given these skills are as can be seen in the table 10 below.

Table 10: Skills taught

Skills	Those trained
<i>How to operate a computer/laptop</i>	86%
Accessing information with computer	74%
How to connect or set up a projector?	68%
Deciding where to look for information about an unfamiliar topic	64%
Identifying references to internet sources	60%
Looking for different types of digital information on topic	60%
Presenting information for a given audience or purpose with a computer	59%
Deciding what information is relevant to include in school work	53%
Organizing information obtained from internet sources	49%
Working out whether to trust information from the internet	41%

4.4.9 Students' attitudes towards use of computers in learning

Feedback on students' attitudes towards use of computers was collected. First, they were given some statements about their work with computers. As can be seen on the table 11 below, most of the students felt positively about the importance of working computers, interest in learning computers and their interest on technology. The majority also felt using a computer was fun, felt it was easy, felt they have always been good with computers, and able to give advice on computer problems

Table 11: Students' attitudes towards use of computers

	Strongly disagree/ disagree	Strongly agree/ agree
It is very important for me to work with a computer	5%	95%
Learning how to use a new computer programme is easy for me	25%	75%
I think using a computer is fun	22%	78%
I have always been good at working with computers	33%	67%
It is more fun to do my work using a computer than without a computer	29%	71%
I use computer because I am very interested in the technology	17%	83%
I know more about computers than most people my age	55%	45%
I like learning how to do new things using a computer	7%	93%
I am able to give advice to others when they have problems with computers	31%	69%

In addition, the students' thoughts on using ICT for learning were gathered. As can be seen in the table 12 below about 90% of the students felt very positively about using ICT for learning on many aspects.

Table 12: Student attitudes towards use of computers for learning

To what extent do you agree or disagree with the following statements	Strongly disagree/ disagree	Strongly agree/ agree
It is really important to me to work with ICT for learning	6%	94%
Using ICT for learning is really fun	19%	81%
It's really worth using ICT for learning because it will help me in my future life as an adult	4%	96%
I use ICT to learn as it will help in the work that I want to do later on	8%	92%
I learn things using ICT that will help me to get a job	11%	88%
Learning with ICT is important for me because I need it for what I want to study later on	8%	92%
Learning with ICT helps me work as a team with my fellow students	7%	93%
Learning with ICT helps me work as a team with my teachers	10%	90%
Learning with ICT helps me understand difficult topics better/faster	7%	93%

Then the students' views on some of the benefits of using ICT in the classroom were also checked. As can be seen in the table 13 below, most students felt strongly that using ICT had the following benefits; helping them remember easily what they have learnt, understand easily what they are learning, concentrate more on what they are learning, work better with other students, feel more independent in their learning, try harder in what they are learning and improving the class atmosphere.

Table 13: Students' perceived benefits of ICT in the classroom

	Not at all/ somewhat/ a lot	Somewhat/ a lot
You concentrate more on what you're learning	12%	88%
You try harder in what you're learning	24%	76%
You feel more independent in your learning (e.g. go over work again, find out more about things you are interested in)	17%	83%
You understand more easily what you are learning	11%	89%
You remember more easily what you've learnt	10%	90%
ICT enables you to work better with other students on tasks	13%	87%
ICT improves the atmosphere in class (e.g. students are more engaged, there is less disruption)	24%	76%

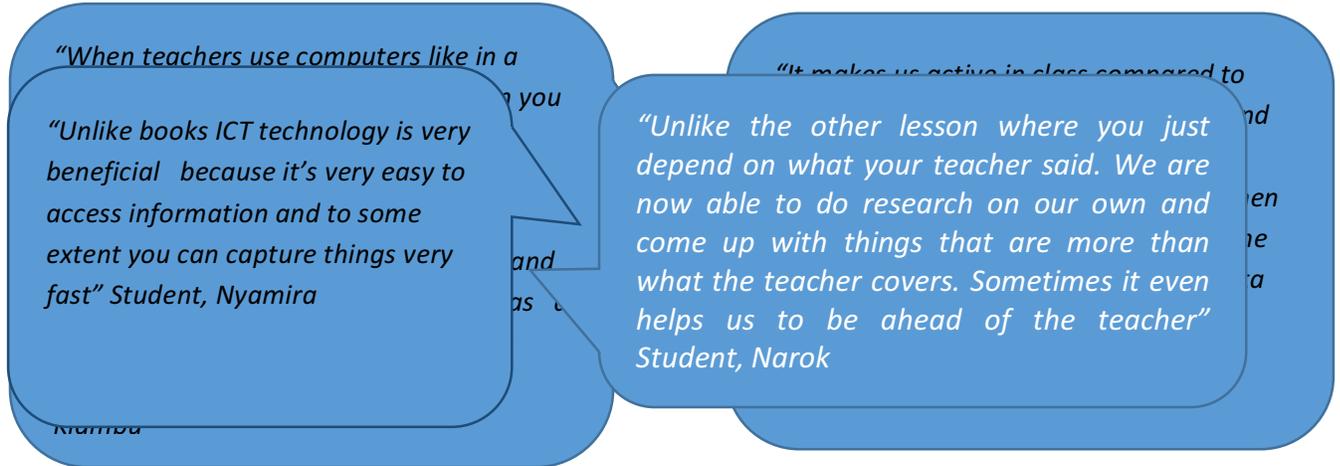
Similarly, in the qualitative interviews, students were unanimous that ICT integration in teaching has many benefits for them including; making difficult concepts easy to understand, making learning fun, helping them recall what they had learnt, making them more active and engaged in learning, making

"The use of projectors in learning makes it possible to see pictures clearly. For instance, in Geography projectors are used to show the process of eruption thus making it more interesting and bring the actual image in our brain" Student, Narok

"The use of ICT makes it easy to re-access information previously used unlike in the case of writing book may lost" Student, Narok

work easy for the teachers and generally making them understand abstract concepts through the power of audiovisual presentations.

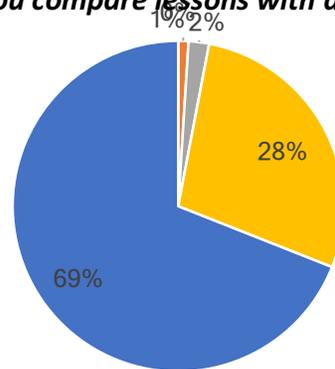
Other reasons given were that ICT had given them opportunities to research and find out more information beyond what the teacher covered. A few also reported that their interest and performance in the subject which ICT is being used had improved. Others said they had noticed that teachers hardly



missed ICT lessons. They also liked

Lastly, the students were asked to compare the lessons with ICT and those without ICT integration to measure their preferences. As can be seen in the figure below, 69% said they highly liked the lesson in which ICT is integrated, 28% said they liked while only 2% said the lessons were the same while 1% said they disliked lessons integrating ICT.

Figure 20: How do you compare lessons with and without ICT (n=1600)



■ Highly dislike ■ Dislike ■ Same as lessons without ICT ■ Like ■ Highly like

The preference for ICT integrated lessons over the conventional lessons was also evident in the qualitative interviews where the students mentioned several reasons why they preferred lessons where ICT is integrated.

“I love ICT lessons because using computers makes you get more information concerning what you want to get info about. I like knowing more about narcolepsy and epilepsy so that a get to know who to control them and how you can be treated and where” Student, Kiambu

“If you compare subject taught using ICT and those that doesn’t students tend to concentrate more in subjects taught using ICT, take example, CRE students get bored fast and lose concentration because it is not tough using ICT unlike Biology where we are taught using ICT” Student, Taita Taveta

“When we have a lesson which requires us to search information on computer, teacher brings the computer in class to help us in learning. The problem we have is that we don’t have projectors so that all students can learn, as you can see we are congested in class. Despite these challenges is has help us a lot” Student, Nyamira

“By using the computers and projector while the teacher is teaching, they play videos, and when you see them concerning a particular subject you cannot forget what you will have learnt, so using computers has made it easier to pupils and also teachers in teaching and pupils in understanding what is taught” Student, Kiambu

Students’ opinion was however divided on whether or not the ICT integrated lessons saved or wasted time. While some say it saved time and they are able to cover so much within a short time, others felt it takes longer to set-up and run a lesson with ICT.

"ICT is very good, but one of the biggest disadvantages is that it takes a lot of time, because a teacher covers fewer topics per lesson compared to the lecture method. Students always want to repeat watching the videos several times thus taking time. It delays the teacher from covering the topic" Student Kiambu

"Lessons taught using ICT is fast and teachers end up saving time unlike lessons taught without using ICT because teachers take more time to explain concepts" Student, Taita Taveta

Students in the ADSI schools also felt strongly that they are more advantaged than their peers in the non-ADSI schools.

"Students in schools using computers have more computer skills compared to those in schools that are not using computers" Student, Narok

"From interaction with other students whose schools haven't embraced use of ICT, I found that I am well ahead when it comes to operating computers. It has helped us to be skilled than those outside there, example I know how to type compared to students whose school haven't embraced use of ICT in learning" Student, Nyamira

Across the board in the qualitative interviews, most students strongly felt that ICT was important for their future. The majority believe that ICT will be important for their future careers either because they aspire to take STEM-related courses which required ICT knowledge or because they believe ICT will be essential in supporting their career growth and performance in their dream jobs.

"Personally I want to do Journalism and Mass Communication. I know ICT will be heavily used in my field. I am happy and glad that I already know how to operate some of these gadgets" Student, Taita Taveta

"Yes, in engineering you may be eager to know how other engineers are doing in the world, so with ICT you can just do a research easily and you will know the new inventions across the world" Student, Nyamira

"I too aspire to be a captain; I know ICT will help me determine locations of places when I am flying" Student, Taita Taveta

"As someone who wants to be a Doctor, I think the use of computers is going to help me so much in doing research on diseases" Student, Kiambu

4.5 Policymakers' views on ADSI

This study also gathered views and feedback on the ADSI project from the education officials across the 4 Counties where ADSI is implemented. The officials included; County Directors of Education, County Quality Assurance Officers, Chief Education Officers and well as Teachers Service Commission Officials. The aim was to collect their views on ADSI, get their feedback on implementation particularly the collaboration as well as suggestions on what may need to be improved.

4.5.1 Educational programmes and projects

First, we wanted to check if there were any initiatives in the counties geared towards improving education or learner achievements. Feedback gathered indicate that the few initiatives that existed were geared towards increasing provision of learning materials especially text books And the Digital Learning Programme for primary schools. For the secondary level, they mentioned mainly the governments' capitation grant and infrastructure expansion. Initiatives such as *Tusome*, the provision of textbooks to school and free secondary education emerged in most of the interviews. Some of the officials also talked about the teacher management and appraisal programme by the Teachers Service Commission which was being implemented to improve the quality of teaching and learning.

"Where I am working we are not having ICT integrated projects, its only GESCI that has come out to work though the government had promised to in traduce ICT projects mainly in primary but in secondary, I have not come around in kind of ICT project" Policymaker, Narok

"There are quite a number, like now we have program like Tusome. Tusome program is ministry based; it is about curriculum implementation which caters for competence based curriculum at Standard 1, 2 & 3. Early Grade Mathematics (EGM), RIDE for primary education and Teacher Appraisal Development, which helps in monitoring of teachers" Policymaker, Nyamira

4.5.2 ICT integration programmes and policies

The officials were then asked if there were any specific programmes working on ICT integration in their Counties. Across the three counties of Kiambu, Narok and Nyamira, there were reportedly no ICT integration initiatives apart from ADSI.

However, in Taita Taveta two organizations called Seavuria and SOTE hub were said to be working with schools to provide ICT equipment and training support to some schools in the county. The only other notable one was a project of the Ministry of Education which had provided some secondary schools with desktop computers.

*“Most of our schools are heading towards the integration of ICT teaching because it’s more Interesting and Interactive to the learners. Like now we have gotten ADSI who our major partner is helping us in capacity building for the teachers. We have another organization called SeaVuria which facilitates ICT facilities and integration of ICT in learning and training”
Policymaker, Taita Taveta*

*“We have partners especially in the ICT ,SOTE house who have started clubs in the school to ensure there is active ICT integration and learning so as to make teaching easier. We have also PC Labs by National Cohesion and Integration Commission which make students to feel beyond the classrooms where they learn issues of citizenship”
Policymaker, Taita Taveta*

ADSI was also said to be in sync with government policies on ICT integration in education. It also emerged that there is a national programme by the Ministry of Education to equip schools with laptops. Information given to us was that the MoE provides desktops for at least 5 secondary schools in each county every year. We were however unable to find any documentation of this policy or programme. The teachers service commission was also said to be enforcing ICT integration and had made it a component for which teachers are evaluated in the TPACK.

*“Of course ICT policies are there, if you look at what the government has done it’s because of lack of enough resources. But every year a minimum of 5 schools per county have been receiving ICT documents, computers, laptops so there is concerted efforts to ensure its spread. Our wish is at least all schools have been computerized, computer as a subject is taught in all schools. Look at even the government effort in providing electricity they are targeting schools a first priority”
Nyamira*

*“The ADSI project fits so well with ministry of education policy which aims to have every school digitally enrolled by 2020. I think ADSI is giving us a good platform to get started because now we have already teachers’ trained on ICT and also boards have embraced it. They are allocating resources however small to support ICT integration”
Policymaker, Taita Taveta*

4.5.3 Officials’ comments on the relevance of ADSI

Across the board the officials had very positive sentiments about the ADSI project with most saying that it was a timely and relevant project which was changing the way learning happens, improving learning outcomes, going beyond the conventional coursework to help the students acquire skills to prepare them for the future and that it was well aligned to government policies, programmes and targets.

"I would be surprised if you can go somewhere and be told that ICT is not useful, for example look at the many young schools and you are demonstrating physics the mixing of chemicals look at how it can be very effective when you use ICT to demonstrate, If you are teaching about e.g. the floods in the bible you interact ICT in it. As the pupils see you demonstrating they are remembering. I went to observe ICT integration in an English literature class.... Oral literature it was so beautiful and I believe it was so clear to the students As they were moving to a story being observed then they come to real situations. So any one who says that ICT is not relevant is an enemy of education" Policymaker Nvamira

The

"Considering we are in the 2st Century and digital era and don't believe there any way you will have it smooth out here without the very basic ICT skills. This helps a lot in online transaction like applying for Helb loan, application for courses among other things. And GESCI is leading the way in this" Policymaker, Taita Taveta

officials also liked the ADSI approaches and said that the ADSI package which combines equipment support and teacher professional development was unique and that it was a programme that had great potential to succeed in helping improve education and learning.

"I think one of the most important aspects is ADSI providing some of these gadgets, like the projector which are usually very expensive. Hope we can get partners to support by selling at subsided price so that all schools can afford them so to help the project" Policymaker, Narok

The

"We are talking of expanded facilities, use of ICT, integration of ICT in teaching and learning, empowerment of teachers in capacity building in terms of ICT, it has created interest in learners in terms of ICT use. Us we have also gone for induction training hence building our capacity. It has also reduced teachers' movement going out to get physical teaching aids" Policymaker, Taita Taveta

whole school approach where principals, teachers, parents and students are targeted in the project also received mention as a key strength for ADSI and one that had provided numerous opportunities for different actors to engage in improvement of education.

"This ADSI happens to be first to do things differently and its being supported but others have not reached your level. ADSI is very consistent and very effective unlike others who come and disappear"
Policymaker, Narok

"Very relevant in this way; one, as a ministry it gave us a forum when we had both teachers, principals, board of management and PTA members come together n one forum to discuss ICT, therefore to us it was a forum which we used to push them to develop an ICT philosophy in schools and an ICT policy so that when you attend the various board of management, they easily understand what you are trying to say. Through this we have infused ICT as a policy in all the departments be it finance, procurement as well as academic" Policymaker, Nyamira

4.5.4

Officials' experience interacting with ADSI

The officials were then asked about their experience with the ADSI project. The officials had very positive reviews on the ADSI project and the project team. Some of the feedback areas were that they were happy that the ADSI Team specifically the Programme Coordinators have been consulting them regularly, communicate the project plans and activities on time, have invited them for meetings, training and events and that the ADSI team respects government plans and policies. Most importantly, the officials were happy that ADSI has involved them in school visits and classroom observations which they said had helped them learn a lot.

"They have been involving us, the person in the ground Waithaka for any activities he will send letters for my approval even when he is inviting teachers, it's me to approve, even when they are going to involve students it's me to approve, then when he has workshops for those teachers we have always been invited, we go there participate in opening and closing, the beauty of it also we have been involved in monitoring where we accompany the teams as they go to schools. We observe as teaching takes place, we also participate in accessing the teachers to ensure it's done" Policymakers, Nyamira

"Since ADIS came to the county there were schools selected which saw training undertake and also ourselves we underwent induction workshops. They also gave us report about performance of other places that gives us some motivation. We together with ADSI officials visit schools for monitoring and support of teachers"
Policymaker, Taita Taveta

4.5.5 Officials thoughts on sustainability of ADSI

Most of the officials feel strongly that the project has great potential for sustainability as they say the knowledge acquired by the teachers and principals will live with them forever. It is however in the equipment aspect that they feel more support will be needed or there can be ways device to make them more affordable to the schools, especially the ones that are not in ADSI.

“It is sustainable because if you look at the direction that you took was to do with; one, sensitization and then two, provide the equipment; at the same time it took an academic approach to understanding the importance of the computer to support learning, and this being a concept, What ADSI has done compared to the digital learning program, they took a step of sensitizing the people, all the stakeholders then provide the equipment and making a follow-up, as opposed to digital learning program that brought the equipments, dumped in schools and walked away; so you find ADSI took an educational approach” Policymaker, Nyamira

“I believe the project is sustainable. Since most of teachers have ICT competencies now, when they sit with their board to convince them on acquiring laptops and maybe Wi-fi for the schools. For the new teachers coming on board they are already tech savvy though for the older one there is a bit of resistance but were are closely working with them to ensure sustainability” Policymaker, Taita Taveta

4.6 ADSI effects and outcomes

Across the board, there are several impacts and outcomes that are attributable to the ADSI project across the schools. Views on ADSI effects on learning achievement were varied amongst the different respondents with some saying ADSI had achieved a lot in terms of improving learning outcomes across the participating schools but with others saying it was still too early to talk authoritatively about the impacts of the project. However, from the feedback we are able to highlight the key impacts of ADSI and where possible, we compare with the baseline findings as follows;

4.6.1 ADSI effects on institutionalization and policies

ADSI has evidently improved the institutionalization and policy development in as far as ICT integration is concerned. The study found that 85% schools had an ICT integration policy at their schools compared to 61.7% at the baseline. In addition, 91% could describe the policies as compared to only 55.3% at baseline.

4.6.2 ADSI effects on access and use of ICT in general

ADSI contributed to improvements in access and usage of various ICT equipment both at school and outside among teachers as follows;

- At baseline, 54% of teachers had personal computers compared to 70% now. In addition, only half (50%) of those who had personal computers at baseline had access to the internet as compared 79% at midline. In terms of frequency of internet access, about 78% access it regularly as compared to 57% at baseline.
- At baseline mobile ownership among the teachers was at 99%- almost similar to the midline at 100%. However, when it comes to access to internet on mobile phones only 45% had accessed internet always on their mobiles at baseline as compared to almost 95% at midline.

4.6.3 ADSI effects on Teacher ICT competencies

There has been a marked improvement on teachers' computer proficiency. A look at how teachers rate themselves on a number of ICT-related task revealed that they rated themselves higher in the midline compared to baseline.

Table 14: ADSI impacts on teacher ICT competencies

How well can you do these tasks on the computer?		Midline	Baseline
o.	Producing a letter using a word processing programme	95%	63%
p.	Emailing a file as an attachment	90%	54%
q.	Storing your digital photos on a computer	95%	55%
r.	Filing digital documents in folders	97%	54%
s.	Monitoring students' progress	80%	36%
t.	Using a spreadsheet	79%	31%
u.	Contributing to a discussion forum on the internet	92%	33%
v.	Producing presentations	97%	31%
w.	Using the internet/ mobile phone for online purchases and payments	90%	51%
x.	Preparing lessons that involve the use of ICT by students	95%	27%
y.	Finding useful teaching resources on the internet	97%	53%
z.	Assessing student learning	82%	27%
aa.	Collaborating with others using shared resources such as google docs	82%	29%
bb.	Installing software	60%	31%

4.6.4 ADSI effects on teachers' attitudes

ADSI has made great strides in helping provide knowledge to teachers on ICT literacy, the importance of ICT integration in education and the need to innovate in teaching. As a result, it has also helped change attitudes of teachers. The project has also created awareness of the many sources of knowledge, information and specifically the Online Educational Resources (OERs).

Table 15: Changes in teachers' attitudes

	Baseline	Midline
Students' use of ICT can support student-centred learning	3.45	4.26
ICTs provide valuable resources and tools to support student learning	3.44	4.19
ICTs can be mainly used for efficient presentations	3.34	3.76
ICTs has limited capacity to provide benefits in the classrooms	2.57	2.57

"I think for me it has been a great experience. Personally I did not know much about computers. The project has made me computer literate and I have learnt a lot personally. Earlier on I could only enter Maths project marks in the computer but now I have learnt a lot. And then for the students they have a lot of materials for the subject. There is a lot of material for geography including content, and even

"It's good teachers have become more confident, they are observed in the presence of your colleagues, when they come to our place many times...when they come to see one or two all teachers converge in one room, we have our lessons in the computers and a teacher gets through to the learners when the others are at the back there observing, the principal, the deputy and the teacher is confident. It has built the confidence of the teacher" Teacher, Kiambu

Teacher, Narok

4.6.5 ADSI Effect on teachers' confidence

Even for the teachers

who were

"Well personally teaching. You that my History, is method way that. So it has theoretical to concept mapping. So it has helped me to change the way I teach" Teacher, Nanyuki

"Yeah in terms of learning, initially you would just get to class....now with ICT you have got to plan and be very sure what you are presenting, u have to search and see whether it is relevant. Especially for relevance, so by the time you are in class you are very sure" Teacher, Kiambu

"ADSI interactive when SBC is pushing us to use ICT in our classes, it has gone to an extent where we are carrying out projects and the students are engaged in looking for information. Instead of looking up to a teacher as the source of knowledge they are given guidelines on how to access knowledge for themselves. It is a good source of gathering information which you can even share with others" Teacher, Narok

ICT

literature prior to ADSI, they report that the project has improved their ability to use ICTs and had given them confidence to work using ICTs and to try new ideas in their work. Others have overcome the phobia for ICT equipment.

4.6.6 ADSI effect on learning and teaching

ADSI has also reportedly fostered changes in how teachers teach as well as deliver learning. Teachers and students report that the ADSI project has made learning fun, engaging, participatory and also student centered.

"On the teachers side it is friendly because much work is done by the students which will help them to understand more because they are researching on their own. Also for me I have a disadvantage, when I came for that trainingand the information we got was based on someone's project. So from the little I

"To say the truth, the teacher work load has really been reduced. The learner is doing most of the work where the teacher is usually doing more of the guidance, evaluation and correcting any misconceptions so it has changed us how we approach the tackling of the content" Teacher Taita Taveta

“Well previously there were some concepts that when I was teaching wasn't easy to cut across and also there were some topics that used to get boring and they have been made a little bit interesting though it has not been very easy gathering information and even presenting what you have gathered. It takes a lot of time” Teacher Narok

“It has made the teaching and learning processes interesting. Previously we were used to the chalk and blackboard. Now we are used to laptops and projectors, apart from that we can now use online research. You can research on a concept and discuss in class... the information on textbooks can be scanty... all you have to do is google and there you are with information to teach in class” Teacher, Narok

Teachers report five key impacts on the learning and students; that it had improved how they teach, improved student interest especially in STEM subjects, helped to shift learning from teacher to student-centered, improved student participation and involvement as well as performance.

“ The project has helped in improving students interest, and they end up liking the subject, especially Chemistry they don't like it but now if you introduce the use of ICT there are some weak students who want to participate, they want to know how to operate the machines, how to do the research, and when they are doing the research they are learning, it's like now when you draw the concept maps, they want to do it so I think it's a very good method” Teacher, Kiambu

“Not that we did not use ICT before ADSI came but when ADSI came it provided a boost and also brought other teachers on board who were not familiar with ICT. Also the equipment have been resourceful, everyone is motivated and wants to adopt the new methods of teaching by obtaining materials online talk about PBL where we engage our learner...giving them a problem to research on it. It has made their learning interesting. It has enhanced our skills of teaching as teachers and made things easier” Teachers, Narok

As a result of the new interest in STEM subjects, some teachers reported that they had seen some students change their career aspirations to more STEM-leaning courses as their interest and performance in the STEM subjects improved.

“Generally as the interest in science subjects increase, you see most students beginning to believe they can take up more technical and science-related courses” Teacher, Kiambu

“You know, I teach physics and its one of those subjects that are considered very difficult. I have seen some of my students gain confidence and even want now to be engineers as a result of presentations I have done in class using the projector” Teacher, Taita Taveta

“ADSI is innovation in teaching. I wouldn’t want just to limit myself to ICT. I think I would...I have been there from the beginning and we have learnt a lot although ICT is majorly a big part of it but even within the ICT there are so many things that we have learnt, the TPACK and those other things and it’s been a good experience. It has really changed my perspective towards how we teach in class, how we relate with our students and how most effectively we can pass across information to the learner. That’s basically ADSI for me” Teacher, Taita Taveta

“What I can say are the benefits of this project. One, we have the computer lab which was not there and then from that computer lab we said that we teachers we don’t know how to handle computers then the school management was forced to hire a teacher who trains the students and now the students are taking computer studies. So through this project that computer lab we have it and then the teacher was employed. We had some students who were disadvantaged and wanted to take computer but the teacher was not there so when we started this project, the

4.6.7 ADSI effects on improving ICT use in the curriculum and pedagogy

ADSI has increased the frequency of use of ICT in the curriculum, and in teaching. A comparison between the levels at baseline and midline show that there had been a significant increase.

Table 16: Frequency of ICT use in teaching

Frequency of use of resources		Baseline	Midline
a.	How often do you use ICTs with students in the context of teaching subjects	2.58	3.56
b.	How often have used educational software related to their subject matter with their students	2.32	3.41
c.	How often have you used digital artifacts from student assignments and evidence of student achievements	1.78	2.72
d.	How often have you used ICT applications to monitor, evaluate and report on student achievement	2.89	3.37

e.	How often have you used presentation software in lessons	2.11	3.51
f.	How often have you used digital resources in their lessons	2.38	3.62
g.	How often have you been sharing their experiences of using ICT use with other teachers during normal meetings	2.66	3.48
h.	How often have you been using computer lab for teaching activities	2.11	3.18
i.	How often have been using ICTs in the classroom	2.17	3.48
j.	How often using ICTs with students for presentations, without altering the classroom setting	1.84	3.03
k.	How often do you use ICT in the classroom for individual study	1.84	2.17
l.	How often do you use ICTs in the classroom for small group activities	1.74	3.02
m.	How often do you use digital resources to enhance school productivity	2.75	3.65
n.	How often do you use digital resources to understand subject matter	3.43	4.01

4.6.8 ADSI effects on infrastructure

One of the top most impacts of ADSI was infrastructure and equipment among both the participating schools and the non-participating schools. While ADSI has provided ICT equipment to the participating schools, it was reported that this had generated interest across the countries and more and more schools are investing in equipment. A case in example is Taita Taveta where as a result of ADSI, all secondary schools were now equipped with whiteboards. There are reports of schools that have purchased more computers, installed power points (sockets) in the classrooms, expanded existing/build modern computer labs, etc.

“As Sub County even the boards of management have embraced the idea of ICT Integration in teaching and learning . There is that commitment they have made that they want to improve performance by making learning more user friendly. That why there is a lot of investment in ICT infrastructure. As Taita Taveta County we do not want our students to be left of digital program” Policymaker, Taita Taveta

“I think this project has helped our school to get more computers, now we have other laptops which are assisting even other teachers to embrace ICT, we have added 2 more projectors and are able to reach most of the students. Our Principal has also been forced to install WIFI” Teacher, Nyamira

4.6.9 ADSI effects on student ICT skills and knowledge

It has also improved students’ ICT access, knowledge and skills making them able to operate ICT equipment but also use it for their own learning. Students appreciate that they can use ICT to learn, research and store information for future reference.

“ Students can operate these computers and projectors. They can even teach using it. By the way students discuss on their own whether you are supervising or not, they can do it. So those skills would have not been there if you had not introduced this. They have now had a firsthand contact with the digital world which they could have not gotten if you had not introduced this. They also participate more” Teacher. Nyamira

“I have acquired some skills, for instance I never knew parts of computer because all the way from form one I never took computer studies, and I have also acquired typing s skills, accessing

"The resources...the Laptops, the projectors have really gone a long way in helping the school. The learners are more interested in the lessons right now and they tend to be around when we see these

"When a teacher comes with the laptop in class mostly students help him to connect them, so it has helped students especially from remote areas to know how to connect the computers and projectors. It has helped students with presentation skills, maybe a teacher has given an assignment and ask student make a presentation" Student, Taita Taveta

4.6.10 ADSI

ADSI has motivated more schools to start teaching computers. Most of the ADSI schools that originally never taught computers studies as a subject have reportedly started as a result of the interest created by the ADSI project. Even those that don't have computer studies as a subject, there are those that have come up with plans to ensure computer literacy among the students. In addition, non-computer students in some schools have been obligated to acquire ICT literacy.

"In my school we now have computer studies as a subject and have made it mandatory for each class to go to the computer lab every week to learn basic skills even though we do not have computer as a subject. We have a timetable which is being followed and the STEM teachers are the ones driving it" Teacher Nvamira

"In the school where I am, the students could not access the computers ,though they were there for the computer subjects there was not a single one they could use for practical, but this program has made it possible for the students to access the computers and projectors. The laptops have also motivated some teachers to get their own personal computers." Teacher,

4.6.11 ADSI effects on students' learning pace

ADSI has reportedly also made it easy for the teachers to break down complex concepts making students understand faster therefore helping in accelerating syllabus coverage. Others say it has also helped in saving time and covering the syllabus faster. It has also introduced teachers to different

"At personal level, like the last program we had and the last day we had I really enjoyed making a photo story out of it, even the features, the nyimbo, I like all manner of songs so I managed to fit in all that I had learned, so I really like it, so at a personal level I would say I have really opened up my mind. I had not fully embraced the channels and everything else, but I find myself going to the internet because of" Teacher. Kiambu

"It has also made teaching and learning a little faster. I will give you an example. I teach Physics so to explain how an engine is cooled, you might use two to three lessons but with a video, one lesson will be enough so it becomes easy for them even remembering the stages" Teacher, Nyamira

methodologies.

4.6.12 ADSI effects on learning and classroom practice

Most for the teachers had the view that the project has significantly changed the practice of teaching and learning and delivery of learning making them more innovative and improving student teacher interaction during lessons. Similarly, the government officials interviewed were unanimous on the fact that ADSI had improved the quality of teaching and learning in their Counties. While some mentioned that ADSI had encouraged student-centered learning, others felt it was making the work of teachers easy.

“As I noted when I started here found it was making teachers work easier instead of doing things manually they can now use computers. When it comes to knowledge most teachers fear to venture into what they have never used. But this has given our teachers a new light” Policymaker, Taita Taveta

“ Yes, because schools which have embraced this are doing well. Syllabus completion is done earlier, this is because it is learner centred and not teacher centred like other schools using traditional way” Policymaker, Narok

“It has changed our way of teaching. It has enhanced active teaching and learning so learners create more interest when we are teaching and so they are gaining much more. And when they do it they improve their IT skills with the use of this PowerPoint. We can also be able to teach the students on how to research materials from the internet” Teacher, Nvamira

“The students are able to get information on their own. It is not a must for the teacher to be around or whatever...to be available. They can do some research and get answers to their questions without having the teacher around although the teacher might guide them to some extent but I believe the students are able to do...to do what? To get the information on their own and I believe the information that you get yourself you well understand it” Teacher, Taita Taveta

4.6.13 ADSI effect on teaching innovation

Feedback from the teachers also revealed that the project and methods of teaching integrating ICT support better comprehension and retention on knowledge among learners. The use of methodologies such as webquests, simulations and project-based learning has enhanced the quality of learning.

“Yes, specifically I was doing a webquest on a “particular nature of matter’. I asked them to do a bit of research on that and were able to access some search engines... and later I went with some questions on that drawn from what they were seeing and of course from what is usually asked and was able to note down questions for them.the outcomes were very different. The responses were quite accurate in the other one than the first one. Teacher, Narok

“Yes because once they see the simulations and all that the concept sticks in their mind like we are talking of the industrial process, preparation of poisonous gases that maybe you hardly do in class and can't prepare in a lab...you just show them how it is prepared and it sticks in their mind. It ceases being the theory”. Teacher,

Most teachers reported improvements in scores and performance on subjects where ICT integration was happening according to the teachers' accounts. Teachers report seeing improved performance of students in certain subjects to improved accuracy and quality of answers to questions on topics where ICT was used.

"I think it has improved the performance of the science subjects particularly after the students interest is aroused during teaching, abstract concepts are able to be explained well for instance the practicals that we cannot carry out in the laboratory...those ones they are well illustrated using ICT and that one is as a result of this project and so I think there is an improvement in the performance of the science subjects in the school" Teacher, Taita Taveta

"Just from simple exams that we give them because exams cover a number of topicsyou can easily tell the topics where the students are scoring higher and the others. You realize that where ICT was used the students are scoring higher than where ICT was not used in teaching. Teacher, Narok

"As assessment between a topic (my colleagues can even try) ...just give attest that was covered in ICT by you and the learner and give another test that was covered theoretically. You can make an assessment and you will realize their response is in terms of that which was covered in IT are actually more accurate and better than the ones which were covered theoretically" Teacher, Narok

"For a while Chemistry in our school has been one of the worst subjects with performing worse than Maths but by the time we opened school we saw improvement across the board from form one to form four and I think, ADSI is really attribute to this" Teacher, Kiambu

The views of the officials were however varied, with some saying ADSI had achieved a lot in terms of improving learning outcomes across the participating schools but with others saying it was still too early to talk authoritatively about the impacts of the project.

"There has been slight improvement in KCSE performance by the students and this is an added advantage as the teachers are also already trained on ICT competence unlike compared their counterpart." Policymaker, Nyamira

"I think its too early to mention any effects the project has heard on learning outcomes. However, I think there is great progress and maybe in future we can see clear results" Policymaker, Kiambu

There were those who were of the view that ADSI had helped a great deal in improving ICT literacy which was good preparation for the students in their future life, work and growth. Some linked this to the acquisition of 21st century skills which they believe is very important.

"We are in the 21st century and preparing our learners on ICT compliance will be the best for learners so as to be update with outside world when out of school like doing transactions online. If they are not equipped with ICT competence they will be disadvantaged and us as educationists we shall have not succeeded to fulfill our mandate" Policymaker, Taita Taveta

4.6.14 ADSI effects on collaboration and communication among school community.

ADSI has also reportedly helped improve the management of communication across some schools helping teachers and principals to be able to pass information better to parents and students. Most of the ADSI schools now have bulk SMS platforms for parents, portal for posting exam results as well as email systems used to communicate both internally and externally.

“On my side I have been able to chat, do research by giving the students questions to go out and research on, I have been able to apply that and it is very effective. Presentations are also very nice in getting students attention, worksheets are very good, have made my work easier for the last 2 years...its easy now to manage my class. Concept maps also helps the students come up with solutions to problems. Those I have not been able to apply are the Lesson Plans. ADSI Lesson Plans. It is very difficult to prepare these Lesson Plans” Teacher, Nyamira

“Our school now has e-presence. In fact it has benefitted our school in that myself I am blogging in so that when the students are at home, it easier to communicate with them and give them assignments and even assisting them in making discussion groups in the blogs that we developed in the ADSI program. In fact if you check our web, you will find that during the holiday, there is much activity in the website than when the schools are on so it has... economically the amount of papers we were using to print assignments for the students has reduced because now we just post the assignments online and then we as teachers assist the students if they may be having any difficulties in those questions. It is like a discussion and you can give a hint to a question if it is

4.7 ADSI challenges, barriers and dislikes

Despite the largely positive feedback on the effects of ADSI, this study also collected views on some of the challenges and barriers to the implementation of ADSI as well as some of the things that various project stakeholders disliked. The main ones are listed below;

4.7.1 Inadequate infrastructure and equipment

Across the board, inadequate infrastructure, facilities and equipment were mentioned as a major barrier. While the equipment support from ADSI had been lauded, most of the teachers, students and officials said the number of laptops and computers was hardly enough going by the populations of students and teachers in the participating schools. There was also a problem of the class set-up for most of the schools did not have power sockets in the classroom to allow for powering of the laptops. Other schools just have small libraries which cannot accommodate a full class.

“What has been difficult to implement is based on resource availability, in my school there are very few rooms which have sockets, you have to alert the teachers in those rooms in advance if you want to use ICT. We use specifically science lab and computer lab which is very small...so if you don't make arrangement in advance you may not use them” Teacher, Nyamira

“The ICT room is not big to accommodate a class of 60 and the computers are less, we only have 22 and out of these five are not spoilt” Student, Nyamira

Another infrastructural issue mentioned as the second major challenge that emerged strongly across the board was that of internet connectivity which many said was poor, sometimes slow or unavailable making it difficult for them to access the online content for preparation of lessons.

“Because the issue of accessing the internet has been a challenge for example getting a class of 50 to access the internet and ensuring all of them do so has been a challenge but we are trying. When we put them in shifts we can do it. So for the ones that we use in class, they have been very easy to do web quest is very challenging” Teacher Nyamira

“Let me also add on internet. We are using routers and the area of coverage is very limited. Like now the webquest we are giving the students could be attending at computer lab but for our case we don't have which is a challenge. You have to get them out of class to be very closer to the administration block, then the computers are not enough and you go searching for internet under the trees...those are some of the challenges” Teacher, Narok

4.7.2 Teacher training and support

One of the major concerns among the teachers was the fact that most of the trainings were often short and hurried and with so much to cover within a short time. Teachers were concerned that there is always information overload that sometimes makes them unable to understand everything adequately and to implement when they go back to school.

“Training period for the workshop should be extended from 2 days to the third day for the same content so that adequate information is passed within

“According to me the training time is normally very brief because we have like a day and we are learning so much so we keep on rushing. So in

“ I looked at your training module and training manual and looked at your projection and then there were your facilitators, I thought you should simply the process of knowledge transfer because it is too academic in terms of approach; Me I will understand it in term of my level of education and my interest in ICT, but BOM chairman, who even the word ICT is a vocabulary. Secondly let us have sample lessons, say a 20 minute lesson with ICT and another one without ICT the make a comparison. I looked at your manual; it will be well understood by Phd holder or a master's holder; but a diploma guy may not get it well” Policymaker, Nyamira

A policymaker also felt there was need to review the training materials to make them simpler and in sync with other government teach development and appraisal program.

Closely related to the above issue was the timing of the training which some said clashed with other activities and frequency of the training which some said was not so effective for implementation as it was often one training per term and people forget. They suggested that the trainings be planned for very early in the school term so that they are able to get into implementation immediately before they forget what they had learnt.

Another concern the teachers had was in the organization of the chats. Some complained that the timings of the chats did not allow them to participate as it collided with their school timetable. There are those who felt that the 1 hour allocated for the chats wasn't adequate.

"The charts and the discussions you get that sometime you are not available when they are taking off why don't you have the person ..."

"Yes. The training was in the first week of January for 2 days on work you will do a whole term in second term. By the time you get to second term so many things have happened in between. So if we are trained in the beginning of the term and go to implement its fine"
Teacher, Kiambu

"Personally I may say there is need to add a few hours for the chats. Like personally I am in charge of the ..."

"The timing of the training especially these two days, its normally the opening week and some of us are pressured by exams, we open the school with exams. So you are here struggling and you know you have some deadline somewhere of marking exams"
Teacher, Kiambu

4.7.3 Inadequate buy-in and support from school leadership

Inadequate and poor support from school management was also mentioned as another issue that poses a challenge on ICT integration for some schools. Some teachers experience problems with their school principals on poor buy-in on ICT integration hence failing to provide facilitation for ICT integration.

"Improving of information and communication in the school by placing emphasis on the use of ICT in school functions like budgeting and financial management" Principal

"Some of the pr regularly briefe well so that the those who are r to one-on-one b Taita Taveta"

4.7.4 Negative attitudes by some teachers

Negative attitudes towards ICT by some teachers were also reported to be a barrier that some schools

"Most of teachers have ICT components when they sit with their board to convince them on acquiring laptops and maybe Wi-fi for the schools. For the new teachers coming on board they are already tech savvy though for the older ones there is a bit of resistance but we are closely working with them" Policymaker, Taita Taveta

"Most of our principals are advanced in age and they never grew up in the computer error, so a number of them would either castigate the same thing to the computer teachers; and during the evaluation the younger teachers are more interested and they have the passion in it as opposed to Headteachers who would walk away and leave the teachers" Policymaker, Nyamira

were struggling with. Some teachers who had been in the service for longer were said to struggling with ICT integration and while there were individual cases of schools that had managed to shift these attitudes, there were reportedly cases where this had not happened.

5.0 Key conclusions, recommendations and discussions

The above findings have generated evidence and insights that can help in generating valuable lessons for continued progress and achievements of the ADSI project. As such, the following conclusions can be drawn across the 4 domains of ADSI implementation. Where possible, we have compared the current levels with the baseline.

- **ADSI impacts on institutionalization:** Evidence suggests that there has been growth in institutionalization of ICT integration across most of the ADSI schools. Almost all the ADSI schools have an ICT policy and or ICT user guidelines to guide the integration. There are also improvements in the level of awareness by teachers and students on the policies. The ADSI project is also evidently aligned to the curriculum and the government of Kenya policy that seeks to mainstream ICT in teaching. There is however very scanty information on the levels of compliance and effectiveness in implementation of these policies and there seems to be very minimal involvement of some critical stakeholder especially parents in planning for ICT integration. Most of the BoM Chairpersons interviewed were aware of the ADSI project but did not demonstrate sufficient knowledge or awareness of the policies and this could be a major barrier to institutionalization and sustainability.

Recommendation: *ADSI engagement with School leaders should focus on emphasizing participation and collaboration in implementing the policies. Further, there is need to give some push to schools to move from just having the policies and plans to mere tangible support such as inclusion of ICT budgets in school plans and using the ADSI lesson to influence policy and practice at both the county and national levels of shifting education policies.*

- **ADSI impact on Digital Schools of Distinction:** Generally, there has been great progress among the participating schools in as far as their progress towards Digital Schools of Distinction status is concerned. The midline gathered evidence of strong buy-in by the school leaders, growth and improvement of ICT infrastructure across schools, access to ICT equipment by both students and teachers, a stronger culture of ICT use in administration and management and generally a more robust ICT culture among most ADSI schools. However, the level of innovation and progress was varied across schools; some schools have taken greater ownership of mainstreaming ICT in education and school life while others were still a bit slow. There are those schools that strongly identify themselves as centres of ICT distinction and have gone a

Recommendations: *Engagement with school leaders must now focus on challenging them to innovate how to resource for additional equipment without GESCI's School leaders should also be encouraged to lobby policymakers to mainstream ICT budget s in eth capitation grants*

long way to mainstream ICT integration in their plans, but there were those where not so much had been done and this could impede sustainability. The main challenge however remains the inadequate equipment and ICT infrastructure which reduces the frequency of ICT use in learning.

- **ADSI impact on Teacher Professional Development:** The project has had a big effect on teachers' ICT literacy, their knowledge of ICT integration and why it is important. It has shifted their attitudes and norms around the use of ICT in teaching and changed their approaches. Generally, teachers report very positive experiences with the ADSI project which they believe is well designed, effectively implemented, relevant and useful for their professions. They speak highly about the impacts the project has had on their skills, knowledge and classroom practice. They consider the trainings enriching, futuristic and believe it helps them to be better teachers and to help students learn in a more fun, easy and collaborative way. They believe modern teaching approaches such as Project-based

Learning, use of webquests and simulations have not only enriched the content of what they teach but also helped them think critically and be at the forefront in generating content. There are 3 major impediments to their professional development; shortage of equipment, inadequate internet and in some cases time constraints due to workloads by the school timetable. Teachers also feel the training and the chat programmes could be adjusted to ensure maximum participation for most teachers and support better implementation.

Recommendations: *There is need for the ADSI Team to rethink the planning of the trainings and the chats to ensure maximum participation. One strategy is to make the chats continuous rather than one hour and also consult with SBCs when organizing the training to get the most suitable timings.*

- **ADSI impact on student learning:** ADSI has increased student access and use of ICT both at school and home. Students also rate their competencies and skills in ICT to have increased significantly as a result of the project. Students appear to have a greater understanding on the potential of ICT to improve the way they learn, they have also developed more positive attitudes towards ICT integration and have greater confidence in operating most ICT equipment. Most of the students approve of lessons where ICT is incorporated and describe them as fun, interesting and participatory making them learn easily, comprehend complex concepts but also recall more. Teachers report that learning has been more student-centred and that there are improvements in scores and learning outcomes among the students. Students also feel that ICT will be useful for them in their future life and careers and believe they are being prepared for the future. However, the challenges around infrastructure remain a huge impediment as students have to share resources from time to time.

Recommendations: *There is need for Schools management to innovate ways of ensuring students are exposed to ICT more. One approach is to ensure every school has a plan on how many times teachers should integrate ICT in a term as well as a plan for follow-up and supervision by the Principals or the Heads of Department.*

- Policymakers' feedback on ADSI:** Education officials have largely positive feedback on the ADSI project. They report that they like the holistic model approach of the project, its approaches that encompass; whole school ICT development, teacher professional development, equipment support and teaching support. They also like that the project aligns very well with national education plans and policies and have high regard for the ADSI teams that they work with. They positively report about the level of collaboration and joint planning and they do not consider the project intrusive or disruptive. They exhibit high buy-in and most have accompanied the project to the field and had first-hand experience. However, feedback also suggest that while the support for this project is huge among the policymakers, little seems to be happening to consolidate the gains, expand reach and or think about sustainability. The government appears to have an ICT equipment support agenda for schools yet its efficiency and veracity is not very clear. There is need for a new way of engagement in order to develop ideas on how ADSI and government could synergize their efforts.

Recommendations: *ADSI Programme Manager and country manager need to engage more with policy makers at both national and county levels to leverage the support mentioned in more tangible ways.*

GESCI should follow-up with government on the computer supply to schools programme with an aim of engaging them on the ADSI model.

6.0 Lessons for implementation

The findings and conclusions have unearthed several lessons that could go a long way in improving implementation, sharpening focus as well as improving the potential for sustainability of the ADSI project. The following are some of the key ones;

- On institutionalization:** Having school-level policies for integration of ICT is critical in creating awareness amongst stakeholders, supporting buy-in and assuring implementation. ADSI appeared to have gained better traction in schools where the policies were well communicated, displayed and embedded in the school plans and targets. Entrenching ICT integration in the strategic plan also appears to hold one of the greatest potential for ensuring sustainability of the ADSI goals and general impacts of ICT integration. However, more needs to be done to support most schools to move from just having the policies and plans to mere tangible support such as inclusion of ICT budgets in school plans and shifting education policies.
- On Digital Schools of Distinction Progress:** Schools where the Principals had taken ownership of the ICT integration appears to have made better progress, with teachers reporting better support and most appears to have innovated and managed to marshal more resources for infrastructure and more equipment. With a strong buy-in from the Principals, there are many possibilities for external support with equipment and infrastructure for the schools as there is evidence of schools that have partnered with NGOs and other government institutions for support.
- On teacher professional development:** There is a strong buy-in and appreciation of the ways ICT can improve the way teachers work. However, teachers grapple with the pressures of their daily workloads and sometimes need some push to be able to deliver tasks. Empowering the SBCs to

have supervisory roles and to have technical capacity to support is critical in managing delivery of the teachers. It was evident that in schools where the SBC had high ICT competency, teachers felt they were strongly supported and able to overcome technical challenges.

- **On student learning:** Project based learning has generated a lot of interest among students. Learning through developing and researching o has created a new shift in the way students view their role in learning and made students feel empowered and confident. Encouraging schools to have basic ICT literacy for the students is critical in unlocking the students' potential to achieve more. At the moment there are several schools that have made strides towards this goal but there needs to be a greater advocacy and sensitization among the school leaders for full adoption.
- **Engagement with policymakers:** ADSI has a great reputation among the policymakers at the County level. This has been as a result of close coordination and alignment of project activities with the MoE activities. There is a strong lesson that engaging and involving these policymakers in project activities such as classroom observation serves to assure them on what is going on. There is need to increase the level of involvement of policymakers and advocacy to start getting them thinking about their role in supporting the sustainability of the project.

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