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Ignite Implementation Fidelity and Child Progress Report for Academic Year 2021–2022

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Executive Summary

Ignite by Hatch™ is a digital learning platform anchored in a child-facing app that delivers engaging learning experiences through a dynamic digital play environment. Built to promote growth and development across seven domains, Ignite by Hatch™ supports children's progression from pre-foundational through early elementary skills. Developed using principles of both early-learning sciences (Vlach, Sandhofer, & Kornell, 2008) and best practices for designing digital experiences for young children (Maimaran, 2017), Ignite by Hatch™ delivers real-time child data to inform differentiated instruction and provides evidence for developmentally appropriate assessment systems. Ignite is used by roughly 20% of Head Start programs and is currently available to more than 100,000 children ages 3–5 in preschool classrooms in the United States. Prior research has supported the validity and reliability of the Ignite experiences (Luce & Lambert, 2022): When used to fidelity (30 minutes per week per child on average), children progress within Ignite to reach kindergarten readiness (Lambert, 2020; Lambert, 2021). Research is currently in progress to determine the relationship between Ignite engagement and children's kindergarten readiness. The following report highlights findings that provide validation of both the scope and sequence of Ignite experiences and implementation framework.

The implementation framework for fidelity of usage is intended for preschool-aged children to be able to reach kindergarten readiness at the end of an academic school year by engaging with Ignite for 30 minutes per week, on average, per child. This recommendation is based on research that children ages 3 to 6 should engage with screen time for less than 2 hours a day (Kamaleddine et al., 2022) and the scope and sequence of the Ignite product, which was designed to optimize recall based on empirical research around child cognition and memory (Vlach, Sandhofer, & Kornell, 2008). Skills are spaced out throughout the content so different skills are presented in a structured and spiraled sequence rather than the same skill presented continuously with increasing difficulty levels. The Ignite levels progress from pre-foundational through early elementary (levels 1–8) and are aligned with state standards for pre-K- and kindergarten-aged children (Luce & Lambert, 2022). Level 4 Ignite experiences are designed to align with kindergarten readiness standards. Research shows that when children engage with Ignite for 30 minutes per week, on average, they can grow two levels across the Hatch domains of learning in 6 months (Lambert, 2022), which means children in preschool will be practicing kindergarten standards-aligned skills when this usage is sustained throughout the academic year.

Third-Party Formative Evaluation of Ignite Experiences and Child Progress

Although the educational benefits of technology in classrooms has been documented in numerous studies (Otterborn, Schönborn, & Hultén, 2019), there are limitations with the implementation and integration of digital tools (Marklund, 2015). To minimize these barriers to implementation, Hatch offers professional development opportunities to support educators in making the most out of Ignite. Additionally, a position statement by the National Association for the Education of Young Children states that childcare and preschool environments should limit screen time to fewer than 30 minutes per day for children in half-day programs and to less than 1 hour per day for those in full-day programs (Donohue, 2017). Since Ignite is just one tool that educators can leverage for learning, it is important that the educational impact is optimized within a reasonable recommendation for implementation with fidelity. This is why every year the following questions are asked: How did children perform in the gaming environment, and is there evidence that the game difficulty level actually progresses as intended?

SAMPLE

The analyses were conducted using data from the entire population of 3-, 4-, and 5-year-old children who used Ignite during the 2021–2022 academic year (n = 63,465). Domain-specific analyses were based on children who completed at least one experience in the domain, resulting in sample sizes as follows:

- Social Studies (*n* = 61,373)
- Science & Technology (*n* = 57,078)
- Social and Emotional Learning (*n* = 53,343)
- Language & Communication Development (*n* = 60,948)
- Physical Development (*n* = 59,615)
- Mathematics (*n* = 58,582)
- Literacy (*n* = 62,247)

The sample was split almost evenly between female (49.5%) and male (50.5%) children. Three-year-old children represented 29.0% of the sample, 4-year-olds comprised 68.3%, and 5-year-olds comprised 2.6%. The racial and ethnic composition of the sample was as follows: white (non-Hispanic) = 32.1%, black (non-Hispanic) = 34.8%, Hispanic = 26.8%, multiple races = 2.6%, Asian = 1.9%, and Native American = 1.9%. Geographically, the sample comprised children from across the entire customer base, and, therefore, was national in scope.

METHODS

First, the initial passing rates for each experience were examined, meaning the percentage of children passing at their first attempt. Passing rates in Ignite are based on empirical research. When mastery criterion is developed based on the level of performance, educators and researchers generally set mastery levels between 80% and 100% accuracy (Fuller & Fienup, 2017). This means that if a child scores between 80% and 100% on a given measure, they have "mastered" the skill. In Ignite, the mastery criterion level of performance is set at 80%. Children have multiple opportunities to practice each skill and work toward mastery. Most digital experiences in Ignite have at least five opportunities within each experience, which gives children five chances to demonstrate mastery of a skill. Next, final passing rates were examined, meaning the percentage of children who passed each game after repeated practice. Both of these analyses were broken down and compared across the three age groups of Ignite users (3-year-olds, 4-year-olds, and 5-year-olds) to determine if passing rates increased with age as expected.

To examine whether the passing rates tended to decrease in a way that corresponded with increases in nominal experience skill level, the Rasch measurement model was used as an exploratory strategy to estimate difficulty. Specifically, this means that Beginning skill-level experiences should be passed at a higher rate than Emerging experiences, which, in turn, should be passed at a higher rate than Intermediate experiences, followed by Accomplishing and finally by Proficient experiences. This approach estimates difficulty relative to all other experiences within the same domain in terms of logit units. Experiences with model-estimated difficulty of .5 logits or higher, meaning an experience location of at least .5 logits above the average experience difficulty within the respective domain, were considered "Difficult." Experiences with model-estimated difficulty of -.5 logits or lower, meaning an experience location of at least .5 logits below the average experience difficulty within the respective domain, were considered "Easy." Experiences with locations on the ability scale within .5 logits of the average difficulty level for the respective domain were considered "Average." Then, these empirical-experience difficulty levels were compared to the nominal or intended skill level for each experience and examined using the developmental pathway generated by the Rasch model.

Finally, multiple regression was used to determine the level achieved based on time spent engaged with the Ignite experiences. This was also divided by age, race and ethnicity, and children in subgroups by usage levels to examine whether high users achieved more levels than children who had not used the system at the recommended implementation.

RESULTS

1. Strong Validity Evidence of Ignite Experiences

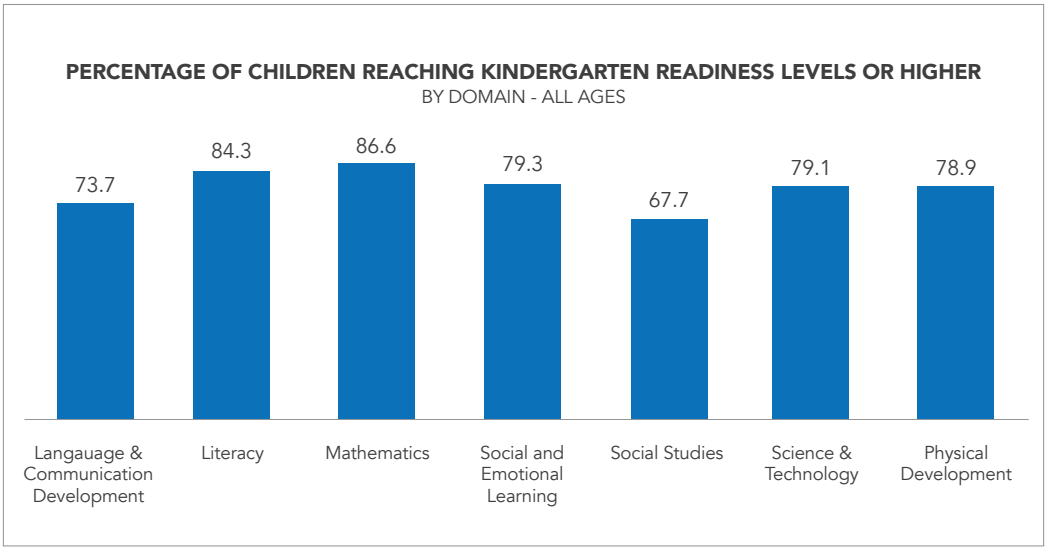
The purpose of this study was to examine how children perform in the gaming environment to determine if there is evidence that the game difficulty level actually progresses as intended. The results of this study demonstrated strong validity evidence for the Ignite learning games. Both initial and final passing rates by game were examined. The results across all domains of development were very positive. Five-year-old children outperformed 4-year-old children, and 4-year-old children outperformed 3-year-old children, for the majority of the games. The initial passing rates followed this expected rank order across the age groups for 100.0% of the games in three of the domains, with a few exceptions across the other four domains.

A wide range of game difficulty levels, from easy to difficult, emerged for all seven developmental domains. This finding demonstrates that children can be challenged and continue to grow, develop, and learn at all skill levels. Very well-defined and sequenced developmental pathways emerged for all seven domains from Beginning to Proficient games with matching initial passing rates and game difficulty levels. This finding indicates a substantial improvement from previous formative evaluation studies (Lambert, 2020; Lambert, 2021), which found a substantial number of games with potential mismatches between intended and actual game difficulty levels. For 90.7% of the games, 351 of the 387 games evaluated across the domains, the results demonstrated a close match between the intended skill level and the initial passing rates and game difficulty levels. Only four of the 387 games yielded results that may need to be investigated for potential mismatches between nominal and actual difficulty level. The tables illustrating this analysis can be found in the full report (Lambert, 2022).

2. Validity of Ignite Implementation to Fidelity Recommendation

Children usage levels were defined by low, medium, and high users. The low-use group was defined as those children who used the Ignite system for less than 2 months and did not meet the 30 minutes per week recommendation. The medium-use group was defined as those children who used the Ignite system for 2–4 months and at least 30 minutes per week. The high-use group was defined as those children who used the Ignite system for at least 5 months and at least 30 minutes per week. It is important to note that this "high"-use group may not have used the Ignite system for the entire 9 or 10 months of a typical academic year. These criteria were based on previous research

that illustrated patterns of growth in children with varying usage levels (Lambert, 2021; Luce & Lambert, 2022). Across all seven domains, the low-use group of children completed approximately one level on average. The medium-use group of children completed approximately 2–3 levels on average. The high-use group of children completed approximately 4–5 levels on average. A substantial percentage of high-use 3-year-old children (38.7%–64.7%, depending on domain) reached at least level 4 during the academic year. The overwhelming majority of high-use 4-year-olds (74.5%–92.8%, depending on domain) reached level 4 during the academic year. Similarly, the overwhelming majority of high-use 5-year-olds (89.8%–97.5%, depending on domain) reached level 4 during the academic year.



Tables 16–21 in the appendix illustrate these findings in more detail.

3. Initial Findings for Equitable Outcomes by Race and Ethnicity

An initial examination of subgroup differences by child race and ethnicity was also done to determine if Ignite's experiences lead to equitable results. These analyses were restricted to three groups: white non-Hispanic children, black non-Hispanic children, and Hispanic children. The remaining groups contributed small numbers to the total user group. Table 22 contains the mean number of levels achieved for each group by age. For 3-year-olds, there were virtually no differences between the race/ethnicity groups across all domains of development, and the differences that did emerge were extremely small.

For 4-year-old children, again there were very small differences between the three subgroups across all domains. Table 23 contains the results of examining these same subgroup differences in terms of the percentage of children in each age group who achieved level 4 or above. For 3-year-old children, there were very small differences between the subgroups. For 4-year-old children, a somewhat different picture emerged with a consistent pattern of small differences. The range of percentages for the three subgroups was between 4% and 6% within a given domain of development. White children showed the highest percentage reaching level 4 or above. Hispanic children showed the next highest percentage, which was consistently higher than the overall percentage for black children.

For 5-year-old children, a different pattern of moderately sized differences emerged. The range of percentages for the three subgroups was between 28% and 35% within a given domain of development. Hispanic children showed the highest percentage reaching level 4 or above. White children showed the next highest percentage, which was consistently higher than the overall percentage for black children. The differences between the three racial/ethnic subgroups were minimal for 3- and 4-year-old children. However, some of the differences between the subgroups for 5-year-old children were moderately sized. When the same analyses were restricted to only high-usage children within each subgroup, the subgroup differences remained minimal for 3- and 4-year-old children. The more substantial differences between the subgroups of 5-year-old children remained as well. The subgroup of Hispanic 5-year-old children was more likely to be in the high-usage group, explaining the apparent advantage for that group.

CONCLUSION

The full report outlines key findings related to the development of Ignite experiences and the implementation of fidelity recommendations. The report provides additional validity evidence for the instructional usefulness of the Ignite experiences. The main focal points were performance differences between 3-year-olds, 4-year-olds, and 5-year-olds for both initial and final passing rates by experience; the match or mismatch between intended experience skill levels and empirically generated experience difficulty levels; and the relationship between time spent engaged with the games and the levels achieved.

Overall, the findings of this study present strong validity evidence suggesting that the Ignite experiences are generally functioning as intended. The results also highlight some substantial improvements to the experiences. Child age was related to both initial and final passing rates as expected. A plausible developmental pathway emerged for

each domain that ranged from the easiest experiences to the most difficult experiences, and the pathway generally corresponded very well to the intended nominal skill levels. Fewer experiences presented potential mismatches between intended skill level and empirical difficulty level than were identified in previous research. A small number of experiences could be investigated for substantial mismatches between nominal and empirical difficulty levels. Usage level was strongly correlated with the number of levels achieved as expected. Specifically, the results of the study demonstrate that when children engage with the Ignite experiences at recommended usage levels, they can reach levels 4 and 5, which are equivalent to skills needed for children upon entering kindergarten.

Future research will need to focus on the factors that are associated with higher usage levels in classrooms. Only a small minority of children used the Ignite system for at least 30 minutes per week across at least 5 months of the academic year. It will be important to provide teachers with additional resources that inform their instructional practice, illustrate the benefits of child engagement with the system, and support instructionally appropriate and consistent use of the Ignite system throughout the academic year.

The results of this study indicate that some preschool-aged children reach more advanced levels intended for elementary-aged children. Future research is needed that includes older elementary-aged children and separate analyses of the experiences rated higher than Proficient. Future research is also needed to undertake a more detailed examination of potential differences by race and ethnicity. These findings need to be monitored going forward to develop a robust set of findings regarding how children from diverse racial and ethnic backgrounds make progress within the Ignite system. The analyses could include differential item functioning and measurement invariance analyses and a more robust analysis of subgroup differences that includes a wider range of demographic variables.

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APPENDIX

Table 16
Number of levels reached by usage group - 3, 4, and 5 year olds

Domain	Usage Group	N	Mean	SD
Social Studies	Low	33419	1.24	0.487
	Med	14413	2.59	0.900
	High	6039	4.17	0.993
Science and Technology	Low	26146	1.16	0.474
	Med	14399	2.52	1.129
	High	6035	4.26	0.959
Social Emotional	Low	25164	1.22	0.530
	Med	14434	2.57	1.201
	High	6039	4.63	1.474
Language	Low	32322	1.47	0.597
	Med	14418	2.73	1.053
	High	6039	4.69	1.463
Physical	Low	28880	1.18	0.471
	Med	14387	2.56	1.105
	High	6036	4.29	0.966
Mathematics	Low	27152	1.85	0.773
	Med	14439	3.46	1.003
	High	6039	4.96	1.261
Literacy	Low	33827	1.48	0.598
	Med	14444	2.84	1.132
	High	6040	4.78	1.381

Table 17
Number of levels reached by usage group - 3 year olds

	Usage Group	N	Mean	SD
Social Studies	Low	11774	1.15	0.398
	Med	3315	2.16	0.735
	High	808	3.44	1.058
Science and Technology	Low	8445	1.09	0.370
	Med	3305	1.94	0.962
	High	807	3.51	1.148
Social Emotional	Low	8159	1.13	0.414
	Med	3314	1.98	0.927
	High	807	3.57	1.372
Language	Low	11164	1.36	0.539
	Med	3308	2.31	0.717
	High	808	3.63	1.325
Physical	Low	9657	1.11	0.375
	Med	3299	1.98	0.932
	High	807	3.51	1.165
Mathematics	Low	8842	1.67	0.700
	Med	3317	2.91	0.894
	High	808	4.04	1.066
Literacy	Low	11974	1.37	0.542
	Med	3321	2.36	0.805
	High	808	3.80	1.301

Table 18

Number of levels reached by usage group - 4 year olds

	Usage Group	N	Mean	SD
Social Studies	Low	20965	1.28	0.514
	Med	10787	2.69	0.884
	High	5192	4.28	0.934
Science and Technology	Low	17204	1.18	0.499
	Med	10783	2.66	1.100
	High	5189	4.37	0.871
Social Emotional	Low	16494	1.26	0.559
	Med	10810	2.71	1.186
	High	5193	4.79	1.415
Language	Low	20489	1.53	0.613
	Med	10799	2.82	1.069
	High	5192	4.85	1.409
Physical	Low	18665	1.21	0.496
	Med	10777	2.70	1.077
	High	5190	4.41	0.873
Mathematics	Low	17730	1.93	0.779
	Med	10812	3.59	0.950
	High	5192	5.09	1.225
Literacy	Low	21124	1.53	0.612
	Med	10812	2.94	1.146
	High	5193	4.92	1.325

Table 19

Number of levels reached by usage group - 5 year olds

	Usage Group	N	Mean	SD
Social Studies	Low	680	1.56	0.690
	Med	311	3.66	1.086
	High	39	4.69	0.655
Science and Technology	Low	497	1.59	0.765
	Med	311	3.79	1.127
	High	39	4.77	0.583
Social Emotional	Low	511	1.65	0.772
	Med	310	4.07	1.506
	High	39	5.87	1.641
Language	Low	669	1.70	0.727
	Med	311	4.09	1.513
	High	39	5.92	1.562
Physical	Low	558	1.56	0.728
	Med	311	3.81	1.150
	High	39	4.79	0.570
Mathematics	Low	580	2.38	1.003
	Med	310	4.63	1.302
	High	39	6.00	1.433
Literacy	Low	729	1.71	0.765
	Med	311	4.25	1.447
	High	39	5.95	1.521

Table 20
Highest levels achieved by usage groups and age levels

Domain	Max Level Achieved	3 year olds	4 year olds	5 year olds
Social Studies	Below 3	89.2	70.0	73.4
	3	7.6	15.4	13.8
	4 or Above	3.2	14.7	12.7
Science and Technology	Below 3	87.8	68.2	70.2
	3	5.9	10.4	10.6
	4 or Above	6.4	21.3	19.2
Social Emotional	Below 3	89.2	69.8	71.8
	3	4.1	7.3	7.9
	4 or Above	6.8	22.9	20.3
Language	Below 3	88.9	69.8	73.3
	3	6.5	12.3	11.2
	4 or Above	4.6	17.8	15.5
Physical	Below 3	89.0	69.8	71.9
	3	5.3	9.7	9.9
	4 or Above	5.7	20.4	18.2
Mathematics	Below 3	68.1	44.6	46.6
	3	20.1	23.6	24.1
	4 or Above	11.8	31.7	29.3
Literacy	Below 3	89.8	70.7	74.5
	3	3.5	6.6	5.9
	4 or Above	6.7	22.6	19.6

Table 21

Highest levels achieved by high users across age groups

Domain	Max Level Achieved	3 year olds	4 year olds	5 year olds
Social Studies	Below 3	19.2	3.8	0.0
	3	42.1	21.7	10.3
	4 or Above	38.7	74.5	89.8
Science and Technology	Below 3	23.6	4.9	2.6
	3	21.9	9.8	0.0
	4 or Above	54.4	85.4	97.5
Social Emotional	Below 3	27.7	6.4	2.6
	3	16.2	6.5	2.6
	4 or Above	56.0	87.2	94.8
Language	Below 3	23.1	4.5	0.0
	3	29.7	13.8	7.7
	4 or Above	47.1	81.6	92.4
Physical	Below 3	24.6	5.2	2.6
	3	21.9	9.0	0.0
	4 or Above	53.5	85.8	97.4
Mathematics	Below 3	3.3	0.4	0.0
	3	27.2	6.8	2.6
	4 or Above	69.5	92.8	97.5
Literacy	Below 3	22.3	4.5	2.6
	3	13.0	4.8	0.0
	4 or Above	64.7	90.8	97.4

Table 22

Highest levels achieved by race / ethnicity across age groups

Domain	Race / ethnicity	3 year olds Mean	3 year olds SD	3 year olds *n*	4 year olds Mean	4 year olds SD	4 year olds *n*	5 year olds Mean	5 year olds SD	5 year olds *n*
Social Studies	White	1.49	0.83	4843	2.24	1.33	11990	2.08	1.32	192
	Black	1.51	0.83	5649	2.09	1.24	12524	1.88	1.05	174
	Hispanic	1.49	0.82	209	2.16	1.34	9303	2.85	1.58	333
Science and Technology	White	1.48	0.94	3920	2.29	1.46	11067	2.17	1.46	172
	Black	1.48	0.92	4529	2.12	1.37	11181	1.92	1.18	153
	Hispanic	1.46	0.92	3140	2.19	1.45	8431	3.07	1.63	286
Social Emotional	White	1.53	0.99	3843	2.43	1.62	10821	2.30	1.56	168
	Black	1.52	0.95	4470	2.24	1.53	11054	2.01	1.39	155
	Hispanic	1.54	0.97	3080	2.40	1.75	8267	3.45	2.08	289
Language	White	1.71	0.91	4663	2.53	1.51	11857	2.32	1.46	184
	Black	1.71	0.88	5454	2.33	1.41	12358	2.07	1.31	178
	Hispanic	1.70	0.88	3824	2.47	1.61	9233	3.26	2.06	332
Physical	White	1.47	0.91	4221	2.28	1.45	11391	2.15	1.45	180
	Black	1.47	0.89	4958	2.11	1.36	11742	1.88	1.19	160
	Hispanic	1.46	0.88	3447	2.19	1.44	8781	2.97	1.64	310
Mathematics	White	2.19	1.09	4092	3.10	1.50	11264	2.93	1.54	174
	Black	2.15	1.06	4634	2.89	1.44	11355	2.70	1.40	165
	Hispanic	2.12	1.07	3251	2.99	1.60	8540	3.88	1.90	307
Literacy	White	1.72	0.93	4951	2.56	1.53	12078	2.35	1.48	199
	Black	1.73	0.91	5702	2.38	1.45	12564	2.12	1.35	191
	Hispanic	1.72	0.93	4022	2.50	1.63	9335	3.27	2.06	342

Table 23

Highest levels achieved by race / ethnicity across age groups

		3 year olds		4 year olds		5 year olds	
Domain	Race / ethnicity	3 or below	4 or above	3 or below	4 or above	3 or below	4 or above
Social Studies	White	96.9%	3.1%	82.6%	17.4%	84.9%	15.1%
	Black	96.8%	3.2%	86.7%	13.3%	93.1%	6.9%
	Hispanic	97.1%	2.9%	84.1%	15.9%	63.7%	36.3%
Science and Technology	White	93.6%	6.4%	75.3%	24.7%	77.3%	22.7%
	Black	93.8%	6.2%	80.1%	19.9%	87.6%	12.4%
	Hispanic	94.2%	5.8%	77.6%	22.4%	53.1%	46.9%
Social Emotional	White	92.8%	7.2%	73.4%	26.6%	75.6%	24.4%
	Black	93.6%	6.4%	78.8%	21.2%	86.5%	13.5%
	Hispanic	93.6%	6.3%	75.5%	24.5%	51.9%	48.1%
Language	White	95.3%	4.7%	78.8%	21.2%	81.0%	19.0%
	Black	95.5%	4.5%	83.7%	16.3%	90.4%	9.6%
	Hispanic	96.0%	4.0%	81.0%	19.0%	61.4%	38.6%
Physical	White	94.3%	5.7%	76.1%	23.9%	78.3%	21.7%
	Black	94.3%	5.7%	81.0%	19.0%	87.5%	12.5%
	Hispanic	95.0%	5.0%	78.3%	21.7%	57.1%	42.9%
Mathematics	White	87.5%	12.5%	63.5%	36.5%	66.1%	33.9%
	Black	89.1%	10.9%	69.3%	30.7%	77.0%	23.0%
	Hispanic	89.6%	10.4%	68.7%	31.3%	48.2%	51.8%
Literacy	White	93.3%	6.7%	73.5%	26.5%	75.4%	24.6%
	Black	93.5%	6.5%	78.6%	21.4%	84.3%	15.7%
	Hispanic	93.6%	6.4%	76.1%	23.9%	56.1%	43.9%