



Impact of Shared iPads on Kindergarten Students' Collaboration and Engagement in Visual Storytelling Activities

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Abstract

There is much debate over the potential impact of the iPad and similar technologies when applied to classroom activities. Some view such resources as distractions that impede collaboration and mutual focus among students, while others see them as resources whose natural appeal to children makes them useful in facilitating cooperative activities and promoting students' mutual scaffolding of knowledge and skills. This study undertakes a qualitative analysis of kindergarten children's collaboration, engagement, and overall outcomes when performing drawing exercises on a relevant iPad app, as compared to performing them on paper. The study finds that the iPad is neither a natural aid nor a natural impediment to collaboration, scaffolding, or skills development, but is a viable alternative resource that can be applied to a Vygotskian model for promoting early childhood development.

Keywords iPad · Kindergarten · Children's collaboration · Drawing · Technology · Artistic development

Background of the Study

The use of iPads in the classroom has become common in a variety of educational settings, including at the early childhood level (Dashti and Yateem 2018). Some instructors and some parents have eagerly embraced this development, often viewing it as a means of keeping students engaged while also permitting them to learn everyday technical skills that will be important to work and general life in years to come. However, others have pushed back against the increasingly prevalent adoption of iPads and similar devices, often based on the view that they are distractions from content-learning or barriers to the interpersonal communications that are so often associated with children's intellectual and social development. This speaks to an underlying differences of opinion regarding technology's overall impact on interactivity.

It is commonly asserted that "all learning is social," although Maddux and Johnson (2010) have expressed worry that this wisdom has typically gone unexamined in educational theory and practice, especially as it applies to

classroom adoption of information technology. As those authors note, the cliché is largely derived from the work of Lev Vygotsky, who described an educational process whereby "children first develop lower mental functions [then], through social interactions with more knowledgeable others, such as more advanced peers and adults... eventually develop higher level mental functions" (Doolittle 1997, p. 84). Within this process, children at higher levels of development assist marginally less advanced peers in attaining positive outcomes. Skills are modeled by instructors and other role models, but pursued independently by learners.

These theories are referenced by Kim et al. (2016) in the context of a study dealing with the interpersonal effects of tablet computers. They claimed that iPad-like technologies facilitate multiple forms of engagement and provide students with opportunities to explore creative imagination in educational contexts. Vygotsky described such imaginative activities as essential to intellectual development in early childhood. Many such activities constitute storytelling among students at roughly the same educational level, something that Hamilton and Weiss (2007) described as a crucial life skill and the essential means by which young children retain information.

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iPads as Verbal and Visual Storytelling Tools

It is easy to recognize the potential function of iPads in facilitating this kind of storytelling. Naturally, with the technology having already been widely adopted in early childhood classrooms, there are apps designed for that specific purpose. Researchers have accordingly begun to examine the effects of these resources. For instance, Hatherly and Chapman (2013) examined what happens when children generated stories using the iPad in class and published them online or shared them via e-mail or social media with other students or with parents and stakeholders. They found that this practice boosted the engagement and personal sense of accomplishment of some students, as well as created a review process by which students examined their own communication and storytelling, with an eye toward reaching a higher level at the next activity.

Latham and Ewing (2018) recognized the importance of storytelling as a technique of intellectual scaffolding. But they lamented the tendency of modern education to separate visual and linguistic methods of storytelling. In fact, Lisensbee and Ford (2018) went even further by noting that traditional storytelling has tended to “focus on narratives demonstrated through the six language arts in the form of reading, writing, listening, speaking, viewing and representing visually” (p. 130). They went on to say that digital storytelling offers an outlet for these same skills while also encouraging “the use of critical thinking and problem-solving skills, collaboration with others, and creatively narrating experiences” (p. 132).

Latham and Ewing (2018) noted that drawing is a language children often use in the creation of stories about their experiences and ideas, even before they fully develop spoken or written languages. But once this development takes place, it is often made to override visual expression and visual learning. The researchers suggested that this may deprive students of a means for exploring the location of their imaginations and for understanding metacognitive processes.

Furthermore, Latham and Ewing (2018) identified grounds for believing that visual and linguistic storytelling can be mutually supportive, since language use has been seen to improve when children mutually discuss one another’s art. This finding points to how visual and vocal interactions with the same iPad app could also go hand-in-hand. And that conclusion was further supported by Siagto-Wakat (2017), who determined that doodling, and perhaps other non-verbal tools as well, help to alleviate the anxiety involved with interpersonal communication, in the context of learning a secondary language.

Lisensbee and Ford (2018) made much the same observation when looking at the overlap between traditional

and digital storytelling. They found that the collaborative features of digital technologies provided particular benefits to children with special needs and to English language learners in predominantly English-speaking classrooms. Such findings highlight the potentially beneficial roles that iPads can play in education and more specifically in the promotion of social engagement and intellectual collaboration among students.

iPads as Aids to Scaffolding

More to the point, the findings seem to fit neatly with Vygotsky’s description of how students help one another with scaffolding for higher-level development. The mutually beneficial effects of separate but interrelated activities can be explained in terms of different students having different levels of skill with the performance of each activity. When visual and linguistic storytelling are both used to demonstrate the same concepts or illustrate the same ideas, students may use either form of expression in order to communicate their own ideas and to understand those that have been expressed by others. This way, one student’s linguistic storytelling can improve another student’s understanding of corresponding images, and vice versa.

In this sense, by helping students to re-integrate both forms of expression, the iPad demonstrates clear potential as a tool for both content-learning and visual arts education, and more specifically for classroom activities that promote overlap between the two. Some such activities can be said to fall within the category of “social dramatic play,” which is important to Vygotsky’s description of the scaffolding process and the means by which intellectual skills develop at an early age. Fleer (2016) specifically pointed out that the iPad can facilitate not only storytelling but also a new variation on this sort of social dramatic play.

In traditional classroom settings, as well as in ordinary direct interactions among children, the educational role of storytelling is often mediated through theatrical exercises. At first, it may be difficult to understand how iPad activities could replace interpersonal play-acting. But in suggesting that they can, researchers like Fleer (2016) have merely raised questions about the essential nature of social dramatic play and whether technologically-mediated activities can still include enough student-to-student interaction that they still serve the same basic role.

Rowe et al. (2018) found that dramatic performances generate more cooperation among students in general, and that this might help foster creativity and generate better metacognitive outcomes for those students. But Fleer (2016) suggested that when used effectively, the iPad may facilitate play in much the same way that physical objects did in traditional classrooms. Also, such technologically-enriched

interactions could even make up for some of the deficiencies Rowe et al. (2018) recognized in traditional forms of educational play-acting.

They noted that shy or inhibited children may be less likely to benefit from the interactivity of theatrical performance unless targeted with specific interventions to help them overcome their inhibitions or provide them with other means of expressing and developing the same sort of creativity. One prospective solution may involve adoption of multi-modal practices and resources in classrooms that involve artistic exercises. And the iPad is certainly a potential example of such resources, given the diversity of its applications and modes of usage.

iPads as a Viable form of Classroom Play

Axford et al. (2018) agreed that a technologically-enriched classroom can provide effective modern analogues to traditional, physical means for modeling and scaffolding of developmental activities. Specifically, they noted that with the correct selection of apps, children can use the iPad to develop fine motor skills that would otherwise have been developed through outdoor activities and manipulables. If the iPad can truly stand in for at least some of the educational activities that were once conducted in the physical world, it is not much of a stretch to conclude that play-acting is among these activities. One might argue that while social dramatic play balances verbal communication and theatrical demonstration, certain iPad activities balance verbal communication and visual communication to similar effect.

This is essentially the argument that Beschorner and Hutchison (2013) made when they identified the iPad as a literacy teaching tool that provides students with multiple means of encountering and associating meaning with symbols, as well as unique opportunities to share their own expressions of that meaning. Such opportunities include the production of stories that can be played back, analyzed, and modified. The underlying cognitive processes are arguably similar to those that are utilized when children discuss and modify scenarios during educational play-acting.

Kim et al. (2016) even went so far as to suggest that the iPad creates advantages over low-tech alternatives, specifically by providing multiple modes of expression for the same concepts and student interactions. They described iPads and similar tablet devices as unique tools that allow for “various instructional strategies that cannot be realized in traditional classrooms” (p. 210).

Additionally, Gerard et al. (2012) described tablet computers as encouraging active learning to a greater extent than more traditional classroom resources. As an aspect of this active learning, older students reported an increased sense of connection with instructors when using such devices.

Meanwhile, younger students, and specifically children at literacy centers, demonstrated an affinity for direct engagement with each other and for collaborative problem solving, sometimes as a consequence of sharing a single device.

According to Dobler (2011), far from disengaging from each other in presence of new technology, students may actually use it to help one another when a teacher is not immediately present to their task. Meanwhile, because iPad apps can be used for drawing in conjunction with other forms of expression, it can be connected to what Latham and Ewing (2018) identified as some of the effects of visual arts activities: the improved development of cognitive faculties that are useful for both innovation and personal empathy. This in turn may improve students’ abilities to interact with one another in positive ways while working together to solve problems.

This should undermine what one might expect to be a common argument against the adoption of iPads and similar devices as classroom technologies, namely that increased engagement may be short-lived. Khoo et al. (2015) explained that some critics have tended to simply regard new classroom technologies as novelties, the appeal of which will eventually wear off without having any noticeable impact upon educational processes or outcomes. According to this view, initial observations of increased engagement can be explained away as short-term responses to a new, shiny object being shared among students who would otherwise have little interest in collaborating with one another.

Potential for Better Application of Technology

However, many educators can be expected to respond positively to anything that increases student engagement, especially if it does so without any further effort on the part of the teachers. This is not to say that such an effect should be expected or even embraced. But if students respond immediately to a new technology, there is a potential opportunity to prolong their interest. Khoo et al. (2015) claimed that when teachers criticized the novelty of iPads, they tended not to consider the different ways in which they could be used, much less the ways in which classroom practice could be built around the particular strengths of the iPad to create what the authors referred to as “iPAdagogy.” This leads to a conclusion that seems to run throughout much of the current literature: that the problems some stakeholders see with the iPad are problems with its ineffectual use and not with the device itself.

Much of the existing literature emphasizes the importance of the teacher’s role in realizing the iPad’s potential to facilitate effective and multi-modal interactions among students at roughly the same stage of development. Additionally,

Daccord and Reich (2015) gave reasons to conclude that instructors have often failed to recognize this potential, and thus have failed to adjust pedagogy in order to utilize it. These authors indicated that some teachers tend to see tablets only as another tool for note-taking, while some have recognized only the finished product of tablet-based activities while remaining blind to the processes that the technology helped to facilitate.

Yet Palmér (2015) indicated that these potentials are not ingrained into the iPad itself, but are dependent upon the choice of apps that are installed onto it. But the same author's references to differing app quality called attention to some of the reasons why teachers and other stakeholders might not be eager to exploit students' natural affinity for the iPad, or to develop their own skills at utilizing the same device. At the same time, the positive observations that other researchers have made of iPad use make it clear that there is significant potential to be unlocked. Yet this potential is not a natural feature of technology; it exists at the intersection of tech adoption, pedagogical practices, and student engagement.

Research Questions

The above review of existing literature establishes the potential for tablet devices and relevant apps to promote student collaboration. More specifically, it points to the perceived role of multi-modal iPad activities in helping students to model and scaffold higher-level skills for one another. Among these multi-modal activities are those that bring together verbal and visual expressions for the same purpose, in the form of collaborative story telling. With this in mind, the following study seeks to answer these two questions about kindergarten students who are tasked with using iPads to complete visual arts tasks in small groups:

1. Do children engage differently with activities when drawing stories on an iPad instead of on paper?
2. How do children collaborate with each other when completing activities on a shared iPad, versus completing simultaneous activities on paper?

Methodology

One kindergarten was chosen randomly from each of six educational districts in the State of Kuwait. Two classes were chosen randomly from each kindergarten; therefore, 12 classes in total participated in the study. The two classes in each kindergarten were assigned randomly to the two groups of the study, group A and group B, each of which was divided into six teams. The six teams in each

group were then tasked with contrasting activities according to the methodology below.

Group A: On day one, the children were trained on the "My Story" app on an iPad and on the next day they were instructed to use the app to create an illustrated story. On the third day they were asked to draw the same story or a different story using paper and materials available in the classroom's "art corner", like pictures, colored papers, feathers, etc.

Group B: On the first day the children were tasked with drawing the story using paper and materials available in the classroom's "art corner". On the next day the children were trained on the "My Story" app on an iPad, and on the third day were asked to use the iPad for drawing the same story or a different story with the "My Story" app.

A parental consent form was sent to the parents of all chosen classes. After receiving parental approval, four children (two boys and two girls) were assigned randomly from each class as a research team for drawing a story. An assent form was read to the children and they verbally agreed to participate in the study. At the beginning of the study, 48 children participated, in 12 teams of four. However, the size of some teams varied over the course of the study. In some cases, a student refused to work as part of an assigned team or with a specific partner. Other students were absent on one day of the study after participating on a previous day. Therefore, some teams shrank to less than four students, leaving a total of 40 participants (17 boys and 24 girls) who provided complete datasets. The participants' ages ranged from four years and six months to six years old. Before starting the research, each child was asked if he/she had used the iPad for drawing before. All children's answers were no.

One researcher worked directly with the children and explained that they would draw a story of their choice as a team, once using art materials and once using the iPad. They were permitted to ask for help at any time during the study, while using either paper or iPad. The researcher observed the children, their discussion, and their collaboration, and recorded the findings on an observation sheet for each child. The children were given a choice of drawing stories from their imagination, a story the teacher told them before, or a popular story. They were also permitted to draw either the same story or a different story using each of the two methods. The researcher directed, but did not force, the children to work together when she noticed that some children were not allowing others to participate in drawing the story.

In each kindergarten, the study was applied for one week (four to five days) during the learning corner period, which was 45 minutes. Three days were dedicated to drawing the stories and learning the "My Story" app. On the fourth and fifth days, the children were interviewed separately. The interviews took 10 to 20 min for each child.

The App: “My Story”

Tablet computers were used because children tend to prefer them and they were already in use by kindergartners (Dashti and Yateem 2018). In addition, the size A4 papers (11.7 in. × 8.3 in) used at the art corner in the participating kindergartens is close in size to the iPad’s screen (9.4 in. × 6.6 in). The iPad screen size is more appropriate for drawing by children than a mobile phone’s screen since the children use their fingers to draw the story or write words.

In selecting an app for the study, the researchers made sure they could answer in the affirmative to each of these questions:

- Is the app appropriate for children 4–6 years old?
- Does it have simple menus with icons?
- Do the size and shape of the icons make them easy to locate and recognize?
- Is it easy to reveal hidden icons?
- Is it easy to move between the app’s sections?
- Can the child draw using his/her fingers, and insert pictures?
- Is it easy to add or delete pages and move between pages?
- Is it easy to insert, delete, resize, and move objects?

Several apps were chosen and tried with 10 children of the same age as the participants. ‘My Story’ school edition, developed by Bright Bot, Inc. was chosen since it met the above criteria and was preferred over the alternatives by eight of the children.

Data Collection

Observation Sheets

Consisted of 29 items divided into three major sections. The first section was about the children’s behavior while drawing and included six items. This section examined whether each child was cooperative with others, asked for help, helped others, and encouraged others. The second section examined seven skills and materials used while drawing the story on paper, plus 15 skills used with the ‘My Story’ app. The third section involved student enjoyment and consisted of four items.

Interview

Children were asked five questions after the study to ascertain which method they prefer for drawing a story and why, which parts of the app they like and why, which parts they

did not like and why, whether they would prefer to draw the story with their friends or alone and why, and finally whether the teachers did a good job of training on the app.

Interviews were carried out in Kuwaiti Arabic, the children’s mother tongue. All dialogue was later translated into English, and results were recorded in that form.

Results

How Children used the App

The children opened the app by touching the app’s icon on the iPad screen. Then they selected the author for their group from the “Author screen”. The teacher assigned an author for each group. After that, the children chose the “Add a Book” icon. Most groups discussed with each other the idea for the story but didn’t give a name to their story. Those groups went directly into drawing the story, without entering anything into the “Title” field. Most of the groups cooperated in choosing the idea for their story. The children were able to add a page by touching the “+” in the middle of the right border of the screen. To move between the pages, they touched the left and right arrows on either edge of the screen.

The children chose either a color or a picture for the background of their pages. This step was done by choosing the pen icon, which reveals available choices for the background. After that, the children added pictures to the background, by touching the picture icon, which brings up the pictures library. The children scrolled up or down to see the different pictures, then touched the chosen picture to insert it on the page. They were able to delete unwanted pictures by touching the “X” on the picture’s frame. They were also able to copy, move, resize, or turn the picture. A few children used their fingers to draw on the page and some used both pictures and drawing. Children used the eraser icon to erase unwanted drawings by wiping it with their finger.

Only two groups added audio to their story. They started recording by pressing the “microphone icon” which became green with the play option. To stop recording they pressed the button again. The audio could be deleted by pressing the “X”.

None of the children showed interest in writing text and therefore they didn’t use the writing option in the app. Also, it was noted that the children did not use the camera option.

At the kindergarten level, the students are not familiar with the voice recording and camera features, and this may explain why none of the children used the camera, while few of them recorded their voices. Also, they used the app only once as part of the study, but continued use throughout the school year might have encouraged more interest in other features of the app.

Question 1 “Do Children Engage Differently with Activities When Drawing Stories on an iPad Instead of on Paper?”

For the paper story, children used different materials that were available at the “art center”: colored pens, stickers, feather, glitters, colored papers, cotton, and pictures. Two teams from group A and five teams from group B (which began with the paper exercise) used different materials beside the colored pens. This sample of the children’s dialogue highlights aspects of their processes: “I will put glue on the flower, and you stick them”, “Let’s put some feathers for the bird”, and “Let’s glue this picture.” In only one team, one of the girls drew on the same papers as other team members. In all the others, each child drew on separate papers.

For the iPad drawing, most of the participants in both group A and B used the background scene, in-app pictures, and their fingers to draw their story. Only two teams from group B used voice recording, with one participant saying, “Let’s put our voices in the story,” and they seem excited. Also, two teams of group B did not use background scenes. All the children used the options for in-app pictures, often after announcing their interest in finding certain pictures (e.g., “I would like to put a circus tent, boys, a car” or “I want to put starfish”). The children were able to resize, delete, and move pictures to different places on the same page. “I like the pictures on the iPad,” said one student. “We can move them anywhere on the screen.” All teams except one team in group A used more than one page for the iPad story. In some teams, each child used a page to do drawings; in others, several children drew on the same page.

At the kindergarten level, the students are not familiar with the voice recording and camera features, and this may explain why none of the children used the camera while few of them recorded their voices. But most of the children liked using the background pictures, as it was something new, but easily accessible for them. It allowed them to create drawings without the familiar white backgrounds.

It is also worth noting that because of their ability to add elements to the story easily via the iPad, many children expressed greater aesthetic satisfaction with the finished product. Their story pages on the iPad mostly featured a background, and many children specified that they liked the background pictures because they covered the entire page and did not leave white spaces. This is a feature that would be difficult for them to emulate on their own, with their existing levels of artistic ability.

The two teams who did not use the backgrounds were from group B, which used the papers first. Because these children did not color the paper backgrounds, it may not have occurred to them to create backgrounds later, when they switched to iPad.

Several children said that they liked the in-app pictures because they looked better than hand-drawing. This

seems to point to different approaches to creating visual art on the iPad versus paper. Specifically, it suggests that the iPad gives students an opportunity to avoid efforts to improve their own drawing skills. Some students specifically expressed dissatisfaction with their paper drawings. “You see my picture on the paper was not nice and I could not delete things I didn’t like,” said one, adding, “But with the iPad my picture is nice, and I can remove anything I don’t like.” Others were similarly pleased by how easily they could change and customize the iPad drawing. “My pictures look nicer on the iPad than the paper; I can change the size of the pictures,” said one. Another noted: “I can delete what I don’t want, and continue on the same page, but with papers I need to use a new page. Also, we can record our voice.”

Most children in both groups preferred drawing stories with the iPad because it has many pictures that helped them draw the story: “There are many pictures you can use for the story.” Also, the in-app pictures gave them new ideas: “The pictures on the iPad allowed me to think of a new story,” said one. Many of them pointed out that they enjoyed changing the size, positioning, copying, and deleting the pictures, which allowed them to make their drawings neat and saved them from having to use new sheets of paper to redraw the same scene. This may explain why the paper pages had fewer drawings on them, as the children didn’t like some of the items on the page and since they couldn’t delete it or change its size or position, they started a new page.

In-app pictures are right at their fingertips and can be added in a second, “We just choose the pictures and put them on the page,” said one participant. With paper, children usually have to rely on their own drawings to get the pictures they want, and this challenges them to try drawing things they’re not used to, but also limits them to images in their working memory, and often leaves them less satisfied with the final product: “My pictures look nicer on the iPad than the paper.” With the app, they can just search and find the image they want and can judge its aesthetic value immediately.

Even though children tended to prefer working with the iPad, many noticed the downside of having to wait their turn before using it. Some also became bored or disengaged, especially if they were partnered with one or more other students who dominated the activity. Some of them recommended that each child should have an iPad. One complained: “I don’t know about the program; girl (1) didn’t let us draw. With the paper we were able to draw.” Similarly, another said, “When we used iPad, I had to wait for my turn, but I can take the papers any time to draw.” And one child highlighted the potential to take the activity outside the classroom, saying, “I finished fast and I’d like to put the program on my iPad; but I have to wait long for my turn [when sharing].”

Two girls from group A preferred the paper drawings. One of them explained that she wasn't limited to certain ideas and she felt that the iPad pictures restricted her imagination. The other girl said, "Papers are more comfortable; paper gives me more freedom to express myself; I can draw leaves bigger than on the iPad." But this comment suggests that the girl forgot about the ability to resize pictures with the app.

Most other children had a different perspective on iPad and imagination. They mentioned that browsing through the app for pictures inspired them with ideas for their story. Therefore, the pre-loaded pictures may represent a means of actively exploring visual imagination that is absent from familiar paper drawing tasks. At the same time, the iPad activities seemingly help children to avoid criticism, conflict, sadness, and withdrawal. These issues were apparent in the paper drawing activities, and they sometimes resulted in disengagement from the task.

It should be noted that different findings with regard to engagement might be observed if students had a greater level of familiarity with the iPad drawing app. After all, the children were already used to using papers for drawing, and so most of them grabbed a paper and started drawing impulsively. The iPad activities generally required a period of adjustment to the new technology, meaning that their attention in that case was split between exploring the visual arts activity and learning the resource through which it was mediated.

The children appeared to enjoy the familiarity of the paper resources insofar as they were able to draw at the same time as one another and could maintain their own pace by taking a paper from the pile in front of them and starting to draw at any time. On the other hand, many stated that they liked the iPad because of the availability of pictures, and because of the ability to delete, resize, and move the pictures.

Despite the higher amount of empty space in paper artwork, most groups produced a higher number of pages overall, as compared to the number of virtual pages on the iPad app. There were apparently multiple causes for this. In some cases, children explored their visual imagination by drawing on more than one page at a time, and this cannot realistically be emulated on the iPad. In other cases, students reached for new paper because they could not erase a drawing they didn't like. Of course, students can start over on the iPad, as well, but doing so will not preserve their original artwork.

In still other cases, the higher number of paper pages seemed to simply be the result of perceived convenience, as students could grab paper at any time, for any reason. As the extra pages on the app are not obvious, one child from group B thought that they had only one page on which to draw. One possible reason for their confusion is that the symbol (+) for adding a page is small, light grey, and positioned

in the middle of the right border of the screen, thus making it difficult for some children to notice, especially when there are drawings or backgrounds. This highlights different challenges in terms of attentiveness, problem solving, and symbol recognition that could arise from using high-tech alternatives to traditional paper activities.

Question 2 "How Do Children Collaborate with Each Other When Completing Activities on a Shared iPad, Versus Completing Simultaneous Activities on Paper?"

The findings show no significant or recurring differences regarding the children's collaborations. In both sections, collaboration seemed to be a function of personality, not method of drawing.

Each group used only one iPad author profile and most groups cooperated in drawing one story. In some groups, one child or two were drawing on the iPad while others helped them, while in other groups, children took turns drawing on the iPad. On one team of group A, a girl was in control of the iPad and didn't allow others to draw or accept their suggestions, which made the boys withdraw from both exercises. "She took the iPad for herself all the time, and she doesn't listen to us," one complained. Although the children drew separately when using papers, in most of the groups the members had mutually supportive discussions and complimented one another's drawings or recommended other features to add.

In Group A, each of the children verbally announced what they intended to draw before doing so. But it is worth noting that their descriptions were often more detailed than the drawings themselves. Girl (1) drew a pair of sisters in a garden and said that after leaving, they visited the zoo. But she did not draw the zoo. Similarly, after drawing a beach scene, girl (2) announced that "the boy went swimming," but this was not included in her drawing.

So even though there was an atmosphere of verbal support in this exercise, the participants' relative isolation may have prevented them from seeking help to produce more complicated visual or story elements. But this undercuts the earlier suggestion that the iPad might give students an opportunity to avoid exploring the upper boundaries of their artistic ability. Ultimately, it was not clear from the data whether the same students would have sought help with similar scenarios during one exercise and not the other. Neither was it clear whether the stories' visual presentation tended to be significantly more complex in one exercise than in the other. These questions represent one potential area of further research.

Children's willingness or unwillingness to ask their peers for help is almost certainly influenced by the social dynamics among them. And some of the data from this study suggests that those dynamics don't change much from one exercise

to another. Or, as an alternative interpretation, it may be that the dynamics established in one exercise tend to influence the ways in which students interact when the switch from physical materials to iPad, or vice versa.

Group B certainly demonstrated similar interactions in both exercises. When using paper, they first decided collectively on a subject for their drawings: a garden. Girl (1) then proved to be faster than the others as they all worked on their own papers. She drew grass and flowers, and spoke aloud about her story while the other children watched and listened. “One day there was green grass, yellow sun, clouds, three flowers,” she narrated. “Two cats fighting, and one died.” Boy (1) and girl (2) copied her by drawing the same sun and flowers, but also made their own additions. Boy (1) said, “I will make a boy playing.” Girl (2): “I will draw a girl smelling flowers.”

Each of the children looked at the others’ pictures throughout the process, but girl (1) received the most attention and effectively led the group. The others asked not only what she was drawing but why she drew it. Boy (1) pointed to what looked like cat’s head and asked, “What is this?” Girl (1) replied, “The cat fought the other cat, so it died.” When girl (2) asked why he drew a table, boy (2) replied, “The boy goes home to eat lunch with his family. This communication also came to include recommendations and instructions, mostly from girl (1), who told girl (2) to “draw nice flowers” and boy (2) to “put rice and juice on the table.”

Girl (1) continued to lead the group in the second session by drawing on the iPad while the others helped her choose backgrounds and pictures for the story. At the start, girl (1) drew with her finger and girl (2) reminded her “there are many pictures you can use for the story” included in the app. Boy (2) suggested that she “choose two boys with a car.” Girl (1) accepted this recommendation but added narrative context: “Ok, the boys drive the car to the beach.” The team continued the story by adding pages about the beach, then had the characters go to the park and finally home. Girl (1) also added detail to other visual elements chosen by her partners.

In contrast, Group A had less success with allowing some members to exert more influence than others. In that case, the two girls were more in control. In the first session, girl (1) chose to make a princess the subject of the iPad story, and girl (2) agreed with her. The boys begrudgingly accepted this, but ultimately withdrew from the exercise. This decision may have been influenced the belief that their voices weren’t being heard, as well as by their general dissatisfaction with the story.

Girl (1) started the drawing by choosing a garden background and adding a policeman. Boy (1) asked, “Why did you put a policeman?” and girl (1) replied, “To watch people and guard the place.” After she added a princess with a guard, girl (2) took the iPad from girl (1) to draw

the second page. Boy (2) objected: “I want to draw, and I don’t like your story.” But when girl (2) replied, “No it’s my turn,” boy (2) refused to continue and left the group, saying, “I don’t want to draw with you.” Girl (2) started drawing by choosing a school scene, then added a car and children. Boy (1) watched the girls quietly throughout these interactions.

The next day, when it was time for the paper story, one boy said on behalf of both, “We don’t want to work with you; you don’t allow us to draw what we want.” When the boys left the table, the girls began working together on a single story. In addition to drawing, they used dried flowers. Girl (1) dictated a cooperative strategy: “I will put glue on the flower, and you stick them.” Then then proceeded to make three more cooperative drawings consisting of a beach scene, a house, and a girl.

One of the teams in Group B experienced similar conflict from the very beginning. Each child took a paper and started drawing his/her story. The instructor reminded them to draw together but all of them insisted on working alone. After 10 min, boy (1) stopped drawing and left after saying, “I don’t want to continue.” When asked why, he said, “I don’t want to draw anymore, and I want to go to another corner.” Boy (2) followed him. The girls continued drawing. Girl (1) drew her story while girl (2) cut out pictures, colored them, and glued them to her paper.

In the second drawing section, girl (1) took the iPad and started drawing. She didn’t allow the other team members to participate and didn’t listen to their suggestions. They waited for fifteen minutes, but when she still didn’t allow them to participate, the other members left. The researcher continually reminded girl (1) to collaborate with the others, but she insisted on working by herself. Girl (1) said, “I want to draw alone; I don’t want them.” Therefore, only girl (1) used the iPad.

In one team of group A and two teams of group B, students complained of partners criticizing their drawings. In two teams of group A and one team of group B, one of the children repeatedly said things like, “I don’t like their ideas and their drawings are not nice”, “Others’ drawings are scribble; I don’t like it”, and “I like working alone because the others will ruin my pictures.”

Although these conflicts impeded certain participants’ ability to complete the exercises, the overall data suggests that as a general rule, the students did not mind working together on either exercise. The exceptions appeared to derive from a simple mismatch of personalities, or difficulty in managing mixed-gender groups of young children. There was no evidence of interpersonal cooperation being affected by whether the children used the app first or began by using paper to draw their stories. And no data suggest that early exposure to the high tech or low-tech activity alters students’ opinions of or experiences with one activity or the other.

Cooperation was not universal but was on roughly equal display in both the paper drawing and iPad scenarios. Cooperation was clearly evident in one Group A team, where participants regularly took turns drawing on the iPad. That cooperation even yielded some meaningful contributions to one another's stories, with the participants giving suggestions to one another or giving direction to those who didn't know how to do something. The children discussed the story then started creating it on the iPad, depicting a family going different places.

Girl (1) in the Group A team began the exercise by saying, "I like the beach, I will draw it," then chose a beach background and used her finger to draw the rest of the picture. She was able to resize, move, and delete parts of the picture without assistance, while others observed. Boy (1) then exhibited a different skill set by creating a snow scene using the pictures from the app. Boy (2) chose the street scene and added car pictures, saying, "I will put many cars in the street." And despite the overall independence of each member of that group up to this point, boy (1) tried to influence mutual understanding of the story by observing, "Then they'll crash into each other."

The group's independence was challenged when girl (2) took her turn with the iPad. Though she had some difficulty using the app, she received help from the other children, especially girl (1). After choosing a theater scene, girl (2) said, "I don't know how to draw princes" and girl (1) guided her through the process of adding characters. The other members of the team helped her to choose the characters, colors, change the size of the objects, and delete what was not appropriate.

Discussion

One cannot confidently conclude from this study that a tech-enriched classroom in general, or an arts classroom that utilizes the iPad in particular, is a better learning environment for kindergarten students. But one also cannot conclude that such classrooms are worse than their low-tech alternatives. In fact, this study seems to support a trend that was highlighted at the outset of the literature review: that there is considerable uncertainty about whether such resources contribute positively or negatively to student interaction and the scaffolding of relevant classroom skills.

Certainly, this study does not point to the sort of affinity for collaboration that Gerard et al. (2012) identified as stemming from tech-enrichment and specifically from the shared use of a single device. Neither does it support Page's (2002) conclusion that students in tech-enriched classrooms were better able to work collaboratively in small groups. Instead, the necessity of device-sharing was sometimes a source of conflict and even a reason for one or more students

disengaging from the study. Yet iPad-sharing also showcased the potential for collaboration, provided that the technology was implemented properly by students who were otherwise capable of getting along.

This speaks to Khoo et al.'s (2015) reference to "iPädagogy" as an instrumental component in determining whether iPads function as a useful classroom tool. Similarly, the findings of this study underscore the notion that neither the positive nor the negative impacts of the iPad on classroom interaction are inevitable. Such technologies represent only one tool, which stands alongside paper and other traditional resources as a potential conduit for effective student engagement. But that engagement, at least in most cases, must be facilitated by a teacher or other authority figure.

This facilitation was largely absent from the present study, and so students proceeded through the study without a means of conflict resolution and real-time scaffolding that would ordinarily be present in classroom conditions. Crucially, the presence and participation of an authority figure is relevant to the Vygotskian processes that are a recurring feature of the literature on this subject.

Indeed, Churcher et al. (2014) noted that where at least some educational technology is concerned, adult overseers have a clear role to play in mediating student content and facilitating the "co-construction of knowledge." Again it should be noted that such processes can be carried out either through iPads and related technologies or through traditional classroom resources. Still, there is nothing in the findings of this study to suggest that the modern technology is detrimental to scaffolding or the collaboration that makes it possible.

The actual effect might vary from one student to another and from one activity to another, but the findings of this study do suggest that students might be particularly interested in using iPads as a tool for scaffolding, simply because they almost universally enjoy completing classroom activities using that resource. To the extent that this factor can be used to encourage more technologically-mediated collaboration, it can also be used, alongside proper teacher guidance, to help students explore the multiple forms of creative engagement that Kim et al. (2016) identified as being common to the iPad and also capable of encouraging childhood intellectual development in line with the Vygotskian model.

It should also be mentioned that certain potentially important aspects of iPad usage in an early childhood arts classroom were referenced but not closely examined in this study, and could be topics for further research that is relevant to the existing literature. For instance, very few of the participants in the study utilized its audio recording features, even though these help to set the iPad apart from paper resources while also pointing to the ability of modern classroom technologies to reintegrate visual and linguistic methods of storytelling—something that Latham and Ewing (2018) expect to be helpful in guiding students to explore

their imaginations and understand their own processes of metacognition.

Conclusions and Recommendations

The overall picture created by the above findings suggests that, in general, kindergarten students who have been tasked with producing visual art both on paper and on the iPad's "My Story" app tend to prefer the latter. However, this preference appears to primarily stem from the versatility of the app as a tool for creating pleasant-looking pictures and providing additional dimensions to the story that children are trying to tell. The preference cannot, however, be said to stem from greater levels of cooperation among students who are sharing a single iPad device, despite the fact that some of the existing literature declares iPads and other classroom technologies to be powerful facilitators of such cooperation.

This is not to say that iPad or the "My Story" app do not or cannot encourage cooperative activity in the creation of visual art by kindergarten students. But it does suggest that cooperation and mutual support are not natural effects of that technology and thus cannot be taken for granted in absence of appropriate pedagogy. As to whether it is worthwhile to establish the appropriate pedagogy and support the broader integration of iPads into classrooms that are engaged in visual learning, more research is needed before any confident conclusion can be drawn.

One question that might guide such research relates to the reasons behind many of the students' expressions of preference for iPad-mediated drawing. It is noteworthy that a number of those participants emphasized the ease with which they were able to add elements to their pictures or their stories which they might have had a difficult time drawing otherwise. In order to determine the desirability of that feature from a teacher's perspective, future research should investigate whether this promotes or impedes students' imaginations, and whether they typically use pre-made images in order to expand the scope of the visual story or to avoid challenging themselves to create images that are slightly beyond their current skill level, in what Vygotsky called the zone of proximal development.

This leads to a somewhat more general question that might provide the basis for future research: Do children express their imaginations differently via multi-media technology than they do via paper drawing, direct conversation, and play acting? Without a clearer sense of the effects of each mode of expression on students' metacognition and approaches to visual learning, it is difficult to draw any conclusion regarding which resource, if any, is more beneficial to student development and outcomes.

While fundamental questions along these lines remain unresolved, the above findings paint a somewhat negative

picture of the iPad's impact on student cooperation in the production of visual arts. Children who failed to share the device or who did not get along while doing so were more likely to disengage from one another completely, implying that even if each student was provided with a device of his or her own, the work would tend toward more isolation and less collaboration than were seen in the paper drawing sessions.

But rather than leading to the conclusion that iPad should be avoided for visual arts curricula, this conclusion only leads to a further recommendation for future study, namely an investigation into whether active mediation by teachers or other adults may have the effect of overriding the isolating effects of the technology. This is arguably a desirable outcome, since the iPad and "My Story" app did have clear positive effects, including an increase in students' self-professed engagement.

These positive effects may be said to support the recommendation that, wherever possible, iPads or similar technologies be made available alongside paper and pencil as part of a multi-modal visual arts classroom.

Pending further research into whether student preferences reflect better outcomes or just a less challenging process, it seems reasonable to conclude that there are both benefits and drawbacks to the use of iPads in the production of visual arts. It is then equally reasonable to conclude that such resources can be integrated into receptive classrooms in a way that utilizes them for instructional and scaffolding purposes without allowing the children to rely on them too heavily. This, in turn, may help to enhance the benefits of multi-media platforms, while mitigating any adverse impact on the student's individual development of artistic imagination.

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