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"Eine Schwebefahrt zu vielerleyen Nutzen in so mancherley Gestalt"

Leibniz's reaction to the pedagogical methods and to the school reform project of his former mathematics professor Erhard Weigel (1625-1699)

Zusammenfassung

In Leibnizens Korrespondenz mit seinem ehemaligen Mathematikprofessor Erhard Weigel (1625-1699) finden insbesondere Weigels pädagogische Bestrebungen, seine Bemühungen um die Förderung der Wissenschaft (Grundung eines Collegium artis consultorum) sowie sein Einsatz für die Kalenderreform ihren Niederschlag. Aus diesem Themenkomplex wird hier ausführlich über das erste Projekt berichtet. Das pädagogische Lebenswerk Weigels wird skizziert und seine pädagogischen Ansätze sowie sein schulreformerisches Projekt erläutert. Eine besondere Attraktion des Weigelschen Schulversuchs war die "Schwebeclaß", die es den Schülern ermöglichen sollte, ihre Übungen mit schaukelnden Bewegungen zu begleiten. Aus Weigels Schrift "Pendulum Polychrestum. Eine Schwebefahrt zu vielerleyen Nutzen in so mancherley Gestalt" geht hervor, dass der Schwebeflug nicht nur in der Pädagogik, sondern in einer Vielzahl von Anwendungen eine Rolle spielt. Leibniz nimmt in einer Aufzeichnung (wohl von 1697) zu Weigels Schrift Stellung.

1. Introduction

On August 21, 1696 (old style) Leibniz made an entry in his diary[1] recalling a meeting in Braunschweig with Wilhelm Ernst Tentzel, a former school master and historiographer from Gotha. The entry concerns Erhard Weigel's model school in Jena and the dynamic teaching method adopted there:

"Ich habe hernach Hrn. Tenzeln in Hrn. Herzog Rud. Aug. Durchl. Bibliothec zu Braunschweig angetroffen, ... Er hat uns viel von Hrn. Weigelii Schuhle erzehlet, der Schuhlmeister wird genennet Freudenmeister, weil alles in Tanzen, Singen und Spielen geschehen soll".

The entry in Leibniz's diary also recalls a tragic incident that had ensued:

"Ein junger Hoym ist drüber umbs Leben kommen, als er beym Schauckeln zum Fenster heraus geschleudert worden, und weil es der einige Sohn, ist der Vater vor Leid deswegen gestorben, und alles dem Bruder, nehmlich dem Cammer Praesidenten zu Dressden zugefallen."

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[1] Tagebuch (LH XLI,4); G. H. Pertz, *Leibnizens Gesammelte Werke* 4 (1847), pp. 183-224, cf. P. 201f.

Thirty three years earlier, in the summer of 1663, the seventeen year old Leibniz matriculated at the University of Jena and attended lectures there given by the mathematician Weigel. Leibniz went on to become Weigel's most renowned alumnus in the field of mathematics and so years later when Weigel visited Leibniz' other great mentor in mathematics Christiaan Huygens at the Hague he introduced himself as Leibniz's former professor, as we glean from a remark in Huygens' letter to Leibniz on September 4, 1691[2]:

"Avant hier me vint voir icy le Sr Weigelius professeur à Jena ... Il dit qu'il a l'honneur de vous connoitre depuis le temps que vous estudiez en Mathematiques sous luy. J'aimerois bien mieux voir icy son disciple".

Before that, in the year 1679, a correspondence between Weigel and Leibniz had developed and in all about 10 letters were exchanged over the last 20 years of Weigel's life. In the later stages of this correspondence three projects of Weigel in particular are discussed, namely his proposals for calendar reform, for the improvement of the organization of science through the establishment of a 'Collegium artis consultorum' and for school reform. In cooperation with another former student Johannes Meyer[3], Weigel lobbied the Reichstag, the Imperial Diet meeting in Regensburg, for the advancement of these three projects. Here an outline of Weigel's pedagogical methods and his educational reform efforts will be given. This will be followed by a review of Weigel's presentation of his ideas in correspondence with Leibniz's and in a publication written in connection with the Reichstag submissions. In conclusion Leibniz's reaction to Weigel's proposals will be considered.

2. Weigel's contributions to education and pedagogy

It seems impossible, in the context of this presentation, to do justice to the achievements of Erhard Weigel in the fields of education and pedagogy or to assess his place in the history of these subjects.[4] The following outline may serve as a basis for a consideration of his association with Leibniz. Weigel's interest in pedagogy developed from his work as a university teacher in Jena, where his most renowned students included Samuel von Pufendorf and of course Leibniz[5]. Weigel was distressed by student deficits in terms of intellectual and moral standards. He saw the root of the evil in the existing school system and accordingly conceived the idea of a model school which would attempt to meet the real-life needs of students. From about 1680 pedagogy and education became a central theme of Weigel's publications; more than 20 titles – representing about a fifth of his published works – are devoted to the subject of pedagogy and school reform. His thoughts on early education and his pedagogical methods were set out in a series of publications starting with

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[2] A III,5, 167.

[3] Cf Weigel's correspondence with Meyer 1697-1699 (LBr 986, 16-23).

[4] Cf. L. Friedrich: „Pädagogische Perspektiven zwischen Barock und Aufklärung", in: R. E. Schielicke et al., eds, *Erhard Weigel – 1625 bis 1699. Barocker Erzvater der deutschen Frühaufklärung*, Thun umd Frankfurt am Main, 1999, pp. 39-68 and H. Schlee: *Erhard Weigel und sein süddeutscher Schülerkreis. Eine pädagogische Bewegung im 17. Jahrhundert*, Heidelberg 1968.

[5] E. Spieß: *Erhard Weigel, der Lehrer von Leibnitz und Pufendorf*, Leipzig 1881.

“Fortsetzung Des Himmels=Zeigers” (1681) and “Kurtzer Entwurff der freudigen Kunst- und Tugend-Lehr, vor Trivial und Kinder-Schulen” (1682). In the year 1681 he petitioned the Elector, and the Landtag or Diet of Saxony, and in 1683, when he appeared before the Imperial Diet, the Reichstag at Regensburg, to argue in favor of a unified calendar, he took the opportunity to start an initiative for a general school reform. Also in the year 1683 he set up a private model school in his own house in Jena and in 1690, following extension of the building, a public model school was opened there. Weigel's publications in the years before and after 1690 deal with the progress of his model schools as well as with curricular, didactic and methodological questions. A moral or virtuous disposition, the importance of mathematics and of the vernacular, and the development of technical skills are themes of Weigel's pedagogical writings in this period. The very titles of Weigel's writings preserved in Gottfried-Wilhelm-Leibniz Library in Hannover, and presumably known to Leibniz or used by him, reflect the range of topics. In addition to the previously mentioned “Kurtzer Entwurff” (1682) we find titles like “Aretologistica, Die Tugend=übende Rechen=Kunst” (1687), “Tugend=Spiegel” (1687), “Extractio Radicis, oder Wurzel=Zug ... Nebst Andeutung einer bessern Lehr=Art so genannter Tugend=Schul” (1689), “Philosophia Mathematica” (1693), which has marginalia by Leibniz, “Paedagogiae Mathematicae ad Praxin Pietatis, Fundamenta et Principia” (1694), “Kurtze Relation von dem nunmehr zur Prob gebrachten Mathematischen Vorschlag betreffend Die Kunst- und Tugend-Information” (no date) and “Unmaßgebliches Gutachten wie die Eltern und Verpfleger sich zu Haus verhalten sollen” (no date).

A particular attraction of the “Kunst- und Tugendschule” was the range of teaching aids and materials devised by Weigel. The notion of activity was at the heart of Weigel's pedagogical system; the children were to be taught in such a way and that they would remain active throughout the lesson. In the early education of the child, the mastery of the skills set known in English as the 3 Rs – Reading, wRiting and aRithmetic – was a central task. Here Weigel developed a number of mechanical instruments. A “Schreibregel”, or writing rule, was developed to train the motor function by guiding the hands of a group of children. Similar mechanical devices (a “Leselregel” and a “Rechen=Regul”) were used to assist the aquisition of reading and of calculating skills. To assist the memorizing process Weigel developed the so-called “Schweb=Claß” or “Schwebeclaß”. This suspended classroom was to be a special attraction among the teaching instruments he devised. The floor on which the school benches were mounted was suspended above and parallel to the main floor and held in place by stout ropes and hooks at the corners. Thus Weigel created a hovering or levitating classroom. The idea here was that the children would relish the swinging movement of the entire class which would at the same time aid their concentration. The rhythmic rocking movement of the “Schwebeclaß” was used in religious instruction and in language teaching to assist the memorizing routines in a playful manner. Rocking horses were employed for purposes of drilling in grammar and vocabulary and also in moral education in that the control of the horse by the rider symbolized the taiming of human appetites through will power[6].

At the heart of the secondary school curriculum was the Quadrivium with the traditional

[6] Cf. L. Friedrich, op. Cit, p. 56.

subjects of Arithmetic, Geometry, Astronomy and Music or in Weigel's German vernacular “die Zahl- und Rechenkunst, die Meß- und Richte-Kunst, die Erd- und Himmelskunst, die Kling- und Harmoniekunst”. The demands made on the students increased with age. Up to the age of 5 to 6 years they were to learn mainly by playing; the preceptor in Weigel's “Freuden=Lehr=Schule” was to be the play master or pleasure master rather than the school master (as Leibniz noted in his diary). This helped compensate for the strict regime of an eight- or nine-hour school day that lasted from early morning until evening. In this early phase of schooling, as indeed in the later phases, spontaneity and activity of the child was a cornerstone of Weigel's pedagogy. In middle school education, up to 10 to 12 years, the mind and spirit were to be trained so that in the final phase of secondary education, up to the age of 16 or 18, the capability of abstract thinking could be developed and become the basis for the acquisition of classical and modern languages, for training in mathematics, in the so-called “Realien”, or realities, and in technical subjects.

In all phases of education and in all subject areas harmonization with nature was a basic principle. For Weigel mathematics played the central role of a fundamental discipline, a universal instrument for the investigation of nature. In his pedagogy too mathematics has the status of a basic science; it is the basis for the rational discussion of problems and of strict or rigorous argumentation. Languages, which had previously dominated education, and which had led to sophistry and hollow rhetoric, it was claimed, failed to harmonize with nature as mathematics did and therefore could not be the basis of education. Weigel's agenda was therefore to undertake a reform of the existing school system with mathematics as the underlying discipline.

3. Weigel's school reform project as reported in Leibniz's correspondence

The principal account of the school reform project is found in Weigel's letter to Leibniz from Jena on April 26, 1694[7]. First of all Weigel announces progress in relation to the planned Collegium Artis Consultorum:

“Zu dem vor diesem schon vnmaßgebig vorgeschlagenen Collegio Artis Consultorum im H. Röm. Reich hab ich vnlängst zu Regenspurg von neuen gute Vertröstung erhalten: werde es diesem Sommer vber nach mögligkeit weiter urgiren.”

Then he informs about his school projects. Here Leibniz is told about the private model school, where the so-called “Schwebeclaß” was employed, as well as about the public model school where he had developed a method for training preceptors in order to be able to cope with large numbers in the classroom. Weigel's continues:

“Interea gehet die Schul-Correction Gott lob wohl von statten, weil ich einen modum erfunden, daß Sie dem publico keine neue Vnkosten macht, auch keine neue Praeceptores erfordert, in dem die alten mit einem sonderlichen Vorth. in 4 Wochen so weit darinnen informiret werden können, daß

[7] A III,6 , 68.

Sie viel Jahr in principiis mathematicis, die zur beförderung des Lateins trefflich viel contribuiren, die Jugend informieren können, vnd zwar mit Lust vnd freunden, doch ohne Schwang der so genannten Schwebeclaß, welche ich nur in meiner privat Schul vor die wenigen kleinen Kinder adhibirt, vnd nach den gewöhnlichen Schul-Stunden, darinnen lauter seria doch auch ihnen angenehme mathematica getrieben werden, zur Ergötzligkeit gebraucht, damit sie ohne Ekl den gantzen Tag ausser Schlaf vnd Tisch-Zeit, Sommer vnd Winter in der Schul bleiben können. In publicis Scholis aber, da 100 bis 200 Kinder in einer Stuben auff einmahl zu informiren sind, werden andere liebreiche Mittel gebraucht, darüber iederman ein groß vergnügen hat. Gibt Gott Gnad v. Seegen, daß hie herum die meisten Schulen also eingerichtet; werde ich nicht ermangeln, wenn mir Gott das Leben v. die Kräffte ferner wie bisher zur verwunderung verleihen (in dem ich septuagenarius viel frischer vnd gesunder alß in der jugend, bis zum 50sten Jahr gewesen, worden bin vnd noch alß alle Tage verjünget werde) auch anderweit mich anzumelden wo sie nicht selbst, wie zu Coburg mich dazu ultro berufen."

It was in Coburg and in the same year (1694) that Weigel's "Paedagogiae mathematicae ad Praxin Pietatis Fundamenta et principia" was published. In his reply on 20. Mai 1694 Leibniz praises Weigel's efforts in the following terms expressing best wishes for continuing good health[8]:

"Bedancke mich hochlich sowohl wegen alles übrigen, als wegen communicirter particularitäten des progressus der Educations-arbeit so alles übertrifft, Gott gebe dazu seinen seegen. Jederman ist schuldig müglichst beyzutreten, deßen hat sich M. h. H. auch von mir zu versichern. Erfreue mich sehr zu vernehmen, dass sie gottlob sich noch so wohl befinden, wundsche ein gleiches noch viele jahre".

Leibniz also received information about Weigel's school reform efforts from other correspondents in the same year. Huldenreich von Eyben wrote from Wetzlar on January 2, 1694 that[9]:

"unter H. Weigelii sachen glaube das vil gutes sich finde, es mangelt aber manus sublimior et fortius brachium ... Gott erwecke lehrer und prister, die ihn mit seinen güten intentionibus portieren und diße glücklicher exequiren könen".

In a letter to Johann Andreas Schmidt on August 13, 1694 Leibniz remarks[10]:

"Weigelius vir et ipse insignis invenerit qui praeclara ejus cogitata in docenda juventute reapse amplectantur".

Schmidt, replying from Jena on 9 September 1694, tells of Weigel's Coburg publication and

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[8] A III,6, 95.
[9] A I,10, 176.
[10] A I,10, 499.

his departure to Regensburg to pursue the calendar reform project[11]:

"Weigelius postquam Coburgi jussu Serenissimi specimem in docenda juventute praestitisset, ea de re a Consistorio literas testes obtinuit. Paucos ante dies Ratisbona rediit, ubi negotium de emendatione Calendarii morati denuo proposuit".

4. Weigel's "Pendulum Polychrestum . Eine Schwebefahrt"

In a three-page undated work entiled "Pendulum Polychrestum. Eine Schwebefahrt zu vielerleyen Nutzen in so mancherley Gestalt (als eines Schiffs / einer Chesen / einer Sommer=Laibe / eines Sessels / einer Sänffte / ...)" – literally, a floating, levitating, or hovering flight with multifarious applications and in many different forms such a ship, a vertical coach, an easy-chair etc. – Weigel outlines the kinematics of a new machine he had devised[12]. To the basic oscillating horizontal motion of the machine a rocking or rolling motion is added and the experience of the pilot or passenger is compared to riding on a gondola in Venice or on a ship on a stormy sea:

"Es ist eine gantz neu erfundene Machine die in regularem Schwang weit hin und her fährt / ohne Trieb; doch ... nicht im Bogen ... sondern immer Horizont-gleich ... / wie Gundeln zu Venedig / aber wenn man will / auch schief und wanckend / wie die Schiff in Sturm und Wellen gehen".

Weigel suggests his machine could be employed to overcome fatigue, insomnia, sea sickness and other maladies. For the world of learning the machine offered a series of applications. Thus the it provided a means of relaxation following concentrated learning; it assisted the memorizing process; it served to bring order to confused minds; it taught one to parry and, through an automatic control mechanism, it worked to establish harmony in that concord produced smooth movement whereas discord caused the machine to stall:

"Diese Kunst=Machine dient ... Zu sanffter Ruhe / wenn man sich müd gesorget und studiret hat ... Hilfft der Memorie trefflich / eine Rede leicht zu momorirn / zumahl wenn sie gebunden oder oratorisch also regular, wie die Bewegung geht / gesprochen oder auch gesungen wird ... Confuse Köpfe bringt sie zu der Regularität: lehrt Ordnung halten ... sie lehrt parirn. Sie recommendiret Concordiam, indem sie bey der Eintracht geht; und bey der Zwitracht stockt und steht".

With the machine in motion a range of activities were possible in a sitting or standing pose. These included reading, writing, sowing, knitting, painting, engraving, card games and playing musical instruments and shooting practice. One could even dine while flying or hovering in the air and engage in tournaments against opponents on similar devices:

"Man kan auf dieser gehenden Machinen dennoch alles thun ... z. E. Lesen/ Schreiben/ Nehen/ Spinnen/ Mahlen/ Kupfferstechen ... im Bret/ in der Karte/ spielen/ musiciren mit Instrumenten. Ja man kan darauf auch in der Lufft alß fliegend speisen/ ohne Verschüttung des Getränckes im Glaß ... Man kan gegeneinander damit fahren/ als beym Ritterspiel/ und beym Turnir ... oder in Gesellschaft; seitwerts oder vorsich nach der Scheibe schiessen lernen ...".

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[11] A I,10, 539f.

[12] The exact title of the work (without date, place of publication or pagination) is: *E.W.C.C. Pendulum Polychrestum. Eine Schwebefahrt zu vielerleyen Nutzen in so mancherley Gestalt (als eines Schiffs / einer Chesen /einer Sommer=Laibe / eines Sessels / einer Sänffte / oder bloß) wie man sie haben will*.

Furthermore the kinematics of the machine ("Die Kunst=Bewegung") could be the basis for fountains, garden sprinkling devices and fire engines. In the education of children the machine could be used to channel the energy of children and to foster their health, growth and wisdom while providing fun and joy. It would counteract pugnacious and boisterous play from which various vices arise:

"Man kan im Hauß die kinder bey der Weil nicht besser als damit entreteniren/ daß sie nicht Muthwillen treiben/ und doch sich bewegen/ und etwas gutes dabey tun/ was ihnen vorgegeben. Dadurch ihre Gesundheit / Wachsthum und Klugheit mit Luft und Freud befördert. Da sie sonst nur kälbern und tumultuiren/ einander bey den Köpffen nehmen/ oder doch also/ wie Hund und Katzen mit einander spielen: womit sie sich allerleye Laster angewehnen".

Pedagogy, however, is but one of many applications for the floating, hovering, or levitating machine, and thus, in the sense of the title, one of multifarious applications in one of many different forms.

5. Leibniz reaction to Weigel's ideas on education

Leibniz's thoughts on Weigel's project are found in a paper or report (probably from 1697), which has been edited under the title "Ueber einige von Erhard Weigel vor den Reichstag zu Regensburg gebrachte Vorschläge. 1697"[13] and in which he considers the three proposals submitted to the Reichstag in Regensburg. The piece begins:

"Es sind von Regensburg drey daselbst gedruckte, von Herrn Erhardo Weigelio, berühmten Mathematico, herausgegebene Schediasmata eingeschickt worden".

The third item is question is the "Pendulum polychrestum. Eine Schwebefahrt zu vielerleyen Nutzen in so mancherley Gestalt". Leibniz considers it unnecessary to consider the details of Weigel's machine which would be similar to amusements found in gardens and parks:

"Das dritte handelt von einer sogenannten, doch nicht beschriebenen Schwebefahrt oder Schwenkung, so zur Gesundheit und Luft dienen soll, und vielleicht denen hin und wieder in Gärten, und sonst gebräuchlichen Umläuffen nicht unähnlich; wovon aber allhier weiter etwas zu melden unnöthig".

Turning to Weigel's proposal for a school reform, Leibniz stresses the idea of the "Tugendschule" which would shift the emphasis in education from the training of verbal skills to real and practical skills while upholding moral values:

"Was nun meine, über die von ihm gethane Vorschläge habende Meynung betrifft, so ist bekannt, daß Herr Weigelius ein in Mathesi sehr erfahrner und gelehrter Mann, und der dabey ein ganz löbliches Absehen zum gemein Besten führet, welches er sonderlich in seiner vorgeschlagenen "Tugendschule" zu erkennen gegeben, allwo er darauf treibet, daß die Jugend in den Schulen nicht nur zu Verbal= sondern auch Real=Wissenschaften, und nicht nur zu Wissenschaften, sondern auch zu Tugenden geführet werden möchte".

Leibniz position is one of cautious support for Weigel's reform ideas:

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[13] LBr 986, 14-15; cf. G. E. Guhrauer: *Leibnitz's Deutsche Schriften* 3 (1840), 473-476.

“Ich stehe auch in den Gedanken, daß ein und anders davon gar wohl in würkliche Uebung zu bringen wäre”.

However, of Weigel's three proposals that for school reform is the one which least impresses Leibniz. Thus he writes:

“so scheinen doch die übrigen Vorschläge von Verbesserung der Schulen, Einrichtung der Zeitrechnung und Bestellung eines gewissen Collegii von mehr Wichtigkeit und Nutzen zu seyn, und sind die beyden lezten eigentlich anjetzo in Betrachtung zu ziehen”.

The rest of Leibniz's report is devoted to the other two proposals of Weigel. In direct correspondence with Weigel Leibniz claims to have acted in support of Weigel's innovative projects. In his final letter to Weigel on June 11, 1697 Leibniz once more expresses his desire for the the prompt realization of Weigel's efforts for an improvement of public instruction and for the advancement of human understand and morality[14]:

“..., ut quam primum et quam efficacissime obtineatur illa emendatio publicae doctrinae et hominum educatio ad sapientiam et virtutem”.

This echoes the sentiments in the previous letter of May 20, 1694 when referring to all three projects[15]. Leibniz stresses that the outcome would depend on the grace and goodwill of the electors and princes of the Empire. Within his own sphere of influence, however, he had supported and applauded Weigel's efforts:

“Was zu Regenspurg zu thun stelle dahin, auff etliche hochanständige Chur und fursten wird es ankommen, ich habe bey vornehmen Ministris davon mit ruhm und applausu erwehnet”.

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[14] LBr 986, 13.

[15] *Op.cit*. (note 8).