Does the Quality of Early Childhood Education and Care Centers Mitigate the Risk of Externalizing Problems? A Genetic-Sensitive Study of Preschoolers in Germany

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Online Appendix

Supplementary Materials

Table S1 Overview of items

Item	Question (English)	Question (German)	Scale
Externalizing problems - Wave 1 & Wave 2 – self-report: What about you? …			
dev0100	Would you say that you are NEVER angry, SOMETIMES angry, or VERY OFTEN angry?	Würdest Du sagen. dass du NIE wütend bist. MANCHMAL wütend bist oder GANZ OFT wütend bist?	1: never 2: sometimes 3: very often
dev0101	Would you say that you NEVER listen to your parents, SOMETIMES listen to your parents, or VERY OFTEN listen to your parents?	Würdest Du sagen. dass du NIE auf Deine Eltern hörst. MANCHMAL auf Deine Eltern hörst oder GANZ OFT auf Deine Eltern hörst?	1: never 2: sometimes 3: very often
dev0102	Would you say that you NEVER have arguments with other children, SOMETIMES have arguments with other children, or VERY OFTEN have arguments with other children?	Würdest Du sagen. dass Du Dich NIE mit anderen Kindern streitest. MANCHMAL mit anderen Kindern streitest. oder GANZ OFT mit anderen Kindern streitest?	1: never 2: sometimes 3: very often
dev0103	Would you say that you NEVER cheat or lie, SOMETIMES cheat or lie, or VERY OFTEN cheat or lie?	Würdest Du sagen. dass Du NIE mogelst oder lügst. MANCHMAL mogelst oder lügst. oder GANZ OFT mogelst oder lügst?	1: never 2: sometimes 3: very often

Source: Codebook, TwinLife Version 5.0.0

Table S2 Results of the confirmatory factor analysis

	TwinLife (baseline sample)	
Fit Statistics	Standard	Robust
Test statistic user model	5.751	7.615
Df	2	2
P-value (Chi-square)	0.056	0.022
Test statistic baseline model	404.220	380.921
Df	6	6
P-value (Chi-square)	0.000	0.000
User Model vs. baseline model		
Comparative Fit Index (CFI)	0.991	0.985
Tucker-Lewis Index (TLI)	0.972	0.955
RMSEA	0.037	0.045
P-value RMSEA <= 0.05	0.073	0.081
SRMR	0.026	0.026
Factor loadings	Estimate (SE)	P >
Externalizing problems		
dev0100	1.000	
dev0101 (recoded)	0.443 (0.077)	0.000
dev0102	0.997 (0.123)	0.000
dev0103	0.693 (0.080)	0.000
N	1,393	

Source: Own calculations, TwinLife Version 5.0.0, and K^2ID-Twins Study

Table S3 Results for the ACE variance decomposition model without moderation

Standardized variance components	**Estimate**	**CI [lw./up. bounds]**
Additive genetic (A)	0.352	[0.257; 0.440]
Shared environment (C)	-	-
Non-shared environment (E)	0.648	[0.596; 0.691]
Unstandardized variance components	**Estimate**	**CI [lw./up. bounds]**
a^2	0.064	[0.041; 0.092]
c^2	-	-
e^2	0.118	[0.095; 0.143]
Total variance ($a^2 + c^2 + e^2$)	0.182	
Unstandardized Estimates for the path coefficients	**Estimate**	**SE**
a	0.253	0.026
c	-	-
e	0.343	0.018
Exp. Mean	-0.013	0.018
-2LL (df= 3)	733.0	
N	368	

Reading Note: The standardized variance components can be calculated by squaring the unstandardized estimates of the path coefficients and dividing the result by the total variance ($a^2+c^2+e^2$). For example: A = (0.253*0.253)/0.182 = 0.352 = 35%.

Source: Own calculations, TwinLife Version 5.0.0

Table S4 Model parameters for the Bivariate Purcell Models (2002)

Model	EP	-2LL	df	AIC	P value (lrtest)
ECEC center size (N_{pairs} = 315)					
Full ACE bivariate moderation model (baseline model)	17	1034.2	1199	1068.2	NA
AE bivariate with moderation effects	13	1035.2	1203	1061.2	0.90
Only unique moderation	11	1038.1	1205	1060.1	0.69
Only common moderation	11	1040.1	1205	1062.1	0.44
Just unique A moderation	10	1041.7	1206	1061.7	0.37
Just unique E moderation	10	1042.6	1206	1062.6	0.29
No moderation effects *	9	1042.8	1207	1060.8	0.38
** Reduced model (excluding non-sig. path)*	*8*	*1042.8*	*1208*	*1058.8*	*0.47*
Group size (N_{pairs} = 244)					
Full ACE bivariate moderation model (baseline model)	17	1132.7	931	1166.7	NA
AE bivariate with moderation effects	13	1134.1	935	1160.1	0.83
Only unique moderation	11	1134.4	937	1156.4	0.94
Only common moderation	11	1134.5	937	1156.5	0.94
Just unique A moderation	10	1134.4	938	1154.4	0.97
Just unique E moderation	10	1134.8	938	1154.8	0.95
No moderation effects *	9	1134.8	939	1152.8	0.98
** Reduced model (excluding non-sig. path)*	*7*	*1137.2*	*941*	*1151.2*	*0.92*
Child-staff ratio (N_{pairs} = 236)					
Full ACE bivariate moderation model (baseline model)	17	1468.4	902	1502.4	NA
AE bivariate with moderation effects	13	1469.3	906	1495.3	0.92
Only unique moderation	11	1473.7	908	1495.7	0.50
Only common moderation *	11	1472.3	908	1494.3	0.68
Just unique A moderation	10	1478.7	909	1498.7	0.17
Just unique E moderation	10	1479.8	909	1499.8	0.12
No moderation effects	9	1479.9	910	1497.9	0.17
** Reduced model (excluding non-sig. path)*	*10*	*1472.4*	*909*	*1492.4*	0.77
Model assuming no moderation vs. reduced model (excluding non-sig. path)	*8*	*1479.9*	*911*	*1495.9*	0.02
Training with focus on early childhood pedagogy (Educators) (N_{pairs} = 207)					
Full ACE bivariate moderation model (baseline model)	17	1349.8	787	1383.8	NA
ACE bivariate with moderation effects	15	1349.8	789	1379.8	1.00
Only unique moderation *	12	1353.1	792	1377.1	0.65
Only common moderation	13	1357.6	791	1383.6	0.10
Just unique A moderation	11	1360.7	793	1382.7	0.09
Just unique E moderation	11	1359.9	793	1381.9	0.12
No moderation effects	10	1364.8	794	1384.8	0.04
** Reduced model (excluding non-sig. path)*	*10*	*1359.3*	*794*	*1379.3*	*0.22*
Model assuming no moderation vs. reduced model (excluding non-sig. path)	*8*	*1371.3*	*796*	*1387.3*	*0.00*
Stress experience (Educators) (N_{pairs} = 223)					
Full ACE bivariate moderation model (baseline model)	17	1523.3	851	1557.3	NA
AE bivariate with moderation effects	13	1526.5	855	1552.5	0.53
Only unique moderation	11	1529.0	857	1551.0	0.46
Only common moderation	11	1526.5	857	1548.5	0.79
Just unique A moderation	10	1529.0	858	1549.0	0.57
Just unique E moderation	10	1529.4	858	1549.4	0.53
No moderation effects *	9	1529.5	859	1547.5	0.63
** Reduced model (excluding non-sig. path)*	*6*	*1530.1*	*862*	*1542.1*	*0.81*

(Table S4 continued)

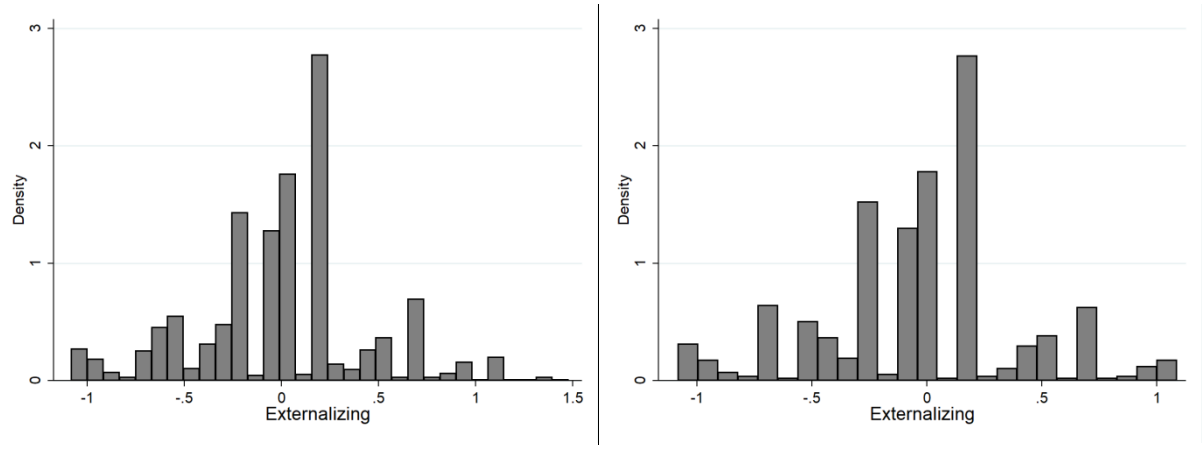
(Table S4 continued)

Model	EP	-2LL	df	AIC	P value (lrtest)
Frequency of talking circles (N_{pairs} = 223)					
Full ACE bivariate moderation model (baseline model)	17	1479.5	851	1513.5	NA
AE bivariate with moderation effects	13	1480.4	855	1506.4	0.92
Only unique moderation	11	1480.8	857	1502.9	0.97
Only common moderation	11	1480.7	857	1502.7	0.98
Just unique A moderation	10	1481.1	858	1501.1	0.98
Just unique E moderation	10	1483.8	858	1503.8	0.75
No moderation effects *	9	1483.9	859	1501.9	0.82
** Reduced model (excluding non-sig. path)*	*6*	*1483.9*	*862*	*1495.9*	*0.96*
Education goal "self-regulation" (N_{pairs} = 223)					
Full ACE bivariate moderation model (baseline model)	17	1487.8	851	1521.8	NA
ACE bivariate with moderation effects	15	1487.8	853	1517.8	1.00
Only unique moderation	12	1493.6	856	1517.6	0.33
Only common moderation *	13	1487.9	855	1513.9	1.00
Just unique A moderation	11	1493.7	857	1515.7	0.44
Just unique E moderation	11	1494.3	857	1516.3	0.38
No moderation effects	10	1495.2	858	1515.2	0.40
** Reduced model (excluding non-sig. path)*	*7*	*1495.0*	*861*	*1509.0*	*0.71*
Model assuming no moderation vs. reduced model (excluded non-sig. path)	*6*	*1498.1*	*862*	*1510.1*	*0.08*

Reading Note: The models marked with * have the best fit to the data according to AIC. For these models, a *reduced model* was calculated in which all non-significant and non-moderated paths were removed.

Source: Own calculations, TwinLife Version 5.0.0, and K^2ID-Twins Study.

Fig. S1 Histogram of externalizing problems in wave 2 for all cases included in TwinLife (left) and the analytical sample (right)



Source: Own calculations, TwinLife Version 5.0.0