

**Higher Resilience and School Performance
Among Students with Disproportionately High Adverse Childhood
Experiences (ACEs)
at Lincoln High, in Walla Walla, Washington, 2009 to 2013**

Research Report, February 2015



Dario Longhi, Ph.D.



PRC

Participatory Research Consulting LLC

**In collaboration with
Theresa Barila, M.S., Walla Walla County Community Network Coordinator
and
Wendy Motulsky and Haley Friel, Whitman College Student Fellows**

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Executive Summary

In 2013-14, an evaluation was conducted of outcomes of practices at Lincoln High, an alternative high school in Walla Walla, Washington, that had introduced trauma sensitive practices from 2009 to 2013. These changes were a result of community capacity efforts and were made in collaboration with The Health Center, a not-for-profit that provides mental and physical health services to any Lincoln High student. Starting in 2007, the Walla Walla Community Network coordinated a unique community response to ACEs through the Children's Resilience Initiative (CRI). In collaboration with its many local partners, CRI worked to create a community conversant in ACEs, brain development and resilience, and to embed the principles from this research into practices by member organizations. The evaluation study identified experiences among students while at Lincoln High associated with changes in practices and tested whether resilience had increased and had moderated the expected negative impact of ACEs on students' school performance.

One student summarized the Lincoln High experience as: *"The most significant change is that I finally figured out what I want to do with my life and that I have friends, students, staff, and my family (which may as well be the people of Lincoln as well as my parents) there to support me..."*

Methods

A mixed methods research design was adopted, using both quantitative and qualitative information and methods. Survey data were collected among all students. Quantitative scales were constructed measuring both student experiences and levels of resilience, and qualitative processes of change were identified by coding answers to open-ended questions and examining patterns. The survey data were then merged with information on student ACEs and school records on attendance, standardized tests and grades. Based on statistical tests and typologies of student experiences, the study provided both: generalizable findings on the relationships among resilience, school performance, and ACEs; and also insights on the processes involved in producing these relationships.

Questions - The study systematically analyzed four questions:

Question 1: Did students' resilience increase while at Lincoln High, especially among those with high ACEs?

Resilience increased significantly overall, and on each of the three component dimensions of resilience: 'supportive relations', 'problem solving' and 'optimism.' Resilience improved, on average, among students at Lincoln High, almost equally at all ACE levels, even among high ACE students who had initially low or just average resilience.

A typology of students emerged: those who were still trauma victims, those who had become trauma survivors and those who were thriving. They had different experiences, and they exhibited different levels of resilience: none or little resilience among victims, moderate resilience among survivors, and high resilience among thrivers.

Question 2: Was improved resilience associated with student experiences resulting from trauma sensitive school practices?

Students who had attained higher resilience reported having important experiences at Lincoln High that were linked to major changes in school practices.

The experiences judged as important by students were 'trust and love', 'mutual respect and help', 'responsibility, control when upset and clear expectations' and 'pride in achievement, timely work and hope for the future.' Quantitative evidence showed correlations between resilience levels and students having these experiences.

Qualitative evidence showed that more resilient students, those labeled 'survivors' and 'thrivers', had a pattern of better coping with anger and depression, more in-depth understanding and confidence from experiencing safety, deeper supportive relationships, more achievements and reasons for optimism. These experiences were associated with systemic, interrelated changes in school practices aimed at increasing 'safety', 'meaningful relationships' 'norms of compassion, tolerance and transfer of coping skills' and 'learning'.

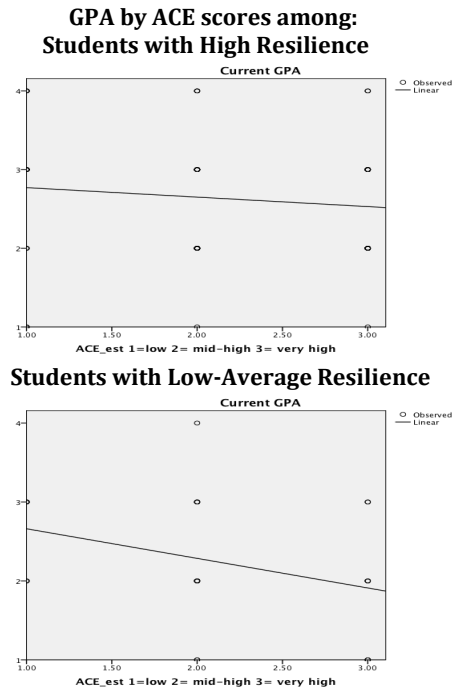
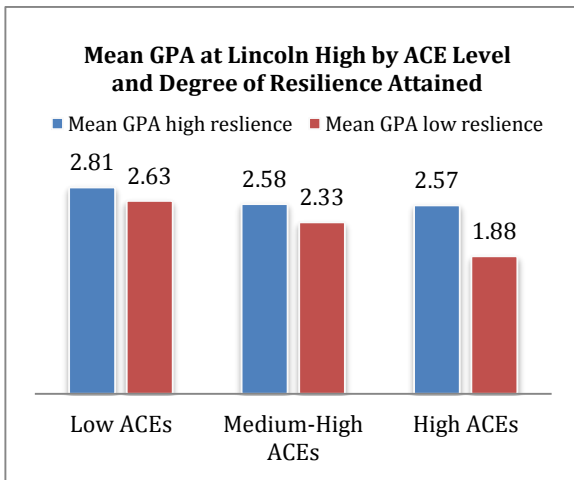
Question 3: Did students with higher resilience do better in school: better attendance, improvements in performance on standardized tests and higher grades?

Students with higher resilience had significantly higher GPAs in high school, higher than their 8th grade GPAs. This was achieved through fewer absences that led to improvements on standardized reading and math tests, that translated into higher increases in grades since enrolling in Lincoln High.

Question 4: Did resilience moderate the expected negative effect of ACEs on school performance?

ACEs impacted school performance differently, depending on level of resilience achieved.

- Students with low resilience: Among the minority of students (30 percent) who still had levels of resilience below the median scale score, those with higher ACE levels had lower grades. ACEs still affected school performance. See the changing GPA scores in the red bars in the bar chart below and the downward sloping line of GPAs as ACE scores increased.
- Students with high resilience: Among the majority of students (70 percent) who had achieved high resilience, higher than the median scale score, grades were uniformly higher, irrespective of ACE levels. Resilience had moderated the negative effects of ACEs on school performance to the point where they were no longer significant. See the same levels in the blue bars in the bar chart below and the almost flat line of GPAs as ACE scores increased.



Conclusions

This study provides empirical support for the thesis that systemic changes in school practices, ones developed with the support of the community to be sensitive to students with high levels of ACEs, have significant beneficial effects for a majority of students by increasing student resilience and improving school performance, even among students with disproportionately high ACEs.

The results are supported by both quantitative factor analyses of student responses and multivariate analyses showing statistically significant relationships among resilience, school performance, and ACEs, and also by qualitative analyses of patterns and processes of student experiences, expressed in their own words. Both analyses provide similar results allowing us to suggest that changes in school practices may be replicable in other schools, located in communities with similar levels of community capacity, and may generate similar outcomes.

Research Report

Introduction: Main Research Questions and Logic Model

In 2013-14, a study was conducted at Lincoln High, the alternative high school in Walla Walla, a town in Eastern, rural Washington State, where the school had introduced trauma sensitive practices. Changes at the school occurred from 2009 to 2013 as a response to a community conversation on Adverse Childhood Experiences (ACEs), brain development and resilience.

On average, students at this school accumulated five out of ten Adverse Childhood Experiences (ACEs), about four times the average number of ACEs among students in Washington State (Longhi, 2010). Research has shown that these accumulated traumas result in students having not only a higher probability of behavioral and health disorders, but also tend to have greater difficulties in learning, all leading to a lower likelihood of academic success (Blodgett, 2012; Longhi, 2010; Shonkoff, 2012). Washington State reports and a recent national study have found that resilience can moderate some of ACEs' negative effects (Bethel *et.al.*, 2014). This study tests the effects of specific practices and student experiences that lead to increased resilience, which then moderates ACE effects on school performance.

In 2009-2013, a systematic attempt was made by teachers and staff at Lincoln High to transform the culture and interactions at the school in order to become sensitive and supportive of such heavily traumatized youth, and to increase their resilience and their capacity to learn. Four systemic 'virtuous cycles' were identified as having been implemented at the school, each reinforcing different values and behaviors - among teachers and staff, between teachers/staff and students, and among students themselves - all supporting a safe, supportive learning environment. Since these changes were made, fewer discipline problems and suspensions have occurred, and the school has achieved a higher student retention rate.

A recent student survey shows how some students have experienced Lincoln High.

One student wrote: *"Yes, I struggled, with anger or depression, for weeks at a time. I felt there was no point in doing things I enjoyed because I was always alone. Now, not often; I have people to encourage me and share my experiences. I am determined to have something to be proud of. I am determined to go to (postsecondary) school ...here I made friends quickly and I finally had people to rely on, support, and understand me. Or just be silly with."*

Another student wrote: *"The most significant change is that I finally figured out what I want to do with my life and that I have friends, students, staff, and my family (which may as well be the people of Lincoln as well as my parents) there to support me..."*

Research Questions

As part of an ongoing developmental evaluation, this paper addresses four main questions:

1. Has resilience increased among students since coming to Lincoln High, even among those with initially low resilience and those with high Adverse Childhood Experiences?
2. Is there evidence that students felt that school experiences resulting from the changes at Lincoln were important to them, and that these experiences were associated with their achieving higher resilience?
3. Is higher resilience associated with better attendance, test performance and grades?
4. Does higher resilience moderate the predicted negative impact of traumatic experiences (ACEs) on academic performance?

Logic Model

The logic model on the next page (Figure 1) visually represents the expected relationships among variables in the current study.

- The green boxes and arrows depict the relationships between change strategies and changes in teacher/staff mental models and actions that developmental research in Walla Walla has shown generated the systemic changes in school culture, practices and norms.
- The red box and the red arrows represent the negative effects of ACEs on resilience, school behavior and performance, evident in the research literature and also expected among students at Lincoln, if resilience does *not* moderate their effects.
- The blue box depicts this study's major focus - measuring and linking students' school experiences with achieving higher resilience while at Lincoln. The vertical blue arrows show the anticipated better school behavior and school performance - improvements in test scores and grades - resulting from such higher resilience, irrespective of ACEs.
- The oblique blue arrows pointed at the red arrows show moderating effects of resilience that may actually alter the expected negative relationship between ACEs and school performance. If resilience is high enough, there may be *no* negative impact of ACEs on school performance.

Mixed Methods: both Quantitative and Qualitative Data and Analyses

Recent methodological analyses on which evaluation designs can best provide evidence of causal relationships in community/organizational wide changes point to the use of mixed methods: a combination of quantitative and qualitative methods.

- The quantitative methods provide scale measures of resilience, student school experiences, ACEs and school performance, enabling statistical tests of relationships that are generalizable.
- The qualitative methods identify the interrelated types of school practices and how they were experienced and linked to student coping, capacities to survive their traumas and thrive: the processes of feeling safe, supported, masterful and optimistic, in the students' own words.

Quantitative data were collected to conduct the statistical tests on the four study questions:

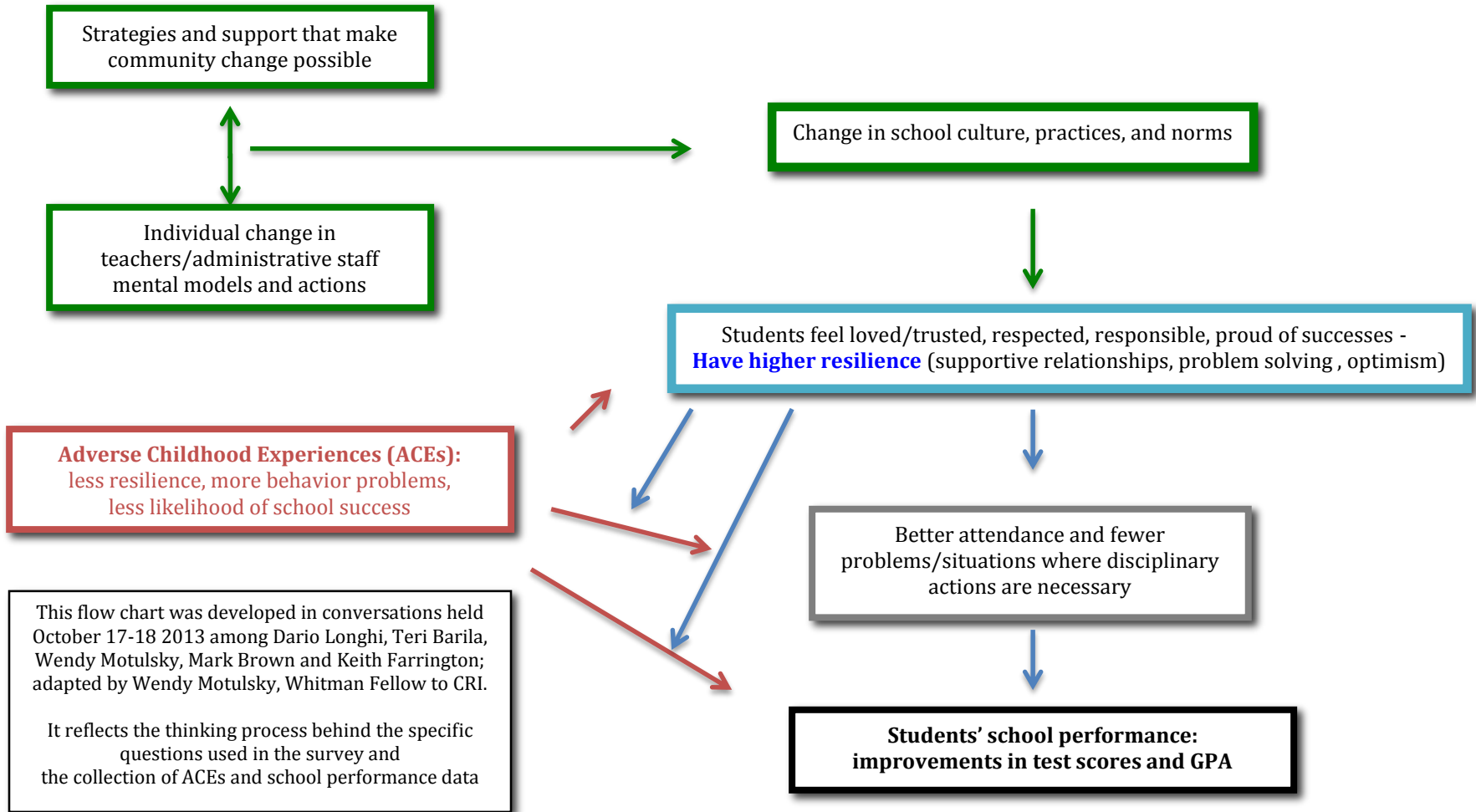
- A student survey of current Lincoln High students measured major dimensions of resilience before and after entering high school using questions and scales developed by Madsen and Amel (2010). The response rate for the survey was very high (75%), resulting in a relatively large student sample size for which we had resilience information (N= 111).
- This survey also asked students what their most important experiences were at Lincoln High, so that factor analyses could generate types of experiences predicted to be important.
- A one page survey collected student self reports on ACE scores (N= 66), and a meeting of school staff provided estimates of all students' ACE levels (low, medium, high and very high)
- Official school records provided a set of data on school behavior and academic performance: attendance, standardized test scores and grade point averages.

Qualitative data were collected to derive typologies, patterns of practices and processes:

- Focus group results from teachers and staff on new school practices, which were then summarized in system-based, interrelated, reinforcing process loops.
- Responses of students to open-ended survey questions on their life and school experiences, which were then coded into pattern variables and a typology of students based on Steele's formal qualitative study (Steele et.al., 2012).

Results from both analyses were used to assess links between school experiences and resilience.

Figure 1
Logic Model - Expected Relations among:
Systemic School Changes, Higher Resilience and Students' School Performance (Test Scores and Grades)
Moderating the Negative Effects of Adverse Childhood Experiences (ACEs) on School Performance



Study Questions and Results

Improvements in Resilience

Question 1: Has resilience increased among students since coming to Lincoln High, even among those with initially low resilience and those with high Adverse Childhood Experiences (ACEs)?

Results based on quantitative data show that average resilience scores increased significantly from before to after Lincoln High, for the overall resilience scale and for each of the three dimensions or sub-scales (see Table 1 below).

Table 1
Mean Improvements in Resilience Scores

	Before LH	After LH	Difference	t value	Stat Sign (p)
Overall resilience	4.52	5.34	0.82	6.74	p<.001
Three resilience sub-scales:					
Supportive Relationships	4.29	5.24	0.95	4.54	p<.001
Problem Solving	4.76	5.42	0.65	3.71	p<.01
Optimism	4.51	5.37	0.86	4.40	p<.001

Valid respondents N=111

Resilience increased for students with previous low and average resilience, and stayed high for students with previous high resilience. Before Lincoln High, only 37% of the students had high resilience, and 28% had average resilience; after Lincoln High, 64% of the students had high resilience, and 24% of the students had average resilience (See Table 2).

- Among students with an initial *low* resilience, 26 percent improved to an average resilience level, 46 percent to a high resilience level, adding up to 72 percent experiencing *improvements* – Only 28 percent stayed at the same level.
- Among students with an initial *average* resilience, 42 percent improved to a high level and 52 percent stayed at the same average level.
- Among students with an already *high* level of resilience, almost all, 98 percent, *maintained the same level of resilience*.

Table 2
Percent of LH Students Improving their Resilience by Resilience Level Before LH

Before LH Resilience Score	After LH Resilience Score			Total
	Low (1-3)	Average (4)	High (5-7)	
Low (1-3) 35%	11 28%	10 26%	18 46%	39 100.0%
Average (4) 28%	2 6%	16 52%	13 42%	31 100.0%
High (5-7) 37%	0 .0%	1 2%	40 98%	41 100.0%
Total	13 12%	27 24%	71 64%	111 100.0%

The average improvement in resilience occurred regardless of student ACEs, even for those students who had many traumatic experiences before entering Lincoln High. The correlation between ACE level and improvement in resilience was found to be close to 0 ($r=.03$) and non significant ($p=.401$). See Table 3 below for average resilience for students with different ACE levels.

Table 3
Mean Improvement in Resilience Score by Estimated ACE Level

ACE score estimated level	Mean Resilience Improvement (after – before)	Std. Error of Mean	N
Low ACEs score: 0-2	1.01	.304	21
Medium-High ACE score: 3-6	1.11	.291	26
High ACE score: 7-10	.91	.265	23
Total	1.01	.164	70

We now turn to examine the *qualitative* evidence regarding levels of student resilience before and after enrolling in Lincoln High.

The qualitative research sought to categorize levels of resilience among Lincoln High students by differences in the language they used and by differences in the types of experiences they wrote about, as they responded to twelve open-ended survey questions. Differences in language and experiences were identified following the guidelines and results of a previous formal qualitative study (Steele, Kuban and Raider 2009) that identified three main categories of children:

Trauma victims with no/little resilience - Due to traumatic experiences in which children feel unsafe and powerless, survival responses of ‘fight or flight’ get automatically triggered by neuron brain processes. Youth who remain trauma victims, by gaining little-no resilience, blame others or themselves, feel anger or grief, fight back or wall-up their feelings and try to escape, feel powerless and alone in their troubles, with little hope to control their future. Even talking about it hurts, since the trauma is re-experienced by talking about it, so youth tend not to talk about it or only very briefly. “The traumatized brain, especially when activated, will have a difficult time processing words.” (Steele 2003).

Survivors with moderate resilience – Some children manage “to experience something that is calming, soothing, familiar...” that enables them “to regain control and regulate their reactions“(those physiological, behavioral, and emotional reactions induced by the brain in response to cumulative traumas). Once safety and empowerment is regained, talking about what happened may help... not hurt... clarify what happened... focus on the present... Conversations in some safe place and with some people they feel safe with... is essential to becoming more resilient and gaining survival skills.”

Thrivers with high resilience – Some other children gain access to “multiple people they feel safe with, multiple safe places to go to, multiple activities that help them regain control.” They are then much more likely to experience “significant adults in their lives and their home and school environment... a sense of competency... a sense of empowerment... a sense of value in their ability to influence...” These children say: “I am important to someone – I am good at something – I can influence my world, and I am a good person.”

The qualitative research conducted among Lincoln High students distinguished differences in types of experiences by examining student responses to open-ended questions in the survey administered in the Winter of 2014.

Based on student answers, the following typology of experiences was devised:

- struggles with anger or depression
- ability to cope with anger or depression
- attitude towards Lincoln High
- forming positive relationships
- value or pride in academic achievements
- value or pride in achievements outside of academics
- degree of change they felt happened
- focus on future goals

The overall level of resilience achieved by students was qualitatively derived by the pattern of student responses: the language they used and the types of experiences described in their answers.

As in the formal qualitative study by Steele, three main categories of students emerged:

Trauma Victims – with Little/No Resilience

These students' answers displayed *a lack of resilience and an inability to accept or cope with their traumas and feeling hopeless about their future*. They had dramatically different answers than more resilient students in terms of both form and content.

Survivors – with Moderate Resilience – low moderate and high moderate

Students categorized as moderately resilient showed a similar pattern of experiences that built resilience and helped them 'survive.' They involved many of the experiences listed in the typology above: the safety and supportive relations at Lincoln, better ability to cope with anger and depression, feeling accepted and starting to trust, achieve some success at school and feeling able to make some future plans.

Some survivor students tended to give shorter, less detailed answers indicative of moderate - *low* resilience. Other survivor students tended to give longer, detailed answers, with a much greater number of 'because' statements. They provided evidence of more insights, logic and reasoning, indicative of moderate - *high* resilience.

Thrivers – with High Resilience

Students categorized as 'thrivers', ones having achieved a high level of resilience, wrote in a unique way about themselves, their strengths and their accomplishments. They had the longest answers, gave examples and demonstrated an unusually clear understanding of their experiences, their inner feelings and desires, and the outcomes of their actions. They appreciated the safety of places and of caring adults and peers, felt supported in many ways, by different relations, had pride in their achievements, felt more in control and had developed life goals and plans.

The experiences of these students in their own words, from victims on the left, to survivors in the middle, to thrivers on the right, are depicted in figure 2 on the next page, so that the reader can compare the different experiences of recovery from trauma and the different levels of resilience.

Figure 2
Trauma Recovery and Resilience Levels
Survivor – Moderate Resilience

Trauma Victim – Little/No Resilience

Yes, I struggle with anger and depression

- all the time – because I deal with it every day and it only gets worse
- I punch walls - punch stuff
- I get mad and want to fight people
- think and cry - cause I don't like talking with people
- well, I don't cry, I hold my own... knowing nobody ever cares... really
- I cry or bottle it up and freak out days later
- smoke weed
- cut myself

Unable to cope

- I take it out by yelling at my brother
- I just like to have time alone. I'm more of a 'self-confine' person - I dislike to tell others about my problems because that would just get them involved

I plan to

- not be a bum
- get a piece of paper that says I am better than the person without it
- leave town
- be homeless
- die by age 20

In my struggles with anger and depression

- I push everyone away from me, so what I do doesn't hurt them
- Sometimes I get down or low, but I have really good people in my life right now

To cope I

- try and calm down, because being angry isn't going to help the situation get better
- talk it out with a teacher
- get over it like an adult

The change

- nobody is judging you, and everyone accepts you for who you are – I think about hurting myself, which I don't, since I am strong enough not to

As for forming positive relationships I

- get to interact with my peers in a safe social environment
- talk to teachers about hard times in life
- look forward to being with people that care
- have gained trust
- met more people that I can count on to be there for me

As for future goals I

- don't get in trouble as much
- do not want to be a life sucker on society
- want to have a life!

As for school work I

- look forward to going to school, knowing that I am better than who I was at my other school
- have a chance to graduate
- can have a better future than the rest of my family

Thrivers – High Resilience

In past struggles I

- used to not eat for 4 days at a time
- too sad to do anything – felt worthless
- no point in doing things – I was always alone

To better cope I

- I was not doing good, but I had great friends to help me get through it all
- I stopped smoking grew better relationship with my family– teachers realized that I was making a change...

The biggest change has been

- my attitude – it has changed since I came to Lincoln – I look forward to every day
- I have become a lot nicer – became close enough to a teacher... to talk about anything
- fieldtrip – showed that everyone has their struggles and all it takes is just to reach out to them and let them know it is okay

Positive relations

- the only school that actually accepted me
- being able to change my life with the support of staff - meeting people I wouldn't think I would have a good relationship with

My proudest moment was

- when I was given support at Lincoln about what I can do – It helped me do more and work harder – to help me raise my GPA
- when I got my grades - I achieved something I never thought I would until I came here
- reached out for extra help in math which is something I probably would have been embarrassed about years ago

My school and future plans are

- I want to graduate from Lincoln High School because I have come too far to quit
- I also want to graduate because I can hold that as a memory that I was here as a part of Lincoln.
- yes, graduate, so I can go to a 4 year college, learn more... make it into a career
- I want to eventually get married and have children who will look up to me and be proud give my children a good role mode

Now we turn to examine what intentional changes occurred at Lincoln High between 2009 and 2013 that may have produced improvements in student experiences and resilience.

Changes in Community and School Practices

The Washington State Community Public Health and Safety Network system was created by legislative action in 1994 to address the major youth social behavioral problems (such as school drop out, teen parentage, drug and alcohol use) by making changes at the local, community level (<http://app.leg.wa.gov/RCW/default.aspx?cite=70.190&full=true#70.190.070>). Depending on the readiness of the local community, each Network worked to promote positive youth development by decreasing risks and increasing protective factors with appropriately selected evidence based programs and community wide efforts. As the system matured, through its feedback system of focus, learning, leadership and reflection, an empowerment model of community capacity development emerged (Flasphohler et.al., 2012). Through exposure to new research on ACEs and their effects on neurodevelopment (Anda, 2010, Shonkoff, 2012), a more comprehensive framework developed to better understand and address the social determinants of public health.

As a participant in the Network system, the Walla Walla Community Network decided to shape a unique community response to ACEs through the Children’s Resilience Initiative (CRI). Conceived in 2007 and piloted in 2009, CRI and its many local partners began to create a community conversant in ACEs, brain development and resilience, and to embed the principles from this research into practice by member organizations. An example of the community response that developed is the changes in practices made at Lincoln High and at The Health Center, a 501c3 entity that provides mental and physical health services to any Lincoln student. Staff from Lincoln High School and the school district had met for trainings and had travelled to conferences where a presentation by Dr. John Medina on how the brain shuts down in response to trauma led to a paradigm shift in thinking on how to provide a trauma sensitive learning environment.

Two years after starting to make changes in school practices at Lincoln High, a focus group of teachers and staff was convened to clearly identify what changes had been made. The focus group met for a whole day, facilitated by Laura Porter, the staff director of the Family Policy Council.

At the focus group, teachers and staff initially talked about the range of changes they had made:

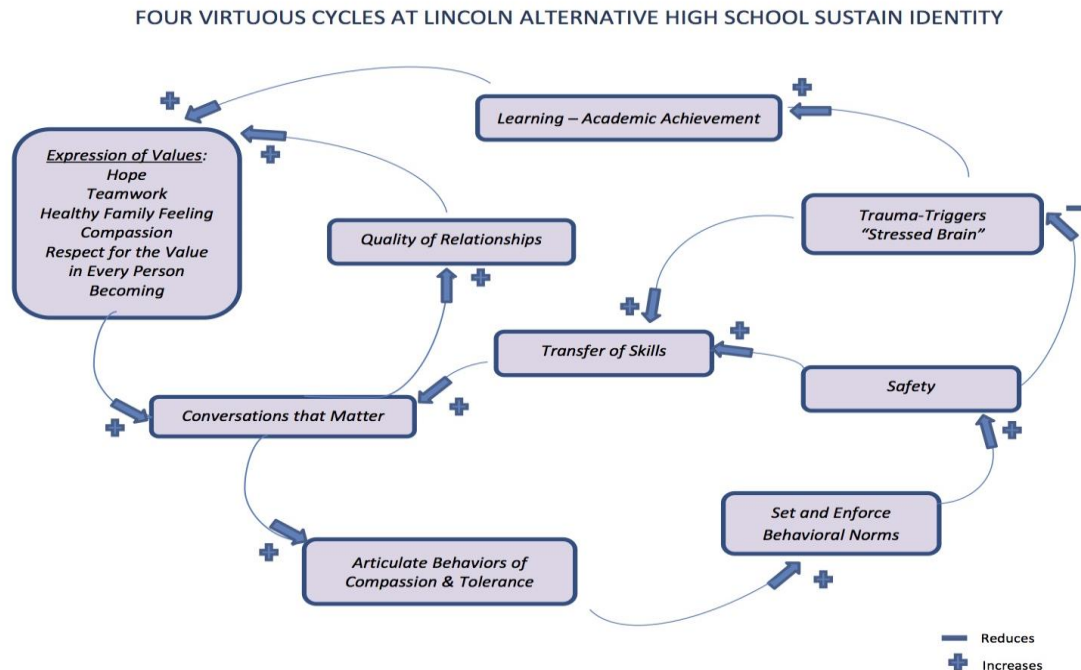
- first, about practices that helped provide students with the necessary safety;
- second, about the deeper changes in values, mindsets and relations that happened between teachers/staff and students to create such safety, through ‘conversations that mattered’;
- third, about how behaviors and norms supporting such safety and different values and relations were maintained by the students themselves, thus making the change sustainable.

By the end of the day, the group identified four virtuous cycles they had put in motion at the school.

Note: A ‘virtuous cycle’ is the name used by system analysts to describe a ‘positive reinforcing loop’ in organizational practices. It is called virtuous, because as the process cycle repeats itself, it improves desired outcomes by looping back and improving initial conditions. This occurs ‘automatically,’ in a self-sustaining way, unless negative factors intervene and negatively affect elements in the cycle.

Identifying virtuous cycles is highly desirable, so that organizations can maintain them, fending off possible negative factors that may intervene and change them, therefore guaranteeing continuous improvement in organizational outcomes. The four cycles that the focus group identified are displayed in Figure 3 on the next page: the safety cycle, the values cycle, the conversations – normative cycle, and the learning cycle.

Figure 3
Four Reinforcing Loops (Virtuous Cycles) Representing Systemic Changes in School Practices



The four interrelated cycles in the above chart are described below:

The safety cycle: *More safety – fewer trauma triggers – more transfer of skills to students – reinforcing safety* (This cycle mainly involves teachers and staff practices)

- Increased safety (increased sense of safety provided by teachers/staff and experienced by students at Lincoln) will decrease
- the occurrence of ‘trauma triggers’ (caused by “the trauma stressed brain”) that will increase
- the transfer of skills to students in dealing with trauma triggers and, eventually, through another student reinforcing/sustainable cycle (described later), will reinforce
- the sense of safety

The values cycle: *Different values – more conversations that matter – increased quality of relationships – reinforcing different values* (This cycle affects relations between teachers/staff and students)

- If teachers and staff hold and express *values of hope, teamwork, healthy family feeling, compassion and respect* (different than ones usually occurring in trauma ridden relations),
- then more *conversations that matter* will occur (between teachers/staff and students) that will
- increase the *quality of relationships*, that will, in turn,
- reinforce the different *values* held and expressed by teachers and staff

The conversations – normative cycle: *More ‘conversations that matter’ – more articulation (verbalized descriptions) of behaviors of compassion and tolerance – more setting and enforcing of behavioral norms – more safety – more transfer of skills – increasing the likelihood of ‘conversations that matter’* (This cycle mainly affects relations among students - leading to normative changes that are ‘self sustaining’, without much teacher/staff interventions).

- The more ‘conversations that matter’ take place,
- the more articulations (descriptions) occur of behaviors of compassion and tolerance,
- the more behavioral norms are set and enforced,
- leading to an increased sense of safety,
- leading to increased transfer of skills that make ‘conversations that matter’ more likely.

The learning cycle (generated by the ‘safety’ loop, reinforced by the students’ ‘behavior/norms’ loop, which is generated by the ‘value-relations-conversations’ loop between faculty/staff and students): *The more learning/academic achievements occurs, the more the values of ‘hope-teamwork-health-compassion-respect’ are expressed, which eventually lead to fewer trauma triggers* (This cycle involves parts of all three previous cycles: the safety, values and normative ones)

- Greater learning (academic achievement) will occur due to
- fewer trauma triggers, generated by
- more sense of safety,
- different values and teacher-student relations,
- sustained by students’ own reinforcement of different skills and norms.

Focus group results show that teachers and staff at Lincoln found that great improvements in learning and academic performance will occur only if all the other three loops are functioning well - that higher academic achievement will derive from increased sense of safety, different values and teacher-student relations, reinforced by the newly established student behavioral norms.

It became clearer during the day what the implications were for schools to generate the organizational capacity to implement and maintain such virtuous cycles:

- It is not a matter of just changing curriculum or training teachers to implement different school practices.
- It involves changing values and mind-sets (often difficult for some teachers and school staff).
- It involves engaging in ‘conversations that matter’ and supportive relationships, not only modifying ‘ways we teach.’
- It involves supporting ways in which students themselves set and enforce new behavioral norms that lead to more safety, resilience, learning and academic achievements.

We now turn to examine the types of experiences Lincoln High students said they had and how they were related to improvements in resilience.

Links between School Practices, Student Experiences and Resilience

Question 2: Is there evidence that students felt that school experiences resulting from the changes at Lincoln High were important to them, and that these experiences were associated with their achieving higher resilience?

1. Students with higher resilience at Lincoln High reported that four main types of experiences were important:
 - learning to trust, confide, be liked and loved
 - learning to respect themselves, to respect and help others, have healthy role models
 - learning to be responsible for their actions, control themselves when upset or angry, ask for help and solve problems, have clear expectations
 - learning that others were proud of their academic achievements (grades), becoming themselves proud of their grades, doing work on time and expecting that everything will be OK.

Factor analyses were run on the level of importance of these four sets of experiences. Four factor scores (see Technical Appendix) measured the importance of each type of experience for each student. These scores varied from negative -2 scores to positive +2 scores. We compared the factor scores to the level of resilience achieved after entering Lincoln High.

2. All four types of experiences were significantly related to resilience achieved. Students who had achieved high resilience after entering Lincoln High reported that these experiences were important to them, much more than did low or average resilience students.
3. Mean levels of importance were pretty similar across the four types of experiences (see Table 4 below) among students with the same level of resilience.

Table 4
Average Importance of Various Types of Experiences by Level of Resilience after Entering LH

Resilience Level after LH		1 Importance of trust and love	2 Importance of mutual respect and help	3 Importance of responsibility, control when upset and clear expectations	4 Importance of pride in achievement (grades), timely work, future OK	Summary importance of all four experiences for students at different levels of resilience
Low resilience (1-3)	Mean (z score) N	-0.50 13	-0.44 13	-0.92 13	-0.56 13	Very low (negative) Range: -.44 to -.92
Average resilience (4)	Mean (z score) N	-0.18 27	-0.42 27	-0.26 27	-0.27 27	Low (negative) Range: -.18 to -.42
High resilience (5-7)	Mean (z score) N	0.16 71	0.24 71	0.27 71	0.20 71	High (positive) Range: +.16 to +.27
Total		111	111	111	111	
Statistical significance of linear relation (p=)		.016	.002	.000	.003	

These experiences were all judged to be *NOT* important by low resilience students (see large negative means: -0.50, -0.44, -.92 and -.58). It is interesting to note the unusually large negative mean value, -0.92, among low resilience students, indicating that these students did *NOT* consider important those experiences linked to responsibility for their actions and to control themselves when upset.

On the other hand, high resilience students judged equally important all four experiences (see positive means: 0.16, 0.24, 0.27 and 0.205). The magnitude of the means were quite similar, indicating that all four type of experiences were almost equally important for students achieving high resilience.

The four types of experiences correspond to key elements of the interrelated four reinforcing loops - virtuous cycles in the system change model that staff and teachers said represented their efforts to reduce the effects of trauma on student behavior and learning (see the graphic display of the four reinforcing loops in Figure 2 on page 9):

- Importance of trust and love corresponds to the safety loop (mainly affecting relationships between teachers and staff).
- Importance of mutual respect and help corresponds to the value - relationships loop (affecting relationships between students and teachers/staff) involving "**values of hope, teamwork, healthy family feeling, compassion and respect.**"
- Importance of responsibility, control and clear expectations corresponds to the behavior-norms loop (affecting mainly student to student relationships) involving compassion and tolerance and transfer of skills.
- Importance of pride and achievement (grades), timely work, future OK corresponds to a greater learning loop (that involves all three previous loops) involving more safety, better values -relations, self sustaining reinforcement of new norms, behaviors and skills, which make possible improvements and pride in academic learning.

Given how the four virtuous cycles are systemically interrelated, the expectation was that if students thought that one experience was valuable, they would probably have experienced the others as valuable as well.

The survey results on the previous page are consistent with this expectation. They show equally important mean scores on all four types of experiences for high resilience students, equally low for low resilience students.

Overall, the survey results conform to the theoretical expectations of what students would consider important in their experiences of school, with the new trauma sensitive practices in place, in order to become more resilient.

The Relationship between Greater Resilience and Better School Performance

Question 3: Is higher resilience associated with better attendance, test performance and grades? And, does increased resilience have positive effects on these school outcomes?

Multivariate linear regression analyses were run to test the existence of these effects, for each school performance outcome: number of absences; reading test scores in 10th grade, compared to 8th grade ones; math test scores in 9th grade, compared to 8th grade ones; and current GPA compared to 8th grade GPA.

Resilience was measured before Lincoln High (student memory) and after entering Lincoln High (current).

If school outcomes were affected by improvements in resilience after entering Lincoln High, then the after Lincoln High resilience variable would be statistically significant, beyond the effect of the before Lincoln High resilience variable.

The multivariate regression results consistently showed positive effects of higher resilience and improvements in resilience with:

- fewer school absences
- better performance on standardized math and reading tests, from 8th grade to 9th and 10th grades, through the effect of resilience on fewer absences, and
- improvements in current GPA, compared to 8th grade, through the effect of resilience on fewer absences and better test performances.

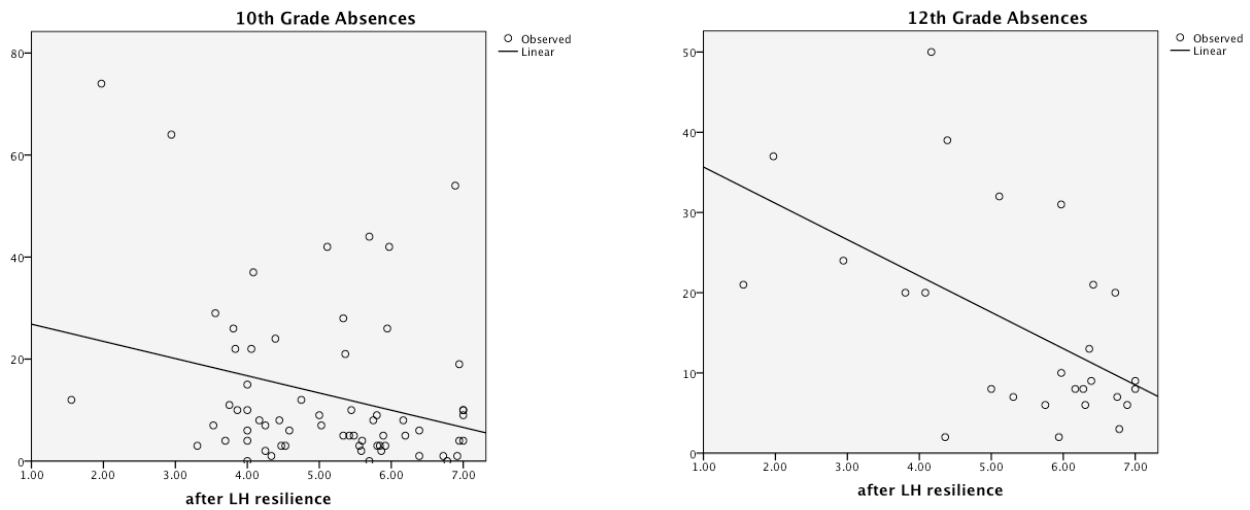
We briefly present the findings for each type of school performance indicator separately. The number of cases that had information on all the indicators was not sufficiently large to permit the analysis of all of them together. However, the sample sizes were sufficiently large to test each of the indicators individually.

1. Absences (10th and 12th grade)

On the next page (see Figure 4) are visual representations of the relationship between resilience and fewer absences for 10th graders, most of whom have been at Lincoln High for at least a year, and for 12th graders.

- Among 10th graders the slope of the relationship between the two variables is downwards, negative: absences are fewer as resilience increases.
- Among 12th graders the slope of the relationship is also downwards, but goes down much more steeply: absences are much fewer as resilience increases.

Figure 4
Relationship between Resilience and School Absences



We next tested whether the change in resilience was associated with fewer absences. This required running multivariate analyses testing the extra effect of resilience after entering Lincoln High, above and beyond the effect of initial resilience.

The results of the multivariate regression analysis (presented below in Table 5) show that the standardized regression coefficients for after Lincoln High resilience were negative and large (-.225 and -.638): the higher the change in resilience from initial levels, the fewer the absences .

The coefficient for the after Lincoln High resilience variable tests the effect of improvements in resilience while at Lincoln High. The coefficients were significant as a trend among 10th graders (p=.072) and highly significant among 12th graders (p=.003).

Table 5
Multivariate Regression Model: Change in Resilience and Absences among 10th Graders

Model variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	30.988	8.047		3.851	.000
Before LH resilience	-.843	1.626	-.079	-.519	.303
After LH resilience	-2.786	1.886	-.225	-1.477	.072

Multivariate Regression Model: Change in Resilience and Absences among 12th graders

Model variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	38.033	8.367		4.546	.000
Before LH resilience	1.466	1.810	.168	.810	.213
After LH resilience	-5.342	1.739	-.638	-3.072	.003

Dependent Variables: 10th and 12th Grade Absences

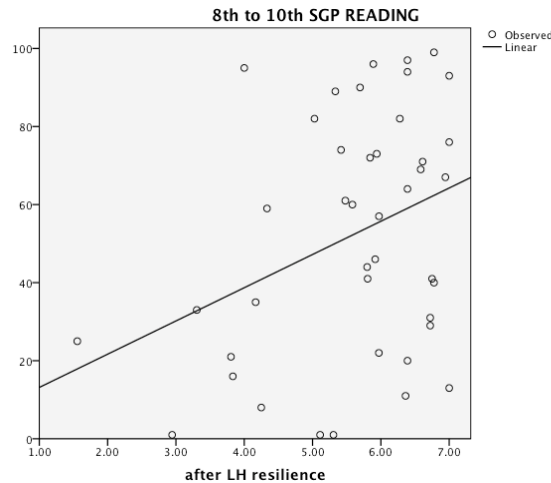
2. Performance on Standardized Reading Tests (from 8th to 10th grade)

The indicator of improvement in reading performance was obtained from the Office of the Superintendent of Instruction (OSPI), that measures improvement relative to percentile improvement statewide.

The average percentile improvement for Lincoln was 52 percent in the year of the survey, 2013-14. This means that Lincoln high school students improved, on average, as much as other students statewide. This is quite remarkable given the ‘alternative’ nature of Lincoln High School enrolling students with relatively poor past school performance.

Below is the visual representation of the positive relationship between resilience level and reading test percentile improvements for students at Lincoln High (see Figure 5). The higher the resilience, the higher the reading performance gain from 8th grade to 10th grade.

Figure 5
Resilience and Percentile Reading Improvement



Then, as before, we tested whether the increase in resilience made a difference.

The first multivariate regression model below (see Table 6) shows the effect of changes in resilience on improvements in reading test scores. The coefficient for the after Lincoln High resilience variable showed a large, but not quite statistically significant result. This is partly due to the small number of cases (n= 41) in these analyses and therefore less statistical power.

Table 6
Multivariate Regression Model: Resilience Effect on Percentile Reading Improvement

Model variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.966	20.976		.094	.926
before LH resilience	4.799	3.863	.234	1.242	.110
after LH resilience	4.918	4.647	.199	1.058	.149

Dependent Variable: 8th to 10th SGP READING

The second regression model below (see Table 7) shows the effect of fewer absences in 10th grade, controlling for before Lincoln High resilience levels. This model shows large effects of fewer absences (a standardized coefficient of-.538) which is highly significant (p=.001). This model explains better than half of the variance in reading percentile improvements (r= .734 and r-square = .539).

Table 7
Multivariate Regression Model: Absences Effects on Percentile Reading Improvement

Model variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	27.318	14.671		1.862	.074
Before LH resilience	8.503	2.818	.416	3.018	.003
10th Grade Absences	-1.180	.302	-.538	-3.903	.001

Dependent Variable: 8th to 10th SGP READING

This means that improvements in resilience affected better reading scores mainly through higher commitment to school reflected in fewer school absences in 10th grade among many of the more resilient students.

3. Performance on Standardized Math Tests (from 8th to 9th grade)

Data analyses below examine the factors that led to improved percentile gains on math tests (Table 8). They show results similar to those for reading improvements. School attendance (fewer absences) is as important for math as it was for reading

Table 8
Multivariate Regression Model: Absences Effects on Percentile Math Improvement

Model variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	71.339	13.134		5.432	.000
Before LH resilience	-4.382	2.583	-.279	-1.696	.051
9th Grade Absences	-.783	.304	-.424	-2.577	.008

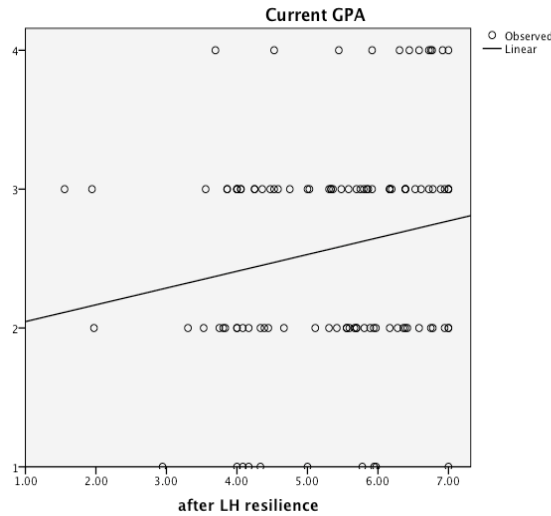
Dependent Variable: 8th to 9th SGP MATH

We finally turn to analyzing the last school performance indicator, GPA.

4. Improvement in Grade Point Average (GPA) from 8th grade to current grade

Grade point average was significantly positively correlated with higher resilience after entering Lincoln High (p=.028): the higher the resilience, the higher the grades (see scatter plot and regression line in Figure 6 on the next page).

**Figure 6
Resilience and Current GPA**



Then we tested whether gains in resilience resulted in gains in GPA since 8th grade.

We ran a statistical model that controlled for both initial student resilience, before entering Lincoln High, and grades in 8th grade. It showed a positive, large (.304) standardized coefficient that was statistically significant ($p=.020$) for the after Lincoln High resilience variable (see Table 9 below).

**Table 9
Multivariate Regression Model: Resilience Effect on Change in GPA since
8th Grade**

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.557	.395		3.944	.000
8th GR GPA	.266	.100	.299	2.661	.005
before LH resilience	-.092	.076	-.176	-1.217	.114
after LH resilience	.175	.084	.304	2.088	.020

Dependent Variable: Current GPA

Improvement in resilience after coming to Lincoln High was associated with improvement in grades since 8th grade.

The remaining unanswered question is how GPAs were affected by performance on standardized tests. We did not have enough cases to do a complete analysis, involving both math and reading, since they involved mainly different students in different grades. We had enough cases to analyze the association between 10th grade reading scores, resilience gains and GPA.

The results showed that grades are affected directly by reading test scores (standardized coefficient of .288 with $p=.044$). They are not affected by gains in resilience, above and beyond successful reading performance. The regression coefficients for the resilience variables are small and not statistically significant (see Table 10).

Table 10
Multivariate Regression Model: Resilience and Reading Score Effects on GPA

Model variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-.723	1.893		-.382	.705
before LH resilience	-.033	.082	-.080	-.409	.685
after LH resilience	.019	.113	.033	.169	.867
10th GRADE READING HSPE	.008	.004	.288	1.760	.044

Dependent Variable: Current GPA

These results provide evidence that resilience works only indirectly on GPA by improving academic performance like reading – which is in turn affected by reduced number of absences – which is significantly affected by increased resilience.

Evidence of Resilience Moderating ACEs Impact on School Performance

The last question addressed by this study is whether resilience has moderated the predicted negative impact of traumatic experiences on school performance (see negative impact of ACEs on school performance based on Healthy Youth Survey data by Longhi, 2010).

We chose grades (GPA) as the best measure of school performance. This is because we had grade information on all students at Lincoln High, and also in 8th grade, before coming to Lincoln. This enabled statistical analyses with large enough sample sizes. Furthermore, grades were found to be a good general summary measure of school performance, since grades at Lincoln were associated with fewer absences and were related to better performance on standardized test scores.

Among Lincoln High students, school performance before going to Lincoln High, as measured by GPAs in 8th grade, was negatively correlated with estimated ACE levels ($r = -.181, p=.064, N= 72$, see Figure 7 and Table 11). The average GPAs are displayed below, visually in a bar chart (Figure 7) and then in a table with correlations and statistical significance (Table11).

Figure 7

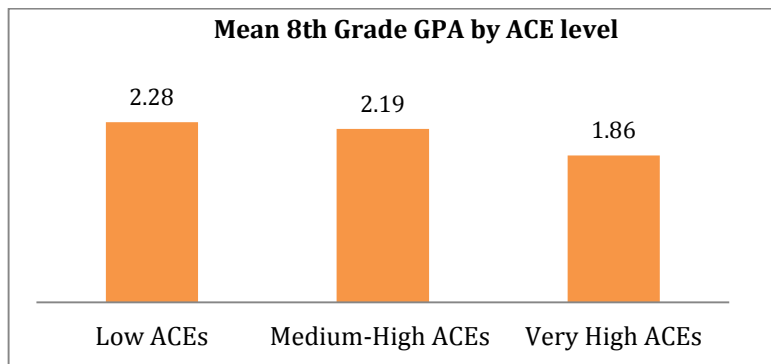


Table 11
Correlation Between ACE level and 8th grade GPA

ACE estimated level	Mean 8 th grade GPA	Std. Error of Mean	N
Low ACEs	2.28	.158	25
Medium-High ACEs	2.19	.157	26
Very High ACEs	1.86	.242	21
Total	2.13	.106	72
Correlation (r)	-.181		
Statistical Sign. (p)	.064		

To see whether there was a moderating effect of resilience on school performance after students entered Lincoln High, current average GPAs were calculated by ACE level separately for students who had gained high resilience and those who still had low resilience (see Figure 8 and Table 12).

If resilience had moderated the impact of ACEs, then we would expect GPAs to be high and similar across ACE levels for students with high resilience, but lower as ACE levels increased for students with still low resilience. The data show these expected patterns (see Figure 8 and Table 12).

This study's *major findings* are:

- Among the majority of students (about 70%), who had attained high levels of resilience while at Lincoln High, current GPAs were much higher than at 8th grade (2.65 versus 2.13) and *they did not differ significantly by ACE level* (2.81, 2.56, 2.57).
- Among the minority of students (about 30%), who still had low levels of resilience, their GPAs were lower on average (2.29 versus 2.65, closer to the 8th grade average of 2.13), and *they did decrease significantly the higher the ACE level* (from 2.63 to 2.33 to 1.88) in a pattern similar to 8th grade GPAs (from 2.28 to 2.19 to 1.86).

Figure 8

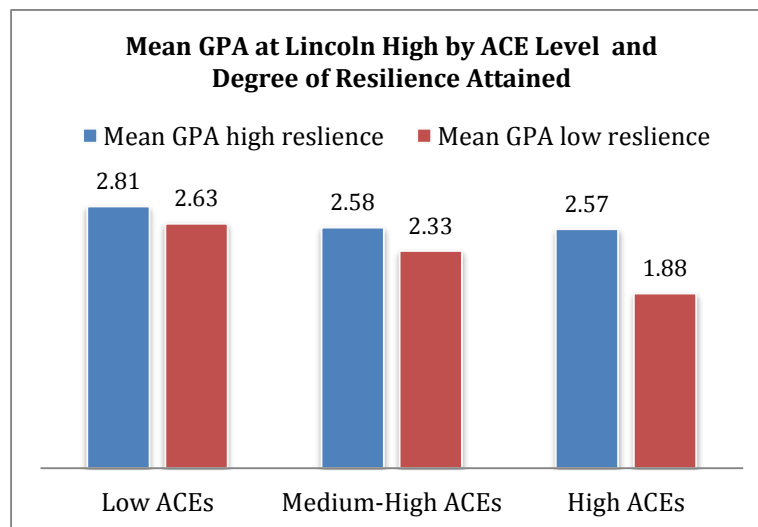


Table 12
Mean GPA at Lincoln High
by ACE Level and Degree of Resilience Attained

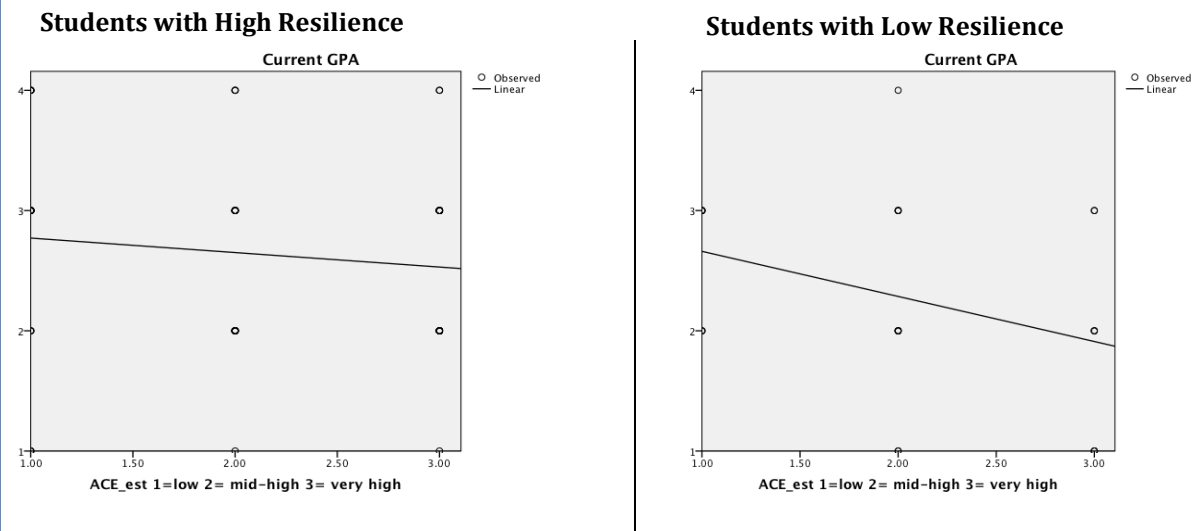
Degree of Resilience	ACE Estimated Levels	Mean GPA	Std. Error of Mean	N
Low Resilience	Low ACEs	2.63	.183	8
	Medium-High	2.33	.256	12
	High ACEs	1.88	.295	8
	Total	2.29	.153	28
High Resilience	Low ACEs	2.81	.214	21
	Medium-High	2.58	.158	24
	High ACEs	2.57	.152	23
	Total	2.65	.100	68
Total	Low ACEs	2.76	.162	29
	Medium-High	2.50	.135	36
	High ACEs	2.39	.144	31
	Total	2.54	.085	96

Regression analyses were then run to calculate the degree to which ACEs impacted grades among the two groups of students: those with high resilience and those with low resilience.

The graphs in Figure 9 visually display the results, the regression lines depicting the relationship between ACE levels and grades.

- For students with high resilience, the regression line is almost flat, indicating no statistically significant relationship between ACEs and grades ($r = -.118$ $p = .168$).
- For students with low resilience, the slope of the regression line is negative and steep, indicating significantly lower grades with higher ACEs ($r = -.356$ $p = .031$).

Figure 9
Relationship between ACE level and GPA for:



The final step was to run multivariate regression models to test the effects of ACEs and resilience on high school grades, statistically controlling for the grades of students at 8th grade, before entering Lincoln High. These analyses provide further evidence of the effects of resilience and ACEs on improvement in grades since 8th grade. Prior results were confirmed by four statistical models (see Table 13 below).

Table 13
Four Statistical Regression Models to Test the Effects of ACEs and Resilience on Grades at Lincoln High Controlling for the Effects of Prior Grades in 8th Grade

Four Statistical Models and Variables in Each Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig. (one tailed)	Model Multiple Corr.
		B	Std. Error	Beta			
Model 1: ACEs effect	Regression intercept (Constant)	2.967	.261		11.355	.000	.184
	ACE estimated level	-.180	.122	-.184	-1.477	.072	
Model 2: ACEs and 8th grade GPA effects	Regression intercept (Constant)	2.228	.372		5.991	.000	.368
	ACE estimated level	-.120	.119	-.122	-1.007	.159	
	8th Grade GPA	.283	.106	.325	2.678	.005	
Model 3: resilience effect with ACEs and 8th Grade GPA	Regression intercept (Constant)	1.703	.513		3.318	.001	.423
	ACE estimated level	-.105	.118	-.108	-.890	.189	
	8th Grade GPA	.257	.106	.295	2.423	.009	
	Before LH resilience	-.053	.084	-.098	-.627	.266	
After LH resilience	.149	.090	.261	1.655	.050		
Model 4: different effect of ACEs for students with low-medium resilience controlling for 8th grade GPA	Regression intercept (Constant)	1.548	.964		1.605	.057	.479
	ACE effect among high resilience students	.041	.145	.042	.284	.389	
	8th Grade GPA	.277	.107	.319	2.587	.006	
	Before LH resilience	-.047	.083	-.088	-.568	.286	
	After LH resilience	.117	.138	.204	.846	.200	
	Different regression intercept (constant) due to different ACE-Grade relationship among low-average resilience students	.799	.651	.467	1.229	.112	
Different ACE effect (regression slope) among low-average resilience students	-.467	.249	-.594	-1.878	.033		

Note: Dependent Variable: Current GPA at Lincoln High Sample Size: N = 63

- The effect of students' ACEs on High School GPA is partly through lower 8th grade GPA. See Model 1 and 2 coefficients in Table 13 for ACEs and 8th grade GPA, highly significant for 8th grade GPA (p=.005).
- However, *resilience significantly affects High School GPA, above and beyond students' prior resilience and 8th grade GPA.* See Model 3 beta coefficient of .261 for after Lincoln High resilience, significant p= .05.

- The effect of ACE level on grades was *close to 0 and NOT significant* among high resilience students, while *high and significant among* low resilience students, irrespective of 8th grade GPAs. See Model 4 coefficients and significance levels.
 - For high resilience students, the ACE effect coefficient is close to 0 (beta = .042), and non-significant (p= .389).
 - For low resilience students, ACE effect coefficient is negative, high (beta = -.594) and significant (p= .033).

These results show that resilience led to significantly higher grades for most students, above and beyond the effects of level of ACEs and prior grades in 8th grade. They also show that once a high level of resilience was achieved, the impact of ACEs on grades was no longer significant. In other words, *resilience among these students moderated the expected negative impact of ACEs on school performance to the point where grades were no longer significantly different.*

Conclusion

This study of Lincoln High quantitatively measured student resilience, both overall and in its three underlying dimensions: supportive relationships, problem solving and optimism. It assessed the increase in resilience for each student and its association with important student experiences, ones that were expected to occur due to changes in systemic, trauma sensitive, school practices.

Qualitative evidence on students' levels of resilience, based on student responses to open-ended questions, provided insights on student struggles with trauma and how resilience differed between students who remained trauma victims and those who were able to become survivors and thrivers.

The study then tested the relationship between resilience and school performance. The results showed that more resilient students had statistically significant better school outcomes on various measures of school performance: fewer absences, better reading and math scores on standardized tests and, finally, higher grades.

Finally, the study found that among the high resilient students, about 70 percent of Lincoln High students, resilience moderated ACEs' expected negative impact on school performance.

These findings show that community supported, systemic changes in school practices, ones developed to be sensitive to students' ACEs and involving interrelated, 'virtuous cycles,' have beneficial effects by increasing student resilience for a majority of students and significantly improving school performance, even among students with disproportionately high ACEs.

Study Limitations

There are two limitations in the current study: the absence of 'baseline' resilience scale data before Lincoln High and the lack of complete information on students' ACEs.

1. The study had to rely on students' recollections of their level of resilience before entering Lincoln High, which could possibly be biased by memory and current student status. However, there was agreement between the quantitative and qualitative data. Student's improvement on resilience scales agreed with students' reports of their significant experiences while at Lincoln High and their descriptions, in their own words, of the processes of improvement on coping with their trauma (see Technical Appendix).
2. Given the low response rate on the student ACE survey, the study relied on estimates of student ACE levels by school staff and teachers. These may be subject to biases. These estimates, however, were found to be relatively consistent with students' self-reported ACEs for those students for whom we had both ACE measures (see Technical Appendix).

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