Playing to Learn: How After-School Clubs Influence Teachers' Beliefs About Instruction

Linda K. Schlosser and Betsy Balzano

SAGE Open 2014 4:
DOI: 10.1177/2158244014558031

SAGE Open
October-December 2014: 1–8

DOI: 10.1177/2158244014558031
sgo.sagepub.com
SAGE

Playing to Learn: How After-School Clubs Influence Teachers' Beliefs About Instruction

Linda K. Schlosser[1] and Betsy Balzano[2]

Abstract

The purpose of the study was to uncover teachers' emerging beliefs and perceptions about developmentally oriented instruction as they participated in professional development workshops and applied the strategies learned with students in after-school clubs. Twenty experienced, urban teachers volunteered to attend monthly workshops where they engaged in math games, simulations, and problem-solving activities based on the Common Core and modeled by college faculty. Teachers used the activities to offer 90-min weekly math clubs for sixth-and seventh-grade students at their schools. Twelve pre-service teachers enrolled in a college course on adolescent development acted as volunteers at the clubs. Data were collected through (a) questionnaires and rating scales, (b) informal group interviews, and (c) weekly electronic journals. Data collected revealed changes in teachers' beliefs about and perceptions of effective instruction as they applied game-based activities in the after-school club settings. Eighty percent of the teachers reported high levels of student engagement and greater sustained interest in problem-solving, and connected their observations to beliefs about game-based learning as an effective and age-appropriate instructional strategy. Pre-service teacher volunteers reported similar observations: The majority of club members were actively engaged in solving complex problems during game-like activities, particularly when volunteers used scaffolding strategies to support students' participation.

Keywords

math strategies, teaching games, middle school

Middle school educators believe that young adolescents learn in ways that are developmentally different from older adolescents, and that the middle years are among the most significant periods of cognitive, socio-emotional, and biological growth (Association for Middle Level Education, 2012). Yet research shows that most experienced teachers do not feel prepared to apply knowledge of adolescent development to teaching. In a 2008 survey of schools of education, the National Council for Accreditation of Teacher Education (NCATE) found that, while the majority of respondents were required to take a human development course as part of their teacher preparation programs, respondents did not connect students' developmental characteristics to the types of lessons they planned and the instructional strategies used (Pianta, Hitz, & West, 2010).

Even recent efforts to improve achievement outcomes through the implementation of a common core of academic standards have not taken the developmental sciences into account. To hold students to higher standards and build those standards from grade to grade may do little to improve student achievement without teachers' understanding of the socio-emotional and instructional climates that support growth at different developmental stages (NCATE, 2010). Along with strengthening teachers' subject matter knowledge and pedagogical expertise, it is important to improve teachers' ability to apply a developmental perspective whereby age-based characteristics of students are used to design instruction (Darling-Hammond & Bransford, 2005). For teachers of middle-grade students, understanding the importance of active learning strategies and knowing how and when to implement them is essential. In this article, we will describe middle-grade teachers' perceptions and beliefs about effective, age-appropriate math instruction gathered across one year of professional development workshops. Each workshop actively engaged teachers in games, simulations, and problem-solving activities to "learn" the math concepts and skills from the sixth-and seventh-grade Common Core standards. Following the workshops, teachers engaged students attending weekly after-school math clubs in the

[1]St. John Fisher College, Rochester, NY, USA
[2]State University of New York, College at Brockport, NY, USA

Corresponding Author:
Linda K. Schlosser, St. John Fisher College, 3690 East Ave., Rochester, NY 14618, USA.
Email: LSchlosser@sjfc.edu

same games, simulations, and problem-solving activities. Results from multiple data sources showed that professional development workshops, as described here, followed by implementation of strategies with students influenced teachers' beliefs about effective instruction.

The Role of Play in Development and Learning

Play has been described by neuroscientists Leong and Carlson as a mechanism that allows our brains to practice flexibility and learn the self-regulatory skills necessary in life and work (Public Information Resources, 2013). Elkind (2008) maintains that play experiences are especially critical in the middle grades because they reinforce the central task of early adolescence: learning to persist in work. Play, simply stated, makes work more fun. While playing games, adolescents must sustain their focus. They engage in planning, initiating, shifting, prioritizing, and sequencing to master the objectives of the game, often without realizing that these same executive skills are important to college and career readiness. In today's world, in fact, educators believe that successful math-related careers require the executive skills that are practiced in games (Kaufman, 2010).

Despite growing interest in the potential of games to teach skills and concepts, solid research that tests the effects of different types of games on development and learning is limited. Research does suggest that middle school students' motivation and attitudes toward math are positively influenced by games (Ritzhaupt, Higgins, & Alfred, 2011), and that using games and imaginative play can help struggling secondary students learn to regulate their behavior (Rosoff, 2007). Plass et al. (2013) found empirical evidence that playing games improves middle school students' math fluency, increases their interest in and enjoyment of math, and leads to the adoption of a mastery goal orientation. It appears that, when games provide opportunities for learners to integrate new knowledge with previous understanding and verbalize their thought processes, students pay closer attention and are likely to retain what they learned (Wouters, van Nimwegen, van Oostendorp, & van der Spek, 2013). A recent report from the National Research Council on simulations and games in science supports these findings, concluding that learning through games increases student interest and engagement in science and therefore should be further investigated as an instructional strategy (Honey & Hilton, 2011).

Although play is considered an integral part of early childhood education, the further up in grades a student progresses, the less likely teachers are to use game-based activities as an instructional strategy. Accountability pressures and lack of professional development may undermine middle-grade teachers' willingness to replace more traditional lecture and paper–pencil exercises in favor of game and simulations. Simply put, solid research on the impact of games and simulations on achievement outcomes is limited (Hines, Jansy, & Merris, 2009; Honey & Hilton, 2011), and teachers' beliefs about the efficacy of games to promote learning is unclear (Bourgeon et al., 2013; Hayes & Ohrnberger, 2013).

Background

"Gear Up for 8th Grade Math" was implemented with funding from a Teacher Leadership Quality Partnership Grant, two high-needs school districts, and two college teacher education programs. The goal was to provide monthly professional development workshops for math teachers for one school year that focused on active learning strategies and that would directly impact middle school students through the implementation of after-school math clubs. Professional development linked to immediate practice with students was an appealing model to the two school districts where standardized math scores were low and, in the larger of the districts, graduation rates were plummeting.

Districts solicited volunteers from among their sixth- and seventh-grade math teachers to attend the monthly 3-hr workshops where a game-like environment was purposefully implemented. That is, professional development was designed so that teachers were immersed in playing the same math games and participating in the same simulations and activities that they would later implement at their clubs. Following the game play, connections between game-based activities and grade-level Common Core standards were made explicit. In addition, teachers analyzed how middle school students might have misconceptions about the mathematical concepts underlying the games and activities, and how those misconceptions could be addressed.

Over the course of the year, numerous mathematical topics generally taught in the sixth and seventh grades were addressed at workshops. For instance, teachers learned to teach ratio, percent, and proportion using games and activities such as (a) eating out games/menu math, (b) body part ratios/measuring and constructing, (c) cooking activities/fraction recipes, (d) Kool-Aid stand simulation/figuring and testing appealing ratios of Kool-Aid to water, and (e) Plinko/a game of probability. In all cases, teachers adapted the games and activities to the students who attended their clubs, from those interested in math to those who had nowhere else to go after school and who found the snacks and games an appealing option. Detailed descriptions of simulations and games from one professional development workshop on probability and statistics are included in Table 1.

Pre-service teachers taking a course in adolescent development volunteered as teacher assistants at the math clubs. They helped implement the games and activities and assisted individuals or groups of students as they engaged in activities. Pre-service volunteers were in the early stages of learning to teach, and assisting at the clubs provided them with opportunities to observe first-hand how adolescents learn.

Table 1. Sample Activities From a Professional Development Workshop on Statistics and Probability.

Common Core standards for Grades 6-8	Sample simulations, activities, and games
Formulate questions that can be answered with data Design and use plans to collect relevant data Analyze data with appropriate methods Interpret results and draw valid conclusions from data that relate to the questions posed Develop understanding of statistical variability Summarize and describe distributions Understand chance processes and probability models Carry out random sampling Understand informal statistical inference Investigate patterns of association in bivariate data	The "Titanic Activity" involved a simulation in which participants were randomly assigned a passenger role. The group then studied the data about the 20 life boats launched from the sinking ship and analyzed the probabilities of each participant's survival if one was first, second, third class or a crew member, whether adults or children had better chances of survival, and whether males or females had higher survival rates. This activity involved looking at frequency and relative frequency tables of data, calculating probabilities and conditional probabilities, and constructing bar charts and segmented bar charts. The "Old Faithful Activity" involved analyzing data about frequency of Old Faithful eruptions to make an inference about waiting time until the next eruption. Small groups enacted a trip to Yellowstone and made decisions about when to visit Old Faithful. This activity involved group construction of dotplots, boxplots, histograms, trend lines, and scatterplots to solve the problem, and noting what additional information each plot gives. The game of SKUNK was played to build a foundational understanding of probability. Participants were engaged in decision-making problems to build a better understanding of choice verses chance. The game of Plinko was played to demonstrate the use of math in modeling and predicting real-world phenomena. The Plinko board is a maze consisting of rows of pegs. A contestant on *The Price Is Right* plays one to five chips, depending on the results of a pricing game that is played before Plinko. The contestant chooses a slot to insert a chip. When a chip hits an interior peg, it has an equal chance of falling to the left or to the right, except when it hits the side of the board or a peg on the outer boundary. If it hits the outer boundary, the chip falls in a direction that allows it to remain in play on the board. Chips come to rest in slots labeled with dollar amounts, at the bottom of the board.

Note. SKUNK was adapted from the game described by Brutlag (1994).

During the first year of the grant, the number of sixth and seventh graders who attended the weekly math clubs varied from a core group of 4 at one school to 20+ students at other schools. Although participation tended to remain stable, students were not required to attend every club meeting to participate. Over the course of the year, the math club teachers reported 2,574 additional student contacts during which small groups and individual students played games, engaged in simulations, articulated strategies, and used their imaginations to solve problems with math.

Looking for Patterns in the Data

Our goal was to capture teachers' emerging beliefs and perceptions about developmentally appropriate instruction as they participated in the math games and activities at workshops, and later put the same strategies into practice with students at the clubs. To understand how they constructed meaning about the effectiveness of game-based activities to teach math, we used inductive thematic analysis (Bogden & Biklen, 2007; Guest, MacQueen, & Namey, 2012), a methodological approach that allows for the examination of teacher perceptions and beliefs by identifying and coding themes within textual data.

Data for this study were drawn from questionnaires, informal interview notes, and journals submitted by 20 experienced teachers and 12 pre-service volunteers across 1 year. We first used open-ended questionnaires and rating scales collected from experienced teachers, after participating in the workshop games and activities, to determine how comfortable teachers were with the specific mathematical concepts and skills covered at each workshop. We then used informal group and individual interviews to develop emergent understandings of how and why teachers perceived specific game-based activities as effective or ineffective instructional strategies. For example, during informal interviews, teachers were asked to identify any games or activities that were "their favorites that month," or especially successful, and speculate as to why. For each game and activity used during the previous month, teachers were asked

to describe students' levels of interest, engagement, and demonstrated understanding. Open-ended, scripted questions were used, but were followed by inductive probes in response to teachers' answers to solicit normative perceptions from the group.

At two points in the year, we asked experienced teachers to complete additional written questionnaires to examine their perceptions of the broader impact of the professional development workshops. We asked teachers the following: (a) Has math club participation impacted your club members' perceptions about math? How do you know? (b) Has math club participation impacted your students' academic progress in math? How do you know? (c) Has running math club changed the way you approach teaching math in the classroom? and (d) What impact have professional development workshops had on your content knowledge in math and your understanding of math concepts?

Finally, electronic journals that teachers and pre-service volunteers completed separately after each club meeting were collected and analyzed. Experienced teachers used a prescribed format to report attendance and activities, and provided free-flowing observations of student participation in games and activities. Pre-service volunteers were given scripted but open-ended questions in which they were asked to describe and provide evidence of successful and less successful activities, focusing on behaviors that indicated the presence or absence of student interest, engagement, and persistence. In addition, they were asked to describe how they assisted teachers with activities and how they helped or interacted with students. Finally, pre-service volunteers used digital photography to capture weekly activities, asking club members to "Tell me the most interesting things I should take pictures of." The journals submitted by pre-service volunteers were used to provide a second source of descriptive information about student engagement, interest, and persistence in the math games.

Textual data were read and reread by two researchers to identify and code themes in the data. Commonalities and differences in teachers' beliefs and perceptions were identified using terms from the descriptions and experiences voiced by the experienced teachers, themselves. This structure was then compared to themes that emerged from a separate analysis of pre-service volunteers' journals.

When the after-school math clubs began, our primary focus was not on the promotion of games as an instructional strategy, but a more global focus on developmentally oriented strategies that could expand teachers' content and pedagogical knowledge as well (Darling-Hammond & Bransford, 2005), particularly that of teachers who had not majored in math. As we read questionnaires and journal entries, however, play surfaced as the theme that explained teachers' beliefs about what motivated young adolescents to engage in activities and to persist in solving problems that required mathematical thinking. Both experienced teachers and pre-service volunteers voiced perceptions that "playing games" was one of the most important reasons that students came to the clubs, and that gaming encouraged students to practice mathematical thinking. Play as an emerging theme enabled us to construct generalizations to describe teachers' perceptions and beliefs about developmentally appropriate instruction across the year of professional development workshops.

Findings: Playing to Learn

Generalization 1: The majority of experienced teachers reported that their personal understanding of math concepts improved through their experience with game-based activities at the professional development workshops.

The Gear Up workshops had unique social benefits that impacted instructional aspects of the workshops. First, the teachers who met each month came together from multiple schools across two high-needs districts to learn new strategies and to share common experiences from their clubs. Second, each workshop was purposefully planned to strengthen connections between activity-based instructional strategies and content addressed in the sixth-and seventh-grade Common Core standards. College presenters used repeating cycles of activity/game, debrief, and implementation discussion to show the "how to" and "why" an activity was important, a procedure that was inherently meaningful to teachers because they would be using the same games at their club meetings over the ensuing month. Playing the games together enabled teachers to share their thinking and ask questions in a socially comfortable environment. In fact, our observations of the Gear Up workshops showed that time not spent actually engaged in activities was spent asking questions, sharing ideas, laughing at mistakes, and helping colleagues with less math background understand the strategies.

The social benefit that playing games contributed to learning math was an interesting insight for many teachers. Although it is a commonly held belief that socialization is a critical part of early adolescence, it was experiencing how much the social environment contributed to their own engagement at professional development workshops that prompted a teacher to tell the group, "Math club has had a two-fold effect for city students. The social setting is as important as doing the math. [While playing games and doing activities] they try things without worry and are much more willing to participate." We observed that this also held true for teachers at the professional development workshops. Because, in this study, 50% of the participating teachers were sixth-grade teachers who did not major in math at college, an environment that allowed them to ask questions and learn from colleagues was especially important. One sixth-grade teacher in an informal group interview noted,

> We don't want to sign up for district math PDs because it's mostly high school teachers talking about math that we don't teach or we don't know, and so there isn't much help there with

> the Common Core that we need to know. You feel reluctant to say anything at those PDs because you don't really know if it's right.

At the Gear Up workshops where "content was sometimes over my head," the majority of teachers made similar comments about the importance of the social environment that naturally evolved while playing games and doing activities: "Working and talking through problems with my colleagues really helped me most of all."

Teachers often drew on specific workshop games and simulations to describe the impact of activity-based strategies on the growth in their own knowledge of math. "I learned so much from . . . 'building roller coasters to measure time, rate, and distance,' 'the kaleidoscope activity,' 'lollipop predictions,' 'the NBA salaries activity to introduce statistics,' 'the Titanic stats simulation,' or 'Plinko Boards' . . . ." There was almost unanimous agreement among teachers that games and activities improved their understanding of math content. Only three teachers did not perceive growth in this area, and these teachers emphasized the impact of activity-based strategies on pedagogy rather than content: "I don't think the games and activities have improved my content knowledge, but they have changed the way I think about content and how best to deliver it." These teachers believed they benefitted most from learning alternative ways to teach. "Every workshop gave me at least one 'A-HA' moment and so many ways to have fun in math. I loved the helicopters and boat activities for dividing fractions!"

Data collected at the end of June indicated that 100% of the teachers believed their increased content and pedagogical knowledge improved their ability to frame math concepts and practices for their students. Comments like " . . . A more solid understanding of math concepts [has helped] me better explain new concepts to my students," "The games helped me develop critical math skills that I didn't develop previously or hadn't used in a very long time," and [I know how to use activities now that] "get students thinking about higher level math without even knowing they are doing math" were common. "Personally, I have always really disliked teaching probability and statistics, but [in the games I learned] much more relevant connections . . . and I can see how I can make it more relevant to my students." Finally, as one teacher summarized at the end of the June workshops, participating in the games and activities has "had a vast impact on my content knowledge. It brought home to me exactly how limited my perception of math has been . . . and broadened my horizons so I understand now that math's purpose is to make sense of what is around us."

> **Generalization 2:** Experienced and pre-service teachers believed that students were highly engaged and persisted longer when math activities at the clubs were perceived by students as opportunities to play games. In game-based activities, even students having difficulty with the math concepts or skills involved in the game could be influenced to continue playing when supportive teacher behaviors were used.

Engagement, persistence, and motivation were the overarching themes that emerged in experienced teachers and pre-service volunteers' journal entries and in experienced teachers' interviews to describe student participation in the games and activities at math clubs. Games were described as a magnet that brought students to the after-school clubs. "My math club students are always talking about what they did at the club [with other students.]" Teachers noted that students were excited on club days, enjoyed the challenges of games, were eager to participate in games and simulations, readily engaged in discussion, and frequently asked questions of their own. The games and activities at math club have helped "students see real-world connections." At the midpoint of the year, 72% of the experienced teachers reported positive changes in club members' motivation to work on difficult tasks, persistence when solving problems, and overall engagement in activities and discussion as compared with student behaviors when clubs began. By year's end, the percent had risen to 80%. Only 2% of the teachers reported no positive changes in motivation, persistence, and engagement among the students attending math club.

Pre-service volunteers' journals and photographs showed clubs could be grouped into two categories: predominately games-based clubs or games-based clubs with some worksheet activities teachers called "packets." While only two clubs were placed in the latter category, they served as interesting comparisons to the other clubs. Using student attendance as reported in weekly journals, we saw early in the year that predominately games-based clubs had strong, consistent, and increasing attendance, while the two clubs that utilized packets occasionally or often had weak attendance that remained the same or decreased across time "even when there were great snacks." Pre-service volunteers reported that students at the clubs were particularly focused when engaged in computer/smartboard games; activities like measuring and drawing body part ratios, graphing ingredients of favorite pies, deciding what to order at restaurants, calculating costs and tax; and simulations like the Kool-Aid stand, Titanic statistics, or river-crossing puzzles. These activities made up less of the agenda in the two clubs where "once again, the students had a packet of math problems to complete." As one pre-service volunteer noted,

> Games are definitely a way to teach because they focus kids' attention. I didn't realize they were so powerful or that the kids could really learn a skill through a game. Everyone is involved and everyone learns something when they do their part to figure out a problem.

Or, as another pre-service volunteer put it, "I would like that excitement in my classroom one day. [Volunteering at the clubs] changed the way I think about teaching."

Table 2. Pre-Service Volunteers' Roles at the Math Clubs.

Type of assistance reported	Representative behavior descriptions
Personal contact/proximity	Sat next to/close by student; provided "friendship"
Encouragement	Used humor; distributed rewards; gave positive feedback
Choice	Suggested options in materials, procedures, sequence, partners
Modeling	Described how to play the game; showed how to start; worked through steps
Provocative questions/humor	Stimulated student to plan or initiate; triggered thinking; relieved stress related to "right answer"
Clues	Suggested where to look or what component to focus on
Modification	Changed a format to benefit the student's performance

One role of pre-service volunteers at the clubs was providing and gradually removing external support so that all students could actively participate in activities. Their self-reports, as contained in electronic journals and photographs, enabled us to look at ways reluctant learners or learners who may have less background knowledge can be supported. The types of assistance pre-service volunteers provided were not predetermined; they evolved naturally in the club environment and were continually practiced by the volunteer across the year if she or he met with success. Pre-service volunteers identified their behaviors as scaffolding and made frequent references to Vygotsky's zone of proximal development (as described in Dolgin, 2011) in their journals. They believed that scaffolding provided a way to reach and motivate learners, one they would use as future teachers of young adolescents.

> Even when the math game was fun, R. couldn't see ahead to the next step and he needed me to . . . give him a clue. He needed someone to break it down so he could just get started and it worked.

Table 2 shows the types of assistance that emerged in pre-service volunteers' journal entries, in order of magnitude, with specific examples of behaviors.

There was some evidence in teacher interviews and questionnaires that teachers believed the engagement, persistence, and motivation they saw in math club students translated to their behavior in the classroom. The most obvious change observed by teachers was the amount of participation in math class: "Even my lowest math club members are more interested and take more risks in math class. I think it is because of the open-ended activities in math club." Other teachers, observing increased engagement during math class, connected the difference to student–teacher relationships fostered by game-playing at the clubs: "Most of my math club members are more willing to try things in my math class because of the relationship we have built outside class." Finally, teachers believed that some math club members showed more persistence and focus in math class: "My math club students take more time on problems and ask more questions during math class," was a common observation.

> **Generalization 3:** Over time, teachers reported some change in the way they approached math in the classroom to include more game and activity-based learning.

At two points during the school year, teachers responded to questionnaires which asked, Has running math club changed the way you approach teaching math in the classroom? At midyear, 94% of the respondents reported noticing that they (teachers) were more excited about math, had renewed enthusiasm, and believed they challenged students more. They also described using more hands-on activities, models, pictures, and stories to increase class discussions: "The ideas and content of the professional development have allowed me to deepen my understanding . . . and have more in-depth planning with extension activities."

At the end of the school year, the percent of teachers reporting changes in their approach to teaching math had dropped slightly to 88%. However, respondents listed more student-focused strategies: "Because of my experiences with math club, I feel that I allow my students more time to struggle and help each other with less help from me, at first, to see if students [can figure things out.]" Or, as other teachers wrote, " I more often have students teaching each other," "I have stepped back . . . and learned that using hands-on activities gets students talking and thinking," and "I have included the games that we learned in my classroom . . . as a training ground or test lab of sorts to try new techniques . . . "

Changes in classroom instruction commonly reported by teachers at the end of the year and attributed to their experiences with activity-based learning in workshops and the clubs included, in order of frequency,

- Using group work and problem-based activities more often
- Asking students to explain steps and teach one another more frequently
- Using more hands-on activities and games to get students interacting with math problems deeply and to practice mathematical thinking
- Allowing additional time for students to help each other and to struggle before providing immediate help
- Providing more time for inquiry learning
- Framing more lessons that contained movement and kinesthetic input

At the end of the first year of Gear Up, only 12% of the teachers reported little or no change in their classroom instruction. Of those, most attributed lack of change to resources needed to implement the activities and games (i.e., not having scientific calculators or computers in the classroom) or tight instructional timelines. "Although I rarely

have time for games and activities in math class, my students who are club members make constant reference to insights and discoveries that they made in math club."

Conclusion

During the first year of Gear Up, the majority of teachers who participated in game-based learning at the professional development workshops believed that their own math knowledge and skills improved. They also reported that the use of games and activities in their math clubs increased students' understanding and enjoyment of math, as well as their ability to focus and stay engaged even when activities were hard for them. So strong was the consensus that game-based strategies were developmentally effective for young adolescents at the clubs, the majority of teachers reported making some changes in the way they approached math in the classroom to include more game and activity-based learning.

Teachers' observations that play experiences motivated young adolescents to think mathematically were central to their evolving beliefs about effective teaching strategies. For most, the socialization and play inherent in the games they learned were pathways to build student attention and focus, increase persistence, and ultimately encourage students to do math work "because learning should be fun."

> The math club has helped me think of math in terms of games. Not just a card game or computer game, but creative, fun, cooperative types of games . . . that motivate students to use math creatively, to be inventive, to work on teams, to listen and communicate.

Based on the Gear Up data, we argue that experiential professional development directly linked to immediate strategy practice with students, as in this case, after-school clubs, is a model that has potential to bring about change in classroom instruction. Meaningful professional development that is targeted, on-going, and, above all, guided by the needs of teachers can improve instruction. In this study, teachers believed they were able to think more deeply about math and make more "real-world connections" for students through the use of the games, simulations, problem-solving activities, and imaginary play in which they participated at workshops. Now into the second year of Gear Up, teachers say they are more confident and eager to continue applying game formats to learning math because they already know that games "stimulate teaching and learning" and "keep people engaged." Our hope is that, as the year progresses, the impact on classroom teaching will continue to grow.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research and/or authorship of this article.

References

Association for Middle Level Education. (2012). *This we believe in action: Implementing successful middle level schools* (2nd ed.). Westerville. OH: National Middle School Association.

Bogden, R. C., & Biklen, S. K. (2007). *Qualitative research for education: An introduction to theory and methods* (5th ed.). Boston, MA: Pearson.

Bourgeon, J., De Grove, F., De Smet, C., Van Looy, J., Soetaert, R., & Valcke, M. (2013). Acceptance of game-based learning by secondary teacher. *Computers & Education*, *67*, 21-35. Retrieved from doi:10.1016/j.compedu.2013.02.010

Brutlag, D. (1994). Choice and chance in life: The game of SKUNK. *Mathematics Teaching in the Middle School*, *1*(1), 28-33.

Darling-Hammond, L., & Bransford, J. (2005). *Preparing teachers for a changing world: What teachers should learn and be able to do*. San Francisco, CA: Jossey-Bass.

Dolgin, K. (2011). *The adolescent: Development, relationships, and culture* (13th ed.). Boston, MA: Allyn & Bacon.

Elkind, D. (2008). *The power of play: How spontaneous, imaginative activities lead to happier, healthier children*. Cambridge, MA: Da Capo Lifelong Books.

Guest, G., MacQueen, K., & Namey, E. (2012). *Applied thematic analysis*. Thousand Oaks, CA: SAGE.

Hayes, E., & Ohrnberger, M. (2013). The gamer generation teaches school: The gaming practices and attitudes towards technology of pre-service teachers. *Journal of Technology and Teacher Education*, *21*(2), 154. Retrieved from http://search.proquest.com/docview/1318603386?accountid=27700

Hines, P.J., Jasny, B., & Merris, J. (2009). Adding a T to the three R's. Science, 323, 53.

Honey, M. A., & Hilton, M. (Eds.). (2011). *Learning science through computer games and simulations* (National Research Council). Washington, DC: National Academy Press.

Kaufman, C. (2010). *Executive function in the classroom: Practical strategies for improving performance and enhancing skills*. Baltimore, MD: Brookes.

National Council for Accreditation of Teacher Education. (2010). *How the developmental sciences can prepare educators to improve student achievement: Policy recommendations*. Available from http://www.ncate.org

Pianta, R. C., Hitz, R., & West, B. (2010). *Increasing the application of developmental sciences knowledge in teacher preparation*. Washington, DC: National Council for Accreditation of Teacher Education.

Plass, J., O'Keefe, P., Homer, B., Case, J., Hayward, E., Stein, M., & Perlin, K. (2013). The impact of individual, competitive, and collaborative mathematics game play on learning, performance, and motivation. *Journal of Educational Psychology*, *105*, 1050-1066.

Public Information Resources. (2013, May). *Executive skills for school success: Enhancing self-regulation, reasoning, and working memory*. Learning and the Brain Annual Conference, Arlington, VA.

Ritzhaupt, A., Higgins, H., & Alfred, B. (2011). Effects of modern educational game play on attitudes towards mathematics, mathematics self-efficacy, and mathematics achievement. *Journal of Interactive Learning research*, *22*(2), 277.

Rosoff, A. (2007). The reality of unreality: Using imagination as a teaching tool. *English Journal*, *96*(3), 58-62. doi:10.2307/30047296

Wouters, P., van Nimwegen, C., van Oostendorp, H., & van der Spek, E. (2013). A meta-analysis of the cognitive and motivational effects of serious games. *Journal of Educational Psychology*, *105*, 249-263. doi:10.1037/a0031311

Author Biographies

Linda K. Schlosser (LSchlosser@sjfc.edu) is an Associate Professor in the Department of Inclusive Education at St. John Fisher College in Rochester, NY. She works with middle level teachers in Professional Development Schools and has prublished numerous articles on middle level education.

Betsy Balzano (BBalzano@brockport.edu) is a retired Distinguished Service Professor at State University of New York, College at Brockport. She has worked extensively providing professional development for urban teachers in mathematics and science education.